Cleaner Engineering and Technology 7 (2022) 100449

Contents lists available at ScienceDirect

Cleaner Engineering and Technology

journal homepage: www.sciencedirect.com/journal/cleaner-engineering-and-technology

Drivers for the adoption of integrated sustainable green lean six sigma agile manufacturing system (ISGLSAMS) and research directions

Dharmendra Hariyani [a,*], Sanjeev Mishra [b]

[a] Department of Mechanical Engineering, University Department, Rajasthan Technical University, Kota, 324009, Rajasthan, India
[b] Department of Mechanical Engineering, University Department of Teaching, Rajasthan Technical University, Kota, Rajasthan, India

ARTICLE INFO

Keywords:
Integrated sustainable green lean six sigma agile manufacturing system (ISGLSAMS)
Sustainable quick responsive manufacturing system
Sustainable customized products
Market
Financial
Social
Environmental
Operational
And sustainable performance

ABSTRACT

Due to the scarcity of resources, and the need for preserving the resources for the future generation, there has been significant growth in research and development in a sustainable market-focused manufacturing system, in particular with the view of product recovery, waste elimination, and landfill legislation. It has extended the responsibility of manufacturing organizations to include the recovery and safe disposal of their product, process, and supply chain waste, as well as, the adoption of a sustainable quick response manufacturing system, to produce sustainable customized products. A more compatible manufacturing system and strategy are required to meet these business goals. It is observed through literature that an integrated sustainable green lean six sigma agile manufacturing system (ISGLSAMS) provides a strong platform to meet all these business, societal and ecological needs under a single umbrella. However, many organizations opt for this strategy voluntarily and many do not. It is observed through a literature survey that through this strategy organizations improve their financial, market, social, environmental, operational, and sustainable performance. The main objective of this review is to identify the various drivers for the adoption of an ISGLSAMS, so that governments, stakeholders, and policymakers may plan the strategy for motivating the organizations for the ISGLSAMS. The review also discusses the key enablers and characteristics of ISGLSAMS, product, and strategy. The review also highlights the key characteristics, and clauses of each driver, and research areas for the drivers for the adoption of ISGLSAMS. The review also shows a performance measurement or performance benchmark framework for ISGLSAMS.

1. Introduction

Manufacturing strategy plays an important role in business success (Chikán et al., 2022; Demeter, 2003). It is used as a competitive tool in the turbulent market (Thun, 2008; Wang and Cao, 2008; Ward and Duray, 2000). It is a set of the co-coordinated action plans and policies used to secure the long-term and medium-term desired outcomes (Ocampo and Clark, 2015). It should be in line with the overall strategic directions of the business (Papke-Shields and Malhotra, 2001), and should provide competitive advantages (Wang and Cao, 2008; Ward and Duray, 2000). It should drive continuous improvement (Budiono et al., 2021; Dangayach and Deshmukh, 2003) and enable the organization to satisfy a wide variety of business, market, and social requirements (Dangayach and Deshmukh, 2001). Thus the selection of appropriate manufacturing strategy at the right time, and in the right direction has a significant role in business success (Sun and Hong, 2002).

Due to the ecological imbalance, and social and economic sustainability requirements (Veleva and Ellenbecker, 2001), organizations are continuously paying attention to harmonizing these requirements in their product, process, system, and supply chain (Wu et al., 2015). It helps the organization to meet the market, social, and other business goals (Mittal et al., 2017). Various manufacturing strategies, viz. lean, green, six sigma, agile, sustainable have evolved to meet various business, social, and sustainability needs. These manufacturing strategies are explained below:

1.1. Lean manufacturing

Lean manufacturing (LM) focuses on the elimination of wasteful activities. It considers anything other than the minimum amount of materials, equipment, parts, processes, skill, space, time to add value to the product as waste (Russell and Taylor, 2000). Lean uses value stream mapping to identify the waste in the lean environment (Rother and Shook, 1998). Environmental Protection Agency (EPA, 2003) defines

* Corresponding author.
E-mail address: dhariyani12002@gmail.com (D. Hariyani).

https://doi.org/10.1016/j.clet.2022.100449
Received 26 May 2021; Received in revised form 30 January 2022; Accepted 18 February 2022
Available online 24 February 2022

the lean goal as the "development and manufacturing of the highest quality products, at the lowest cost, with the shortest lead time by systematically and continuously eliminating waste, and respecting for people and environment". Fig. 1 shows the various widely discussed lean practices in the literature (Salonitis and Tsinopoulos, 2016) for improving system performance.

Leadership, management style, availability of funds, organizational culture, organizational skills, and expertise are found the critical success factors for lean implementation (Achanga et al., 2006). Organizations involve customers, suppliers, and employees in the planning and designing process of the system and supply chain, to streamline the process of value addition (Womack et al., 1990). Also, a customers feedback system helps in meeting the customers' value (Yadav et al., 2020). The close relationship with the suppliers and customers improves the product and process aspects of lean strategy (Jayaram et al., 2008).

(Bhasin, 2008) demonstrated a five-dimensioned dynamic performance measurement model, closely aligned with organization strategies, for the lean performance measure (Table 1). To remain competitive, every organization has to benchmark on these dimensions. This enables the organizations to successfully check and evaluate the success of lean in the organization.

An organization has to develop lean management leadership, organizational culture, organizational skills, and expertise for the successful implementation of lean (Al-Najem and Dhakal, 2012). An organization has to strategically plan the lean implementation method. An inappropriate method of lean implementation cause disruptions in the process instead of desired improvement (Karim and Arif-Uz-Zaman, 2013). Table 2 shows the various benefits of lean manufacturing.

1.2. Green Manufacturing

Green manufacturing (GM) focuses on the reduction of the environmental impacts of the manufacturing and consumption of goods and services (Karuppiah et al., 2020). It is an initial step towards sustainability, which covers the first 3Rs of sustainability, i.e, reduce, reuse and recycle, along with the use of ISO 14001, environmental management system (EMS), green supply chain, strategic operation, and management planning (Sarkis, 1998; Florida, 1996).

For green manufacturing, also known as clean manufacturing (Bhatt et al., 2020a) or environment-conscious manufacturing (Sarkis, 1998), organizations proactively measure the environmental impact and environmental risks of the system (Paulraj, 2011). Close relationships and strategic integration with suppliers facilitate the development, and adoption of environmental and industrial innovations concerning the green product, green process, and green system design, which leads to productivity improvement, quality improvement, cost reduction, continuous improvement, and technological innovations (Florida, 1996). Organizations must leverage their industrial modernization

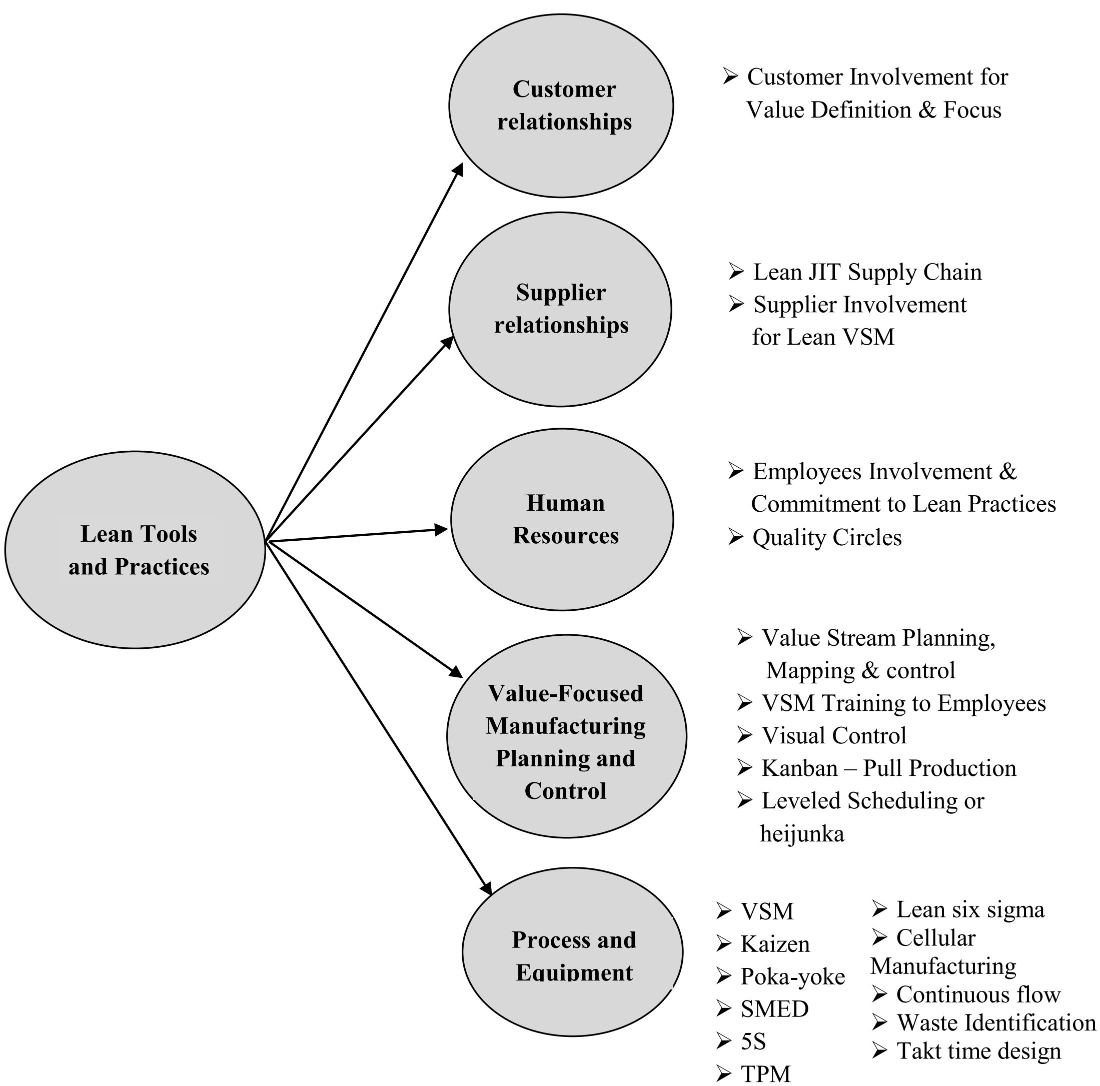

Fig. 1. Lean manufacturing practices (Salonitis and Tsinopoulos, 2016).

Table 1
Five dynamic performance measures for the lean performance.

Financial Performance Measures
1. Profit after interest and tax
2. Rate of return
3. Current ratio
4. Earnings per share
Customer and Market Measures
1. Market share by product group
2. Customer satisfaction index
3. Customer retention rate
4. Service quality
5. Responsiveness
6. On-time delivery.
Process Performance Measures
1. New product development lead time
2. Cycle time
3. Time to market for new products
4. Quality of new product development and project management processes
5. Quality costs
6. Quality ratings
7. Defects of critical products or components
8. Material costs
9. Manufacturing costs
10. Labor productivity
11. Space productivity
12. Capital efficiency
13. Raw material inventory
14. Work-in-process inventory
15. Finished goods inventory
16. Stock turnover
People's Performance Measures
1. Employee perception survey on health and safety per employee (accidents, absenteeism, labor turnover)
2. Retention of top employees
3. Quality of professional/technical development
4. Quality of leadership development
Future Performance Measures
1. Depth and quality of strategic planning anticipating future changes
2. New market development
3. New technology development
4. Percentage sales from new products

Table 2
Benefits of lean manufacturing.

improvement in -	reduction in -
– net sales, return on assets, profitability, market share (Fullerton et al., 2014) – inventory turns, on-time delivery, manufacturing cycle efficiency, vendor performance, product quality (Fullerton and Wempe, 2009) – first-pass yield (Ghosh, 2013) – labor productivity (Singh et al., 2010; Shah and Ward, 2003a) – flexibility, rapid response (Taj and Morosan, 2011) – capacity, customer satisfaction (Andersson et al., 2006) – quality, production rate, competitive cost, globally competitive market position (Karim and Arif-Uz-Zaman, 2013) – customer order accuracy (delivery and quality) – breakdown of in-company functional barriers, joint development of value stream KPIs (Melton, 2005) – leveling of schedule (Naylor et al., 1999) – quick delivery, overall productivity (Rahman et al., 2010) – organizational operational performance (Belekoukias et al., 2014) – competitiveness (Doolen and Hacker, 2005; Goldsby and Martichenko, 2005; Oliver, 1996) – market performance (Yang et al., 2011) – environmental performance (Chiarini, 2014; Rothenberg et al., 2001) – financial performance (Hofer et al., 2012b) – communication flow, non-tangible benefits (Worley and Doolen, 2006)	– cost and lead time (Dennis, 2007; Liker, 1996) – equipment downtime, scrap, rework, setup times, throughput time (Fullerton and Wempe, 2009) – work-in-process, cycle-time (Andersson et al., 2006) – lead time, inventory, cost of conversion, space requirement (Ghosh, 2013) – manufacturing cycle time, scrap, rework costs, unit manufacturing costs (Shah and Ward, 2003b) – processing time, work-in-process inventory, manpower requirement (Singh et al., 2010) – cost through inventory leanness (Hofer et al., 2012b) – supply chain cycle time, safety stock (Melton, 2005) – manufacturing, transportation, warehouse, and supply chain cost (Rahman et al., 2010; Goldsby and Martichenko, 2005) – waste (Rothenberg et al., 2001)

strategies with the environment by source reduction, recycling, production process improvement, pollution prevention, green design (Florida, 1996).

For green product development, organizations have to focus on (i) recyclable, biodegradable, energy-efficient materials, (ii) total life cycle impact, and (iii) extending the life of the product (Moktadir et al., 2018; Jawahir and Bradley, 2016). Greening the supplier, and green innovation with the suppliers help the organizations to meet tighter environmental regulations, and to build sustainable competitive advantage (Chiou et al., 2011). Supplier relationships help organizations to achieve their environmental goals (Dubey et al., 2015b). Green supply chain management focuses on green procurement, green manufacture, green distribution, green logistics (Ninlawan et al., 2010). Green logistics focus on recycling, waste collection, final treatment before landfill (Ninlawan et al., 2010).

Organizations must have product stewardship for successful environmental management strategies. Product stewardship extends the responsibility of minimizing the product's environmental impact during its life cycle to all stakeholders, i.e. to designer, producer, seller, and users (Rusinko, 2007). The organizational characteristics, viz. market leadership, size, profitability, and outputs of past environmental management practices affect the magnitude of the organizational environmental management practices and new initiatives (Hofer et al., 2012a).

Awareness about environmental issues, product and process impact on the environment, legislation, and pressure from societies are the main drivers for green manufacturing (Barve and Muduli, 2013). Table 3 shows the various benefits of green manufacturing.

For getting a green brand image, organizations are moving towards green manufacturing, green supply chain management, and green purchasing (Dubey et al., 2013; Olugu et al., 2010; Shang et al., 2010). Technology, best green practices, and waste reduction through collaborations with the suppliers and customers have a positive impact on the organizational environmental performance (Dubey et al., 2014).

1.3. Six sigma practices

Six sigma practices or world-class manufacturing is used for developing world-class quality products. Six sigma is a data-driven methodology for eliminating defects by driving the process output at the six sigma quality level, i.e., towards 6 standard deviations between the mean and specification limit (Linderman et al., 2003). DMAIC (Define, Measure, Analyse, Improve, Control) and DMADV (Define, Measure, Analyse, Design, and Verify) approaches are used for the six sigma quality level (Breyfogle, 1999).

DMAIC approach enhances the processes already in use, whereas DMADV designs the new process for the six sigma (Mast and Lokkerbol, 2012). The first three phases are the same for both methodologies. In the define phase, critical to quality characteristics (CTQ) is identified through the voice of the customer (VOC). In the measure phase, data about CTQs are collected. In the analysis phase, critical analysis of data about CTQs is carried out with the help of quality tools viz. fishbone diagram and Pareto diagram to identify different causes that can be attributed to a problem. In the improvement phase of DMAIC, failure mode and effect analysis (FMEA) is carried out to identify and prioritize

Table 3
Benefits of green manufacturing.

improvement in -	reduction in -
– organizational market position, reputation, product-process design equipment benefits, and sale (Bergmiller and McCright, 2009) – organizational environmental performance (Dubey et al., 2014) – increase in entry barriers to the competitors, improvement in green efficiency, compliance with regulation, response to external environmental pressures from customers, global competitive advantage with better product quality (Chiou et al., 2011) – cost benefits and high ROI due to an efficient system, market share, improve the quality of the production process and product, tax benefits, investment support by the government, increased capacity (Deif, 2011) – subsidies (Zhu et al., 2005) – market performance (Florida, 1996) – eco-performance (Pujari et al., 2003) – resource efficiency (Rothenberg et al., 2001) – organizational image, new customers, new market opportunities, innovative ideas, product performance (Rusinko, 2007) – corporate sustainability performance (Zhu and Sarkis, 2004) – production efficiency, corporate image, and relations (Sezen and Çankaya, 2013) – competitive platform due to green marketing, customer satisfaction, customer loyalty, sales (Shang et al., 2010)	– cost, lead time, process waste, process impact on the environment (Bergmiller and McCright, 2009) – cost of hazardous waste disposal (Chiou et al., 2011) – material consumption, water and energy use, waste, emission, disposal, disposal handling cost, time or labor hours (Deif, 2011) – cost, manufacturing time due to product stewardship (Rusinko, 2007) – raw material costs, environmental and occupational safety expenses (Sezen and Çankaya, 2013)

the possible types of failures that could occur, and the process is improved at the six sigma quality level. In the control phase of DMAIC, improvement results from the six sigma initiatives are institutionalized through documentation and standardization of the new process. In the design phase of DMADV, testing and optimization of the process are done to deliver customer requirements. In the verification phase of DMADV, the ability of the process to deliver VOC or customer requirements is verified. Six sigma practices improve the quality of products, processes, and services through robust design, i.e., through parametric settings that reduce the variability due to noise or assignable factors. It also improves process capability. Six sigma quality level yields 99.997%, which means a maximum of 3.4 defective parts will be there in a million products (Linderman et al., 2003; Harry, 1998). Table 4 shows the various benefits of six sigma practices.

1.4. Agile manufacturing

Agile manufacturing (AM) or quick response manufacturing, responds quickly to customer needs for variety in the unpredictable environment by using a reconfigurable manufacturing system. Agile manufacturing system provides quick response to new product development and dynamic capacity allocation to meet the unpredictable demand (Elkins et al., 2004; Sharifi et al., 2001). Various enablers of agile manufacturing associated with technology, strategy, people, and system highlighted by most of the researchers are shown in Fig. 2 (Gunasekaran, 1999).

Organizational agility depends on organizational competency, flexibility, reconfiguration (convertibility, scalability, integration, modularity, diagnosability), responsiveness, and speed. In agile manufacturing, risk and information are shared among the suppliers for managing agility. Delivery reliability of the product or services is further enhanced by vendor-managed inventory (VMI) in the market (Dubey and Gunasekaran, 2015). Agile manufacturing gives the competitive advantage of mass customization, new product innovations, and flexibility in an unpredictable market (Adeleye and Yusuf, 2006). For agility, the manufacturing strategy must also be flexible to adapt to changing environments quickly (Brown and Bessant, 2003). Agile organizations create a competitive advantage by leveraging quality, inventory, process, and human skills – simultaneously (Eltawy and Gallear, 2017). Suppliers, employees, and customers are united through information technology for quick communication and updated data information (Crocitto and Youssef, 2003). For fruitful results, virtual organizations are strategically aligned or streamlined through information technology (Cao and Dowlatshahi, 2005). Good management leadership, organizational culture, training, and reward system provide the platform for developing an agile environment (Crocitto and Youssef, 2003). Through agile manufacturing, manufacturers, suppliers, customers, and employees get benefited from good market share and profit (Jin-Hai et al., 2003). Table 5 shows the various benefits of agile manufacturing.

Table 4
Benefits of six sigma practices.

improvement in -	reduction in -
– effective management decisions due to reliable data, improvement in customers' satisfaction, loyalty due to critical-to-quality service performance characteristics, efficient and reliable internal operations, market share, shareholders' satisfaction, employees' job satisfaction due to better problem-solving approach, proactive organizational culture, cross-functional teamwork, employees' safety, robust process performance, quality, reliability, cost benefits due to savings, financial benefits (Antony et al., 2007; Antony, 2006) – process performance (Zu et al., 2008) – financial returns (Kwak and Anbari, 2006) – yield, customer satisfaction, projection of process improvement opportunities (Raisinghani et al., 2005) – eco-efficiency level (Lucato et al., 2015) – sustainability performance (Yusof and Habidin, 2012; Calia et al., 2009) by DMAIC model (Garza-Reyes, 2015) – organizational capability for data-based project management (Cherrafi et al., 2016)	– reduction in cost associated with misdirected problems or issues, lead time, customers' complaints, operational cost (Antony et al., 2007; Antony, 2006) – quality tools expenses, cost of poor quality, labors' expenses, production time, cost/volume ratio (Soković et al., 2006) – defect (Raisinghani et al., 2005) – process and product variability (Zu et al., 2008)

1.5. Sustainable manufacturing

Sustainable manufacturing (SM) evolved from sustainable development. World Commission on Environment and Development in 1987, defined sustainable development as "economic development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs". For sustainable manufacturing, there must be productive harmony between humans and nature, i.e, the balance of profit, planet, and people (EPA, 2003). Sustainable manufacturing incorporates all the three dimensions of manufacturing, i.e., social, economic, environmental and product life cycle dimensions. Fig. 3 shows the social, economic, and environmental dimensions of sustainability (Garbie, 2015).

Sustainable manufacturing incorporates all four stages, i.e., pre-

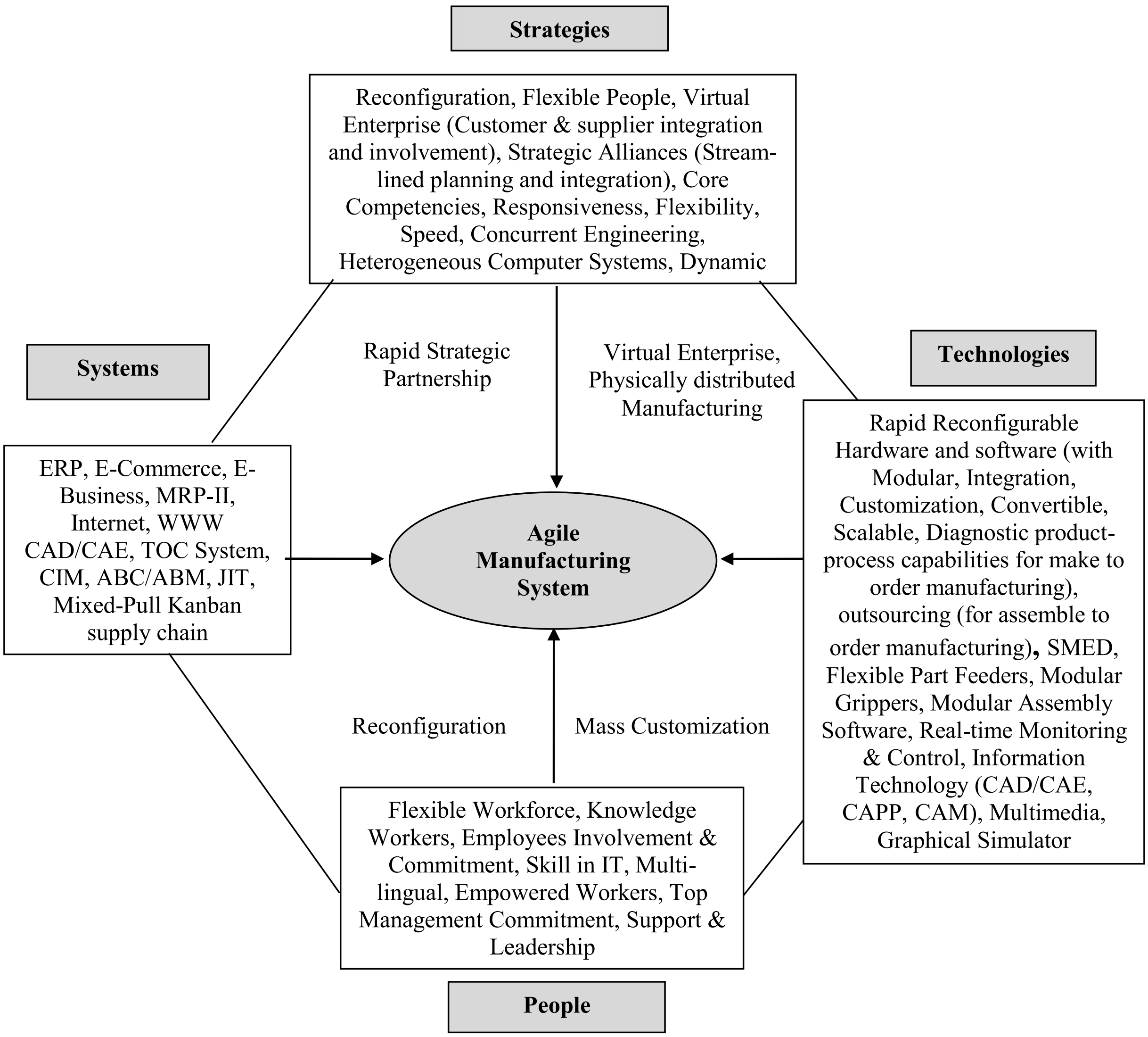

Fig. 2. Agile manufacturing enablers (Gunasekaran, 1999).

manufacturing, manufacturing, use, and post-use of product life-cycle with a 6R approach to achieve the triple bottom line (TBL) goals, i.e., social, environmental, and economic dimension of manufacturing (Hariyani and Mishra, 2021; Jawahir et al., 2006; Westkämper and Alting, 2000).

For sustainability, organizations must focus on the entire supply chain and the manufacturing system than only on the product or process itself (Faulkner and Badurdeen, 2014). For the sustainable design of the manufacturing workstation, the organization has to consider some basic elements, viz. power consumption, manufacturing cost, environmental friendliness, waste generation, operational safety, personal health, etc. as shown in Fig. 4 (Jawahir and Dillon, 2007). Sustainable manufacturing practices provide sustainable performance and outcomes (Muslimen et al., 2011). The organization's corporate social initiatives also improve the organization's social and market image (Arendt and Brettel, 2010). For sustainable manufacturing, a more holistic, systems-based, and closed-loop approach is required (Badurdeen et al., 2009). Table 6 shows the various benefits of sustainable manufacturing.

All these strategies, in partial or full, are integrated to get the competitive advantages of each strategy. The following section highlights some findings from the literature.

1.6. *Integration*

Above manufacturing strategies, are integrated to get the combined advantages of the manufacturing strategies.

In integrated lean-green manufacturing, both lean and green practices are integrated. As lean reduces both the cost of waste, waste and pollution (Klotz et al., 2007; Womack and Jones, 1997) so, lean manufacturing is complementary to green (Baumer-Cardoso et al., 2020). Thus, lean provides the base for green practices (Bergmiller, 2006). Integrated lean-green manufacturing focuses on zero waste, zero-emission (Bhatt et al., 2020b), zero inventory, lean green product and processes design (Florida, 1996). It makes organizations more competitive than the green one alone (Mollenkopf et al., 2010). Organizations having ISO 9000 quality management system are more likely to adopt ISO 14000 (King and Lenox, 2001). Integrated lean-green manufacturing improves quality, delivery, customers' satisfaction (Duarte and Cruz-Machado, 2013; Bergmiller and McCright, 2009), profitability, market position, reputation (Thanki et al., 2016), equipment utilization, equipment benefits (Domingo and Aguado, 2015), product-process design (Das et al., 2014), sale, productivity, performance, profit (Florida, 1996), market, financial, and environmental performance (Yang et al., 2011); reduces process waste, lead time, cost (Bergmiller and McCright, 2009), waste and pollution (King and Lenox,

Table 5
Benefits of agile manufacturing.

improvement in -	reduction in -
– customer service, customer satisfaction, product customization, delivery speed, cost management, logistics cost, quality, delivery reliability, delivery flexibility, order flexibility, productivity, information systems support, order fill capacity, advance shipment notification, asset management, inventory turn, return on assets, return on investment, profit, return on sales, market share, sales volume, sales (Inman et al., 2011) – mass customization (Brown and Bessant, 2003; Gunasekaran, 1998) – market growth, profitability, product-service innovation, organizational reputation (Cao and Dowlatshahi, 2005) – customer satisfaction, cost-effectiveness for variety needs in an unpredictable market, quick responsiveness to changing market requirements, flexibility (Gunasekaran, 1998) – develops manufacturing competitive strength (Vázquez-Bustelo et al., 2007) – new product introduction, customer-driven innovations, strategic benefits (Yusuf et al., 1999) – chances to grab the opportunities in a volatile market, increased profit, service levels for product differentiation (Naylor et al., 1999).	– lead time (Naylor et al., 1999)

2001).

Integrated sustainable-lean manufacturing minimizes the environmental and social impact (Ng et al., 2015; Sharrard et al., 2008) while integrated lean-six sigma improves process quality and performance (Cherrafi et al., 2016), product quality and performance (Bendell, 2006), customer satisfaction, bottom-line results, lead time and costs (Snee, 2010).

Integrated sustainable-lean-six sigma manufacturing improves economic, environmental, and social performance (Chiarini, 2014; Pampanelli et al., 2014). Studies show that to achieve maximum sustainability performance, organizations have to integrate six sigma with lean, green, sustainability (Garza-Reyes, 2015; Banawi and Bilec, 2014).

Leagile manufacturing is a value-added reconfigurable manufacturing system (Krishnamurthy and Yauch, 2007). For leagile manufacturing, strategic and technical facets along with proper coupling and decoupling points must be planned (Elmoselhy, 2012, 2013). Earlier, lean or efficient manufacturing is used at the upstream while agile or effective supply at downstream, thus bringing together the best of both paradigms (Christopher and Towill, 2000; Mason-Jones et al., 2000). After development in a reconfigurable energy-efficient system, leagility is used at the upstream side. Many organizations use modular and reconfigurable products for customization (Elmoselhy, 2013; 2015a). Leagility provides the organizational capability to cost-effectively provide (Krishnamurthy and Yauch, 2007) the product to the customers in an unpredictable and turbulent market (Agarwal et al., 2006).

The use of virtual groups to the functional layouts helps the management to change the focus on system improvement in leagile manner, which otherwise remains focused on only from processes to products. It increases their focus to meet customer demand at all stages of manufacturing along with getting benefits of lean and agile standing side by side (Prince and Kay, 2003).

In leagile manufacturing system, agile manufacturing reduces the bullwhip effect, this reduces the organization's global inventory by 45% which increases the leanness of the supply chain of the organization (McCullen and Towill, 2001). Leagility reduces the lead time and cost, and improves quality and service level (Agarwal et al., 2006), product mix flexibility (Hallgren and Olhager, 2009), and optimal performance (Mason-Jones et al., 2000) in the unpredictable market.

To foster the integrated lean-green-agile manufacturing strategy, the organizations should involve the customers at the design level and optimize the resources to maintain a minimum inventory level (Mittal et al., 2017).

Fig. 5 shows the integration level of various manufacturing strategies along with the focus of the core strategy.

It is observed through literature that there are always various external and internal drivers that drive an organization to opt for a manufacturing strategy. Due to the scarcity of resources and the need for preserving the resources for the future generation, and the unpredictable ever-changing market, a sustainable competitive manufacturing strategy is of prime importance for any manufacturing organization to compete in the market. It is observed through literature that sustainable and agile manufacturing, i.e., integrated sustainable green lean six sigma agile (ISGLSA) manufacturing strategy with integrated sustainable green lean six sigma agile manufacturing system (ISGLSAMS)

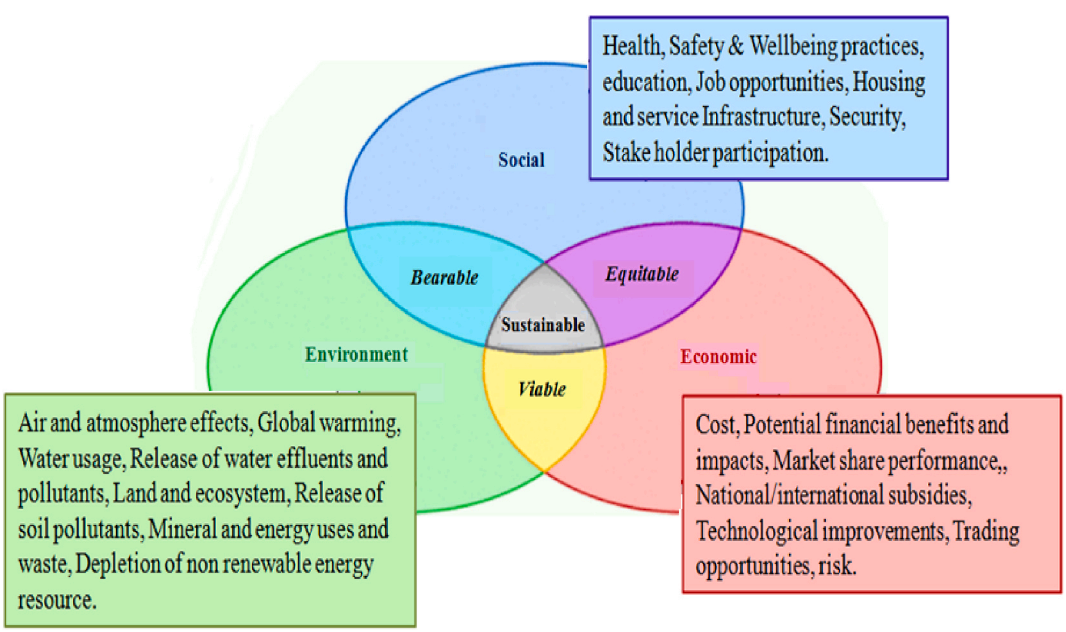

Fig. 3. Three dimensions of sustainability (Garbie, 2015).

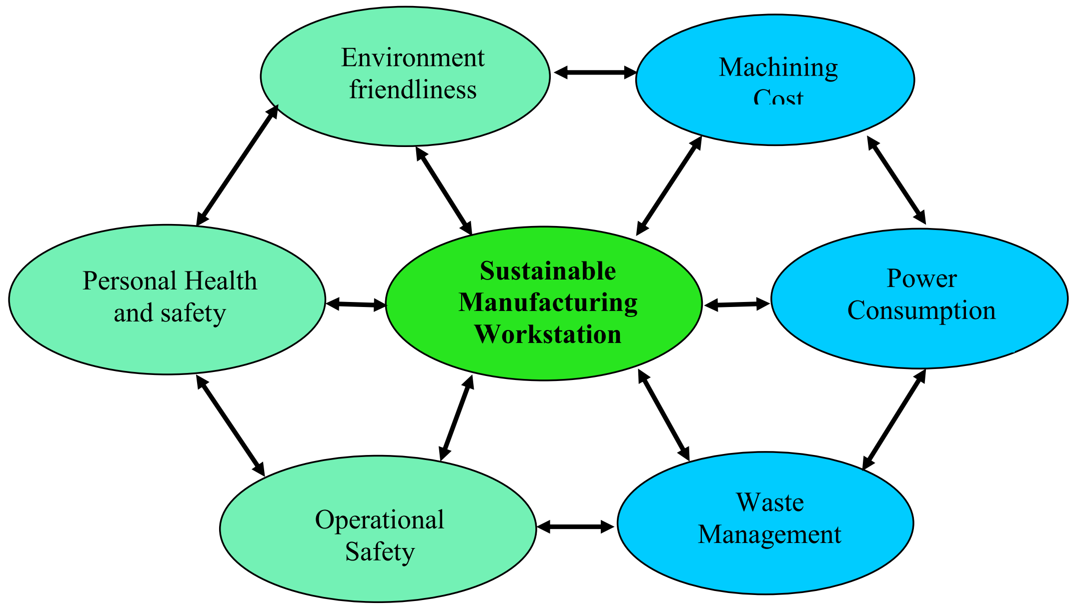

Fig. 4. Sustainability assessment of a manufacturing workstation - basic elements (Jawahir and Dillon, 2007).

Table 6
Benefits of sustainable manufacturing.

improvement in -	reduction in -
– economic growth while ensuring environmental protection and societal well-being, more effective utilization of resources, business-to-business relationships (Badurdeen et al., 2009) – source reduction, improvement in ecological balance (Despeisse et al., 2012; Westkämper and Alting, 2000) – environmental, societal, economic benefits (Jayal et al., 2010) – better risk management, environmental stewardship (Joung et al., 2013) – multiple benefits (Jovane et al., 2008) – end-of-life options (Kaebernick et al., 2003) – product life extension (Linton et al., 2007) – competitiveness, profitability, productivity, manufacturing sustainability, and environmental stewardship (Rosen and Kishawy, 2012) – green image (Garetti and Taisch, 2012)	– wasteful or harmful practices (Badurdeen et al., 2009) – source dependency (Gardner and Colwill, 2016; Sáez-Martínez et al., 2016) – life cycle cost (Westkämper and Alting, 2000)

provide the platform to the organizations to meet business social, environmental, economic, financial, and market performance goals. Many organizations try to opt for this manufacturing strategy voluntarily but still, the gap remains due to the absence of many internal and external drivers (Hallgren and Olhager, 2009).

This paper through a literature survey identifies the various drivers and associated clauses or items for the adoption of ISGLSAMS so that through the individual or mutual interaction of the drivers, desired sustainable outcomes can be achieved. By changing the driver's pressure, the government, management, organizations, and stakeholders can influence the adoption of any manufacturing strategy or policy.

Organizations should also assess their strengths, weaknesses, and current state to plan the strategic approach to opt for ISGLSAMS. The organization must set the priorities and goals for the successful implementation of ISGLSAMS. Various enablers, strategic planning, practices, and proactive measures must be taken by the organization to meet the requirements of ISGLSAMS drivers and to achieve the desired performance outcomes and competitive advantages proactively.

2. Paradigm definitions of ISGLSAMS

With sustainable development, awareness, and ever-changing customer demand, customers consider the total value of the product in terms of many metrics, viz. quality, service, cost, lead time (i.e., time from placing the order to product delivery) (Johansson et al., 1993), and environmental footprint during the product life cycle (Dangelico and Pujari, 2010) as presented in Fig. 6. For maximizing the value of the product, cost, lead time, and environmental footprint of the product during the life cycle must be minimized and quality and services must be maximized. These metrics are the key areas of research to gain market share, profit, brand image, social image, and becoming a global player in the global business market. ISGLSAMS provides a solid platform for meeting these value metrics.

Various practices and key concepts of individual elements of ISGLSAMS highlighted by most of the researchers are already discussed above.

The ISGLSAMS incorporates:

- Sustainable, green, lean, six sigma, and agile manufacturing strategy and practices simultaneously in an integrated manner under a single umbrella in a manufacturing system with strategic, tactical, and operational planning (Mittal et al., 2017; Nieuwenhuis and Katsifou, 2015; Elmoselhy, 2013).
- Innovative business model (Madsen, 2020).
- Strategically planned and designed elements. Resources are purchased and developed accordingly (Mittal et al., 2017; Nieuwenhuis and Katsifou, 2015; Elmoselhy, 2013; Stump et al., 2012).
- Reconfigurable, and quickly responsive manufacturing system to changes in the product designs, product mix, and functional, ergonomic, and aesthetic needs for the different market groups in the unpredictable market in a sustainable manner (Mittal et al., 2017; Nieuwenhuis and Katsifou, 2015; Elmoselhy, 2013; Stump et al., 2012).
- Information Technology to predict the market changes (Krishnamurthy and Yauch, 2007; Naylor et al., 1999).
- Virtual corporation of supply chain partners for streamlined ISGLSAMS (Elmoselhy, 2015b; Krishnamurthy and Yauch, 2007; Christopher and Towill, 2000; Naylor et al., 1999).

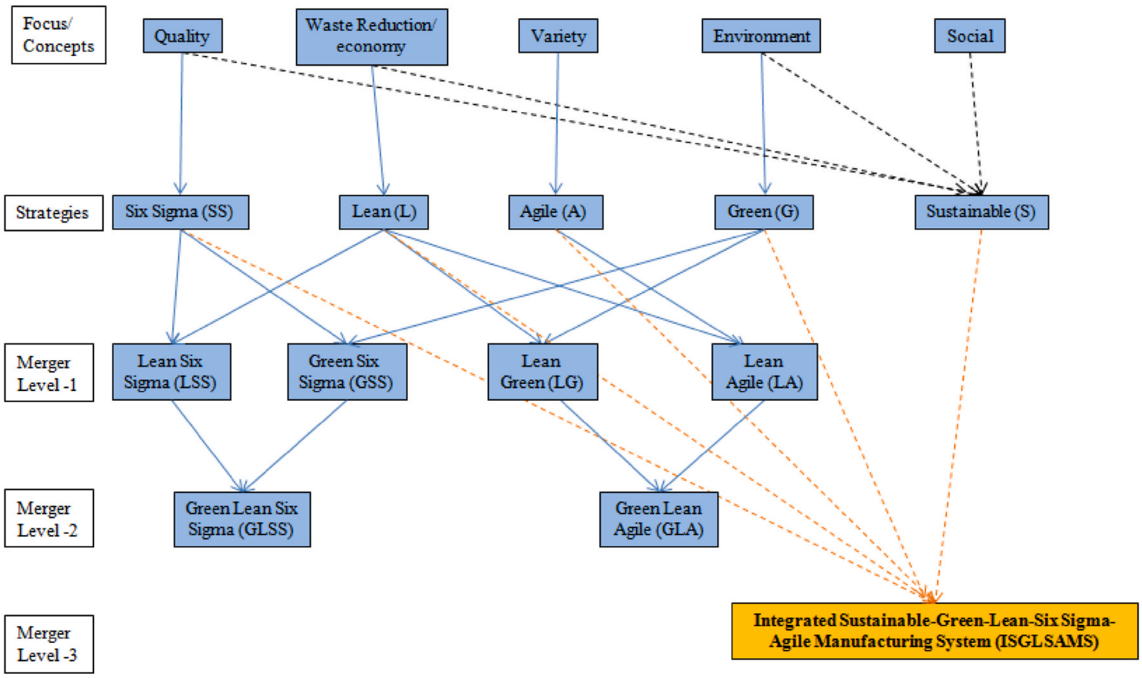

Fig. 5. Integration level of various manufacturing strategies along with the focus of each strategy.

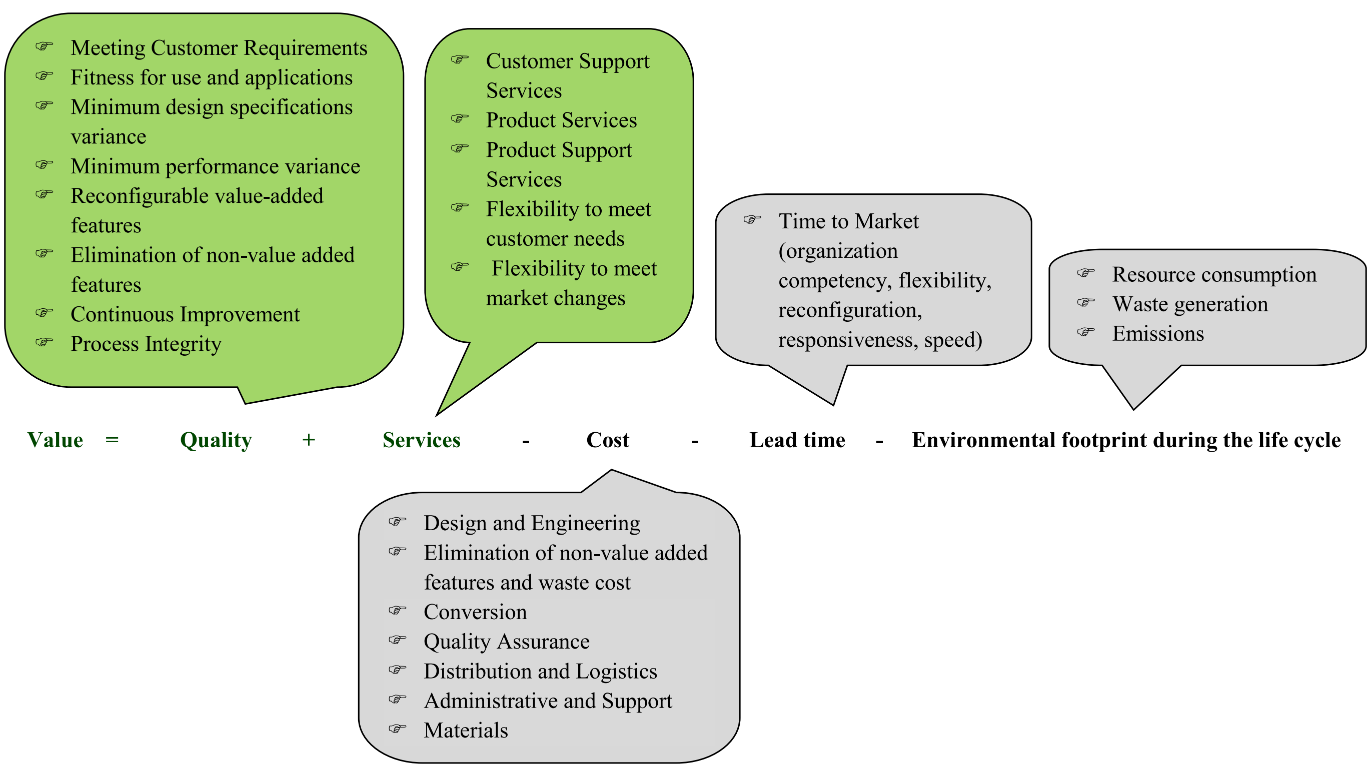

Fig. 6. Total value metric of product covering ISGLSAMS dimensions (Dangelico and Pujari, 2010; Johansson et al., 1993).

- Rapid reconfigurable robust clean manufacturing system and supply chain for lead time compression, and quality and variety product (Mittal et al., 2017; Elmoselhy, 2013, 2015b).
- The reverse supply chain for recovery, remanufacture, reuse, and recycle (Bergmiller and McCright, 2009).
- Well-cross-trained workers in all aspects of ISGLSAMS (Mittal et al., 2017; Naylor et al., 1999).
- Rapid reconfigurable robust sustainable product design (Mittal et al., 2017; Nieuwenhuis and Katsifou, 2015).
- Sustainable clean reconfigurable manufacturing resources are purchased and the workstation is sustainable-green-lean-six sigma designed for a particular product or product variety needs (Nieuwenhuis and Katsifou, 2015).

Proper coupling and de-coupling points for leagility must be planned

(Nieuwenhuis and Katsifou, 2015; Mason-Jones and Towill, 1999). Lean implementation is generally considered an antecedent to agility. If lean and agility rule out each other in a plant then managers must recognize correctly their organizational context (Putnik and Putnik, 2012; Banihashemi, 2011). In the case of an inclusive relationship, the managers should focus on the specificities (Putnik and Putnik, 2012) of the system. The system is reconfigured at decoupling points and then again integrated sustainable green lean six sigma value stream-based manufacturing is done for new setting (Nieuwenhuis and Katsifou, 2015).

In ISGLSAMS, the economy is achieved through lean, sustainability, and six sigma (i.e., by (i) minimizing non-value-added processes, (ii) robust product, process, and system design, (iii) recovery, remanufacture and redesign of the product during its life cycle) and agility through reconfiguring its technological and human resources in response to changes in the market or customers' need (Mittal et al., 2017; Nieuwenhuis and Katsifou, 2015).

As ISGLSAMS involves leagility inbuilt, for inventory procurement, hybrid Keiretsu-Kraljic purchasing portfolio matrix (Fig. 7) (Elmoselhy, 2013; 2015a) along with sustainability evaluation of the suppliers is used. An organization must balance Kraljic's purchasing portfolio model and Japanese Keiretsu suppliers' relation approach (Elmoselhy, 2013; 2015a) with the suppliers of the sustainable products, to get the ISGLSA supply chain design for the purchase goods. According to this, the purchasing portfolio matrix should be filled out as follows "(1) The bottleneck and non-critical categories should be as empty as possible, by using standardization and pooling of items, to increase the impact of the manufacturing enterprise's own business on the environment, (2) The leverage category should be filled with qualified partners, based on (i) dimensions of supply evaluation, i.e., delivery reliability and, (ii) dimensions of supplier-buyer relation, i.e., mutual trust, mutual commitment, buyer's dependence, and supplier's dependence. At the strategic level, the core capabilities of an outsourcing facility should be assessed based on the speed of delivery, quality, production flexibility, sustainability, and cost. Those who best meet these conditions become qualified to enter into the Keiretsu relation with the manufacturing enterprise, (3) The strategic category includes strategic partners, with the capabilities for co-design of items with backward integration for components to decrease the impact of the environment on the manufacturing enterprise's own business. This will increase the robustness of the manufacturing system" (Elmoselhy, 2013, 2015a; Murray et al., 2005).

"Strategic decisions should be made on how much inventory to be carried to strike a balance between the cost of stocking (that costs as much as 30% of the product value) and the cost of lost sales that costs more than this. The use of the internet in purchasing, termed e-sourcing, along with adopting the proposed hybrid Keiretsu-Kraljic supply framework lead to the promising results" (Elmoselhy 2013, 2015).

For ISGLSAMS, organizations use mixed-pull supply chain strategies of replenishment pull and sequential pull (Elmoselhy, 2015a). Buffer stocks are kept at the strategic and bottleneck locations (Elmoselhy, 2015a).

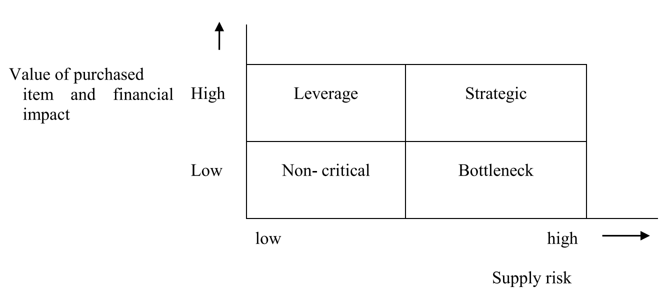

Fig. 7. Hybrid Keiretsu-Kraljic purchasing portfolio matrix (Elmoselhy 2013, 2015).

Table 7 highlights the various characteristics of an ISGLSAMS.

Fig. 8 shows the application area of ISGLSAMS. As seen from Fig. 8, lean focuses on quality and cost while agile focuses on quality and responsiveness. ISGLSAMS provides customer-driven quick response manufacturing of sustainable reconfigurable products and services cost-effectively through the integration of reconfigurable manufacturing processes and systems, outsourcing, and various best practices in a knowledge-rich leagile manufacturing environment (Garza-Reyes, 2015; Nieuwenhuis and Katsifou, 2015; Elmoselhy, 2013; Christiansen et al., 2007; Krishnamurthy and Yauch, 2007; Christopher and Towill, 2000). Through ISGLSAMS cost, quality, responsiveness, and sustainability benefits can be achieved for market and business success (Mittal et al., 2017; Nieuwenhuis and Katsifou, 2015; Elmoselhy, 2013).

Due to the limited resources, global warming, and unpredictable market, a sustainable customer-focused reconfigurable manufacturing approach viz. ISGLSAMS will be the winning criteria in the business for the long term. In ISGLSAMS, organizations strategically redesign, remanufacture and recover the product and process waste than simply using green manufacturing practices, viz. reduce, reuse and recycle of product and process waste.

For successful implementation of ISGLSAMS, an organization has to proactively involve suppliers for planning, designing, manufacturing, resource development, delivery of the purchased product in an ISGLSA manner. Supplier development and earlier resolution of the issues are

Table 7
Characteristics of ISGLSAMS.

Distinguish Characteristics of ISGLSAMS	
Manufacturing resources	Sustainable clean reconfigurable
Market demand	Volatile and Unpredictable
Information enrichment, i.e., use of market knowledge through IT	Essential
Product variety	Medium to high or personalized
Product life cycle	Short
Customer drivers	Sustainable product with quick responsiveness, delivery reliability and cost
Forecast mechanism	Either or both algorithmic or consultative
Purchasing portfolio	Hybrid Keiretsu-Kraljic
Purchasing policy	Vendor Managed Inventory
Typical products	Product as per customer demand
Stockout penalties	No place for stockout
Eliminate waste	Desirable
Rapid reconfiguration	Essential (for make to order)
Outsourcing	Based on competency and reconfiguration available (generally for assemble to order manufacturing)
Virtual corporation	Essential
Cost	Market Qualifier
Sustainability and responsiveness	Market Winner
Quality	Market Qualifier
Lead time compression	Market Qualifier and essential
Smooth demand/Level scheduling	Desirable
Mixed-Pull supply chain strategies	Essential
6R approach	Essential
Dominant Cost	Physical, marketability and sustainable supply chain cost
Profit Margin	Moderate
System Management Complexity	Moderate
Inventory Level	At strategic and bottleneck locations
Robustness	Essential
Flatter matrix organizational structure	Essential
Self-organized teams	Essential
Short feedback cycles with Kaizen	Essential
Information radiators with Visual Management	Essential
Employees as facilitating servant-leader (trained in ISGLSA value stream concept)	Essential
Whole team together approach (incl. stakeholders) with ISGLSA focus	Essential

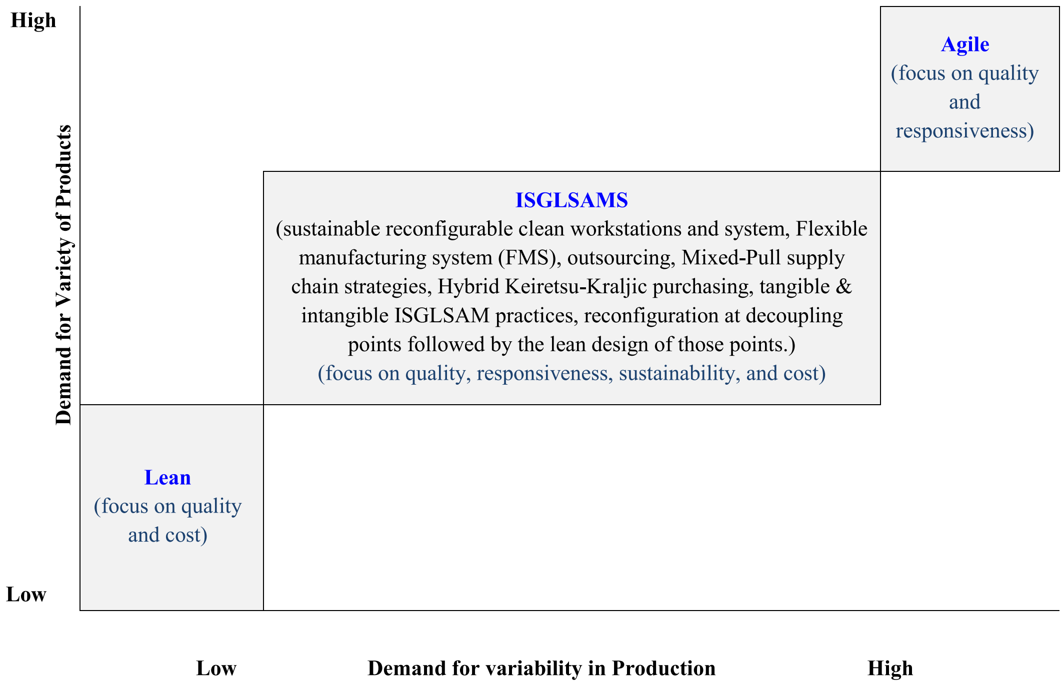

Fig. 8. Application of ISGLSAMS

also essential for ISGLSAMS.

Employees are the value makers for the customers, and profit and brand image-makers for the organization. They are directly associated with the workplace and more familiar with the technical aspects of the process; worthful suggestions generally come from their side. The organization must develop a culture of voluntary participation of the employees for continuous improvement of product, process, system, and supply chain for ISGLSAMS. Also, proper training and skill development are essential for the successful implementation of ISGLSAMS and strategy.

As observed in Fig. 9 and literature, for ISGLSA product design, the organization must focus on design for resource utilization, design for environment, design for robustness, design for recyclability, remanufacture, design for social impact, and design for reconfiguration with the total lifecycle and total value focus (Rosen and Kishawy, 2012; Jawahir et al., 2006).

Fig. 10 shows the mindsets of ISGLSAMS. As shown earlier ISGLSAMS integrates sustainable, green, lean, six sigma, agile manufacturing under a single umbrella. The integration of each aspect of ISGLSAMS with a strategic approach is important; as many organizations are not able to integrate all these aspects under a single system and fail to get fruitful results. For example, if (i) the organization focuses only on green manufacturing then either they are partially or not opting for another 3Rs, i.e., remanufacture, redesign, recover, of sustainable manufacturing, (ii) some organizations opt for few lean practices but not approaching six sigma quality level, (iii) some organizations opt for leagile practices but not concentrating on sustainable manufacturing, (iv) some organizations opt for sustainable manufacturing but not the agile, vice versa. In the unpredictable or turbulent market, stakeholders' values will get maximized through the implementation of an integrated sustainable green lean six sigma agile manufacturing system (ISGLSAMS) than individual practices alone as shown in Fig. 11.

Apart from the exploration of various competitive bases, viz. (i) responsiveness, flexibility, innovation, competence, quality, cost, sustainability, profitability (Elmoselhy, 2013, 2015b; Nieuwenhuis and Katsifou, 2015), (ii) better market and social image in an unpredictable market (Vázquez-Bustelo et al., 2007; Elkins et al., 2004; Gunasekaran and Yusuf, 2002; Christopher and Towill, 2001), (iii) social, environmental, financial, economic and market performance (Mittal et al., 2017; Elmoselhy, 2015a; Nieuwenhuis and Katsifou, 2015), (iv) various government incentives and subsidies (Jiang et al., 2018) still organizations are not moving towards ISGLSAMS.

3. Review question

It is observed in the literature that organizations are opting for lean, green, six-sigma, sustainable, and agile manufacturing strategy in an individual or partial mix manner, but still not able to obtain sustainability and business goals in an unpredictable market. To achieve these goals, the implementation of ISGLSAMS is essential. Considering this context, the review questions addressed by this study are: (i) What are the various drivers for the adoption of ISGLSAMS? (ii) What are the key characteristics of ISGLSAMS? (iii) What is the benchmark and performance measurement framework for ISGLSAMS? so that strategic successful implementation and adoption of ISGLSAMS can be planned by the government and peers to meet the business sustainability, market, organizational, and operational goals in the unpredictable market. To answer this question, a systematic literature review of the sustainable, green, lean, six sigma, and agile manufacturing system, and drivers have been carried out.

4. Review objectives

The objectives of this paper are (i) identification of various drivers, through extensive literature survey, for the adoption and successful implementation of ISGLSAMS, so that successful adoption and implementation of ISGLSAMS by the organizations can be planned by the government and peers to meet the business' sustainability, market, organizational and operational goals in the unpredictable market, (ii) development of the key characteristics of ISGLSAMS, (iii) development of benchmark and performance measurement framework for ISGLSAMS, (iv) identification of further research areas for the drivers for the successful adoption of ISGLSAMS. The paper also discusses some strategic and technical facets of ISGLSAMS.

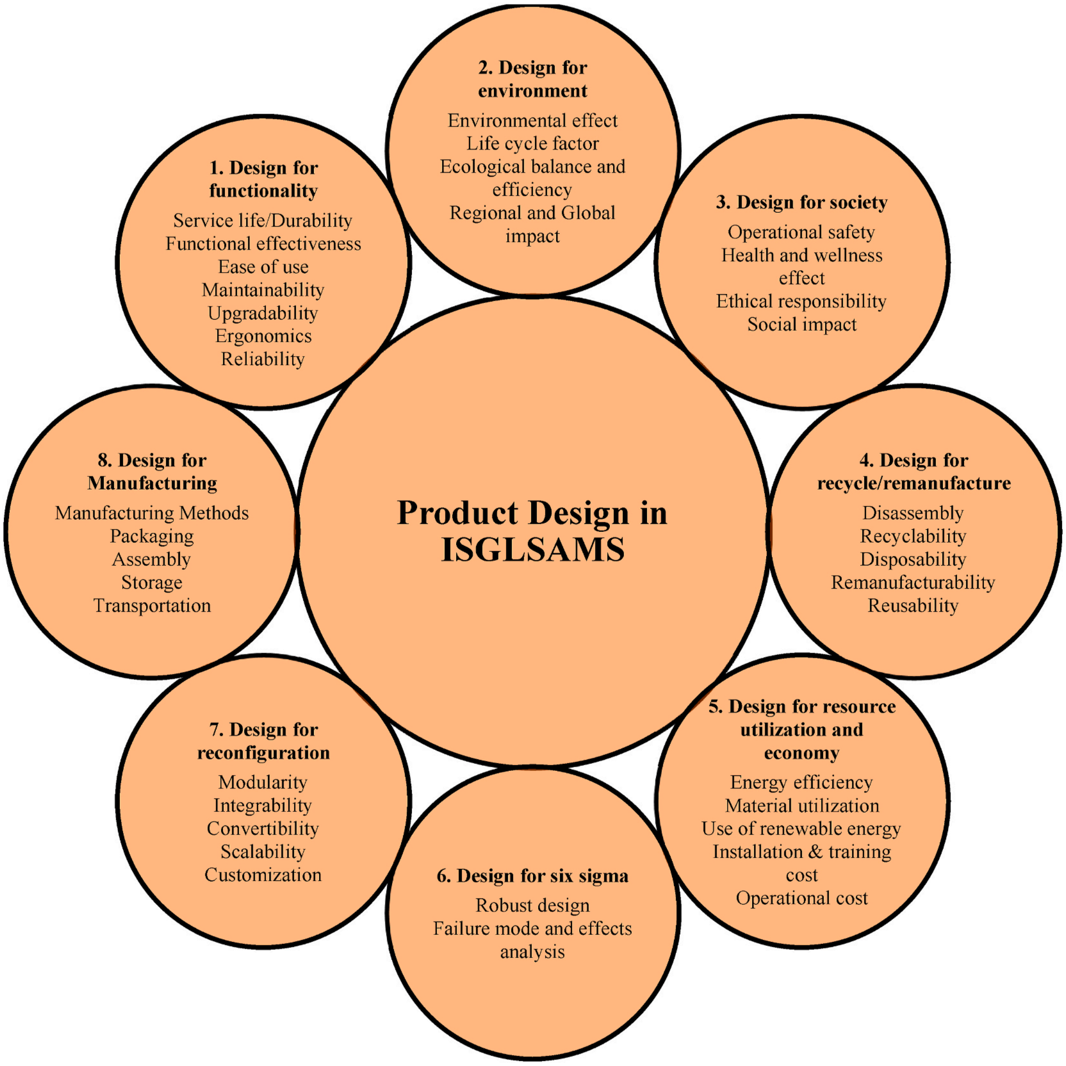

Fig. 9. Product design for sustainability or Product sustainability wheel (Rosen and Kishawy, 2012; Jawahir et al., 2006).

5. Review methodology

An in-depth literature analysis has been performed on various perspectives of ISGLSAMS drivers in line with review objectives. The present review followed a qualitative type of review analysis. The review methodology includes targeting relevant publications databases and searching using a wide range of keywords and phrases related to ISGLSAMS.

The selection of papers to be included in the literature review is done as per (Moher et al., 2009a,b), involving (a) identification of the papers; (b) screening; (c) eligibility; and (d) inclusion steps. As for the identification step, the Web of Science and Google Scholar database was included. The database was queried between August 20th, 2019 and Feb. 25th, 2021. The search criteria include (i) the terms 'Lean' AND 'Manufacturing' AND 'Drivers', 'Agile' AND 'Manufacturing' AND 'Drivers', 'Green' AND 'Manufacturing' AND 'Drivers', 'Six Sigma' AND 'Manufacturing' AND 'Drivers', 'Sustainable' AND 'Manufacturing' AND 'Drivers'. The period of publication was not specified during the search. In the screening process, papers other than english language and full content access denied papers were excluded. In the eligibility step, the full contents of articles were analyzed with the following exclusion and inclusion criteria: (i) papers in which the terms 'Sustainability' and 'Drivers', 'Green' and 'Drivers' 'Lean' and 'Drivers', 'Agile' and 'Drivers', 'Six Sigma' and 'Drivers' were not used in the sense of the review question were excluded, and (ii) papers with individual driver and relevance were included. As a result of applying these criteria in the end, 219 papers were included for identifying the relevant drivers.

6. Drivers to the adoption of ISGLSAMS

Many times organizations do not adopt ISGLSAMS either due to lack of various drivers or due to various barriers or due to short term goals; but for the benefits of the society, organization, future generation, and sustainability sometimes the adoption of ISGLSAMS either imposed or voluntarily accepted either to remain competitive or to remain in the market. There are always various internal and external drivers that drive the organization to opt for ISGLSAMS. The following section discusses the various drivers and their associated clauses or items identified through a literature survey, at the various levels of management for the adoption of integrated sustainable green lean six sigma agile (ISGLSA) manufacturing system and strategy. Table 8 shows the resources of the papers included in the study and Fig. 12 shows the year-wise distribution of the papers included in the study.

6.1. Government regulation and current legislation

Government regulation and current legislation are the presence of stringent regulation and legislation for (i) planet protection, (ii) conserving resources, (iii) green product and process design, (iv) green supply chain management, (v) environmental strategies and

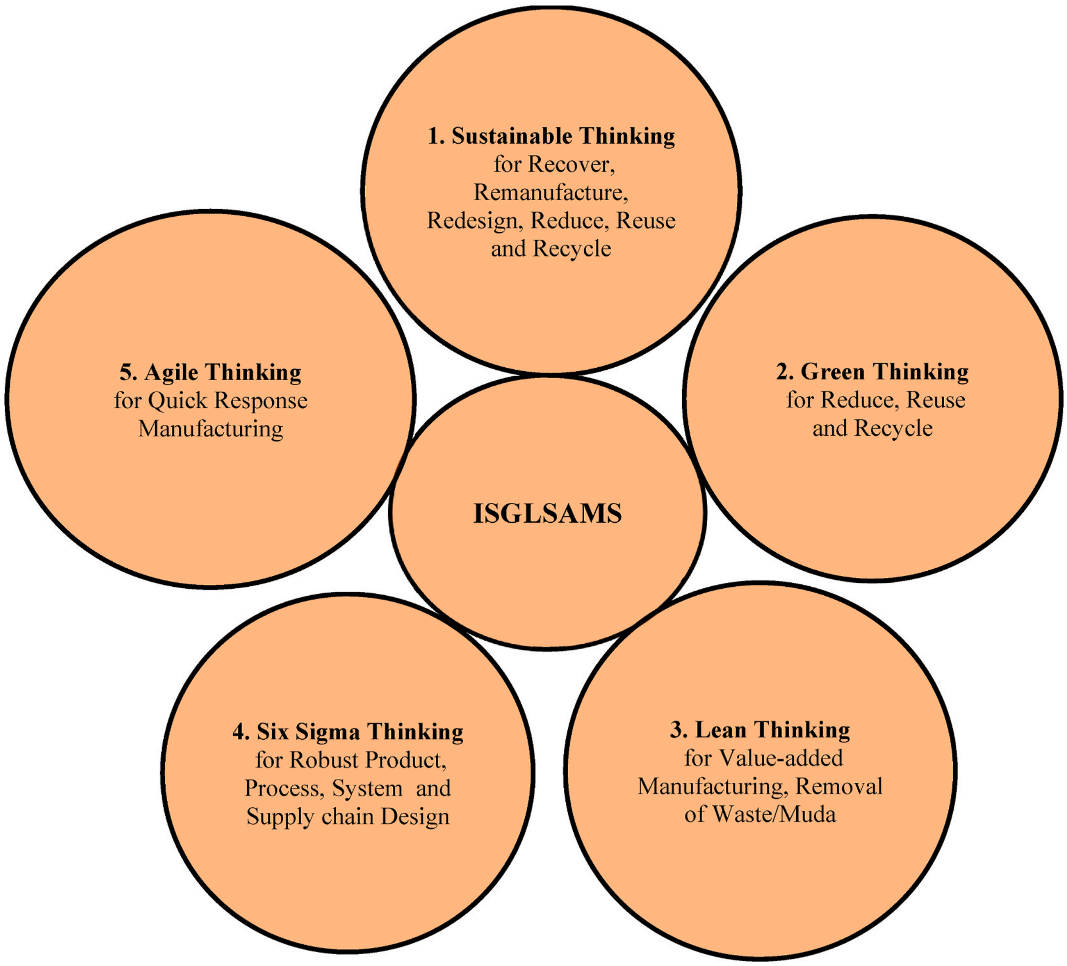

Fig. 10. Mindsets of ISGLSAMS

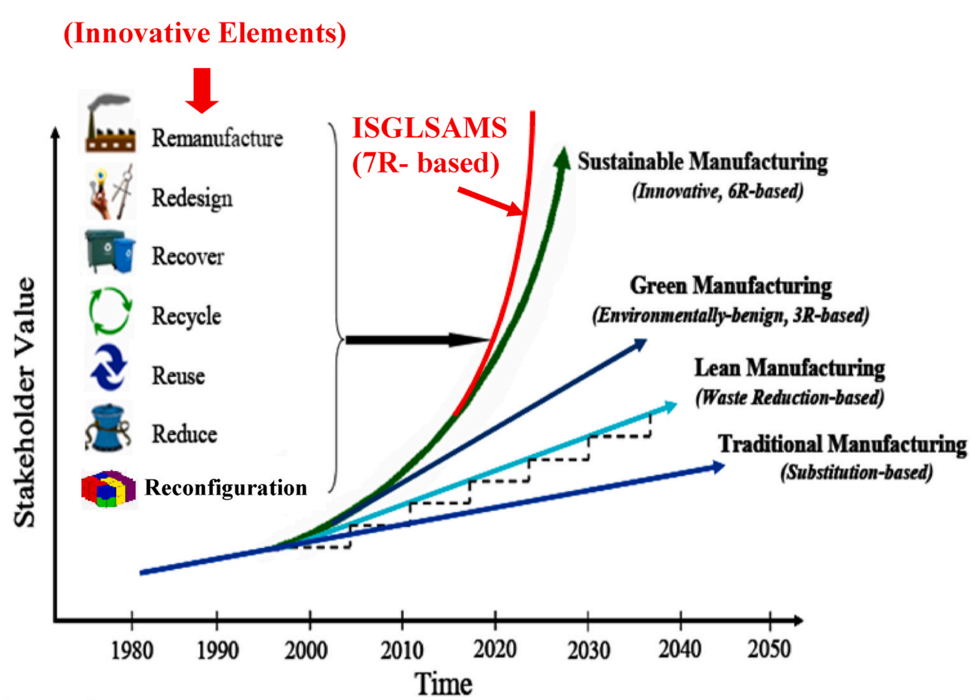

Fig. 11. Timeline path of innovation in manufacturing strategy and stakeholders' value.

Table 8
Resources of the papers included in the study.

Journals	Authors
Academy of Management Review	Hart (1995)
Academy of Management Executive	Berry and Randinelli (1998)
Annals of Operations Research	(Shibin et al., 2017; Zhou, 2016)
Applied Ergonomics	Siemieniuch et al. (2015)
Benchmarking	Nunes and Bennett (2010)
Business Process Management Journal	(Karim and Arif-Uz-Zaman, 2013; Jin-Hai et al., 2003)
Business Strategy and the Environment	(Hall and Wagner, 2012; Hofmann et al., 2012)
Business Strategy and the Environment	Liu et al. (2012)
California Management Review	Florida (1996)
Corporate Social Responsibility and Environmental Management	(Lozano, 2015; Guoyou et al., 2013; Bradford and Fraser, 2008)
Distribution Logistics	Brito et al. (2003)
Ecological Economics	Tudor et al. (2007)
Engineering Management Journal	Booth (1996)
Environment and Urbanization	Robins and Kumar (1999)
European Journal of Innovation Management	Gallouj (2015)
European Journal of Operational Research	(Agarwal et al., 2006; Yusuf et al., 2004)
European Journal of Purchasing and Supply Management	(Walker et al., 2008; Zsidisin and Siferd, 2001)
IEEE Transactions on Engineering Management	(Driessen et al., 2013; Azevedo et al., 2012; Rusinko, 2007; Zhang and Sharifi, 2007; Hafeez et al., 2002)
IFAC-Papers On-Line	Cabrita et al. (2016)
Industrial Management and Data Systems	(Raisinghani et al., 2005; Crocitto and Youssef, 2003; Li, 2000)
Industrial Marketing Management	Richey et al. (2005)
Information Sciences	Tseng and Lin (2011)
International Journal of Academic Research in Business and Social Sciences	Krishna Moorthy et al. (2012)
International Journal of Advanced Manufacturing Technology	Dubey and Gunasekaran (2015)
International Journal of Agile Systems and Management	(Ngamsirijit, 2011; Adeleye and Yusuf, 2006)
International Journal of Automotive and Mechanical Engineering	Nordin et al. (2010)
International Journal of Human Resource Management	Jabbour and Santos (2008)
International Journal of Innovation and Technology Management	Rehman and Shrivastava (2011)
International Journal of Lean Six Sigma	Chiarini (2011)
International Journal of Lean Thinking	Al-Najem and Dhakal (2012)
International Journal of Logistics Research and Applications	Knowles et al. (2005)
International Journal of Management Reviews	Srivastava (2007)
International Journal of Managing Value and Supply Chains	Abu Seman (2012)
International Journal of Manufacturing Technology and Management	Mehrabi et al. (2000)
International Journal of Operations & Production Management	(Abdul-Rashid et al., 2017b; Piercy and Rich, 2015; Bhamu and Sangwan, 2014; Hsu et al., 2013; Hallgren and Olhager, 2009; Vázquez-Bustelo et al., 2007; Rao and Holt, 2005; Brown and Bessant, 2003; Sharifi and Zhang, 2000, 2001; Sohal and Egglestone, 1994; New, 1992)
International Journal of Physical Distribution & Logistics Management	(Mollenkopf et al., 2010; Christopher and Towill, 2001)
International Journal of Precision Engineering and Manufacturing - Green Technology	(Abdul-Rashid et al., 2017a; Dornfeld, 2014)
International Journal of Production Economics	(Orji and Liu, 2020; Yalabik and Fairchild, 2011; Zhang, 2011; Prince and Kay, 2003; Stratton and AuthorAnonymous, 2003; Naylor et al., 1999; Sharp et al., 1999; Yusuf et al., 1999)
Journals	**Authors**
International Journal of Production Research	(Dubey et al., 2015a; Mittal and Sangwan, 2014a; Jayaraman et al., 2012; Bi et al., 2008; Yusuf and Adeleye, 2002; Mason-Jones et al., 2000; Gunasekaran, 1998)
International Journal of Productivity and Performance Management	Singh Sangwan et al. (2014)
International Journal of Quality & Reliability Management	(Agus and Hajinoor, 2012; Behara et al., 1995)
International Journal of Research in Engineering and Technology	Bhool and Narwal (2013)
International Journal of Six Sigma and Competitive Advantage	Basu (2004)
International Journal of Sustainable Development and World Ecology	Somsuk and Laosirihongthong (2017)
International Journal of Sustainable Engineering	Rahimifard et al. (2009)
International Journal of Systems Science: Operations and Logistics	Dubey et al. (2015c)
Journal of Business Ethics	(Leonidou et al., 2015; Maon et al., 2009; Williamson et al., 2006)
Journal of Business Research	Yen and Yen (2012)
Journal of Cleaner Production	(Song et al., 2020; Yadav et al., 2020; Zameer et al., 2020; D'Souza et al., 2020; Kumar et al., 2020; Latapí et al., 2020; Nielsen, 2020; Zarte et al., 2019; Farias et al., 2019; Seth et al., 2018; Aboelmaged, 2018; Gandhi et al., 2018; Moktadir et al., 2018; Helleno et al., 2017; Ribeiro et al., 2016; Cherrafi et al., 2016; Maniatis, 2016; Rehman et al., 2016; Govindan et al., 2015; Chofreh et al., 2014; Tseng et al., 2013; Agan et al., 2013; Zhu and Geng, 2013; Massoud et al., 2010; Zhu et al., 2007; Zhu and Sarkis, 2006; Hall, 2000)
Journal of Economic Behavior and Organization	Arora and Gangopadhyay (1995)
Journal of Economics, Business and Management	Kamolkittiwong (2015)
Journal of Environmental Economics and Management	Chandra et al. (2010)
Journal of Industrial Ecology	Mathews and Tan (2011)
Journal of Industrial Engineering and Management	Kumar et al. (2013)
Journal of Manufacturing Technology Management	(Ghobakhloo and Azar, 2018; Huang et al., 2015; Barve and Muduli, 2013; Ghosh, 2013; ElTayeb et al., 2010; Holt and Ghobadian, 2009; Achanga et al., 2006)
Journal of Marketing	Luo and Bhattacharya (2006)
Journal of Materials Engineering and Performance	Frazier (2014)
Journal of Modelling in Management	Mittal and Sangwan (2014b)
Journal of Operations Management	(Hofer et al., 2012a; Swink and Jacobs, 2012; Linton et al., 2007; Montabon et al., 2007; Swafford et al., 2006; Cao and Dowlatshahi, 2005; Melnyk et al., 2003)
Journal of Organizational Change Management	Kumar et al. (2016)
International Journal of Productivity and Quality Management	Rehman et al. (2014)
Journal of Purchasing and Supply Management	Giunipero et al. (2012)
Journal of Supply Chain Management	(Foerstl et al., 2015; Reuter et al., 2010)
Journal of World Business	Kolk (2010)
Logistics Information Management	Beamon (1999)
Management Decision	(Lee, 2009; Yusuf et al., 2003)
Management Research News	Sim and Rogers (2008)
Management Research Review	(Nkrumah et al., 2021; Zhu et al., 2010)
Management Science	Savaskan et al. (2004)
Policy Studies	Vickers et al. (2005)
Production & Operations Management	(Corbett and Klenindorfer, 2009; Fleischmann et al., 2001)
	(Vokurka and Fliedner, 1997)

(*continued on next page*)

Table 8 (*continued*)

Journals	Authors
Production and Inventory Management Journal	
Resources, Conservation and Recycling	(Shen et al., 2013; Diabat and Govindan, 2011)
Robotics and Computer-Integrated Manufacturing	Burke and Gaughran (2006)
SSRN Electronic Journal	Goyal and Agrawal (2020)
Strategic Management	Shrivastava (1995)
Journals	**Authors**
Strategic Management Journal	Sharma and Henriques (2005)
Structural and Multidisciplinary Optimization	Koch et al. (2004)
Supply Chain Management	(Hitchcock, 2012; Lee, 2008; Wells and Seitz, 2005; Van Hoek, 1999)
Sustainability	(Chen et al., 2019; Shankar et al., 2016; Olugu et al., 2010)
Sustainable Development	Moon (2007)
Sustainable Production and Consumption	Fernando and Wah (2017)
Technology Analysis & Strategic Management	(Kemp and Schot, 2000)
Technovation	(Kwak and Anbari, 2006; Vázquez-Bustelo and Avella, 2006; Irani et al., 1997)
Transportation Research Part E: Logistics and Transportation Review	(Gunasekaran et al., 2015; Chiou et al., 2011; Zhu et al., 2011; Daugherty et al., 2005; Carter and Jennings, 2002)
Universal Journal of Mechanical Engineering	Minhaj et al. (2013)
Waste Management & Research: SAGE Journals	Agamuthu et al. (2009)
Conferences	
CIRP Annals - Manufacturing Technology	(Bey et al., 2013; Jovane et al., 2008; Wiendahl et al., 2007; Bruccoleri et al., 2005)
CIRP Journal of Manufacturing Science and Technology	Jayal et al. (2010)
IEEE International Conference on Industrial Engineering and Engineering Management, 2014	Nordin et al. (2014)
Industrial Engineering Research Conference	Bergmiller et al. (2009)
Procedia - Social and Behavioral Sciences	Sezen and Çankaya (2013)
Procedia CIRP	(Almanei et al., 2017, 2018; Mittal et al., 2017; Fargani et al., 2016; Jawahir and Bradley, 2016; Salonitis and Tsinopoulos, 2016; Ghazilla et al., 2015; Gupta et al., 2015; Mittal and Sangwan, 2014c; Hu, 2013)
Procedia Manufacturing	(Koren et al., 2018; Mwanza and Mbohwa, 2017)
Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture	Sharifi et al. (2001)
Proceedings of the International Association for Business and Society	Lampe et al. (1991)
Proceedings of the International Multi-Conference of Engineers and Computer Scientists 2010, IMECS 2010	Ninlawan et al. (2010)
Magazine Article	
ASQ Six Sigma Forum Magazine	Moreton (2003)
Harvard Business Review	Nidumolu et al. (2009)
MIT Sloan Management Review	(Berns et al., 2009; Ginsberg and Bloom, 2004)
New Statesman	Cowe (2003)
Quality Progress	Fontenot et al. (1994)
The McKinsey Quarterly	Bonini and Oppenheim (2008)
Report	
	(Gilbert, 2001)

Table 8 (*continued*)

Journals	Authors
Greening supply chain: enhancing competitiveness through green productivity	
Book	
Handbook of Sustainable Engineering	Spangenberg (2013)
Manufacturing Technologies for Machines of the Future	Koren et al. (2011)
Our Ecological Footprint: Reducing Human Impact on the Earth. Gabriola Island: New Society Publishers.	Wackernagel and Rees (1996)
The Machine that Changed the World: The Story of Lean Production.	Womack et al. (1990)
The New Manufacturing Challenge: Techniques for Continuous Improvement	Suzaki (1987)
book section	
Enabling Manufacturing Competitiveness and Economic Sustainability	AlGeddawy and ElMaraghy (2012)

environmental management, (vi) sustainable manufacturing, (vii) green purchasing, (viii) corporate sustainable manufacturing practices, (ix) circular economy and green operations, (x) sustainable product recovery and recycle, (xi) employees health and safety, (xii) social well being, (xiii) workplace health and safety (Vickers et al., 2005), (xiv) pollution control norms, (xv) landfill taxes, emission trading, polluted water discharge norms, eco-label (Rehman et al., 2016; Rehman and Shrivastava, 2013).

Organizations have to ascertain government regulation and current legislation in the manufacturing system, and policies for running the business (Mittal et al., 2017).

Legislation plays a major role in shaping organizational environmental attitudes (Holt and Ghobadian, 2009). It motivates the organizations to adopt environmentally conscious manufacturing (Mittal and Sangwan, 2014b), corporate sustainability (Lozano, 2015), circular economy of materials and packing (Agamuthu et al., 2009). Government regulation, customer and competitive pressure affect organization investments in environmentally conscious manufacturing, innovation, production, corporate environmental behavior (Yalabik and Fairchild, 2011).

Organizations have to ascertain the compliance of legislation laid down by pollution control agencies (Gandhi et al., 2018; Mittal and Sangwan, 2014b).

For green manufacturing, organizations have to comply with government regulation and legislation in the following domain areas (i) certification of suppliers' environmental management system, (ii) planning at operational and shop floor level, (iii) environmental collaboration with customers, suppliers, (iv) product green design, (v) ISO 14001 certification, reduction of energy consumption, reuse and recycle of materials and packing material, and reverse logistics (Abu Seman, 2012), (vi) treatment of waste, evaluation of product and system design for EMS, and corporate social responsibility (Gandhi et al., 2018; Agan et al., 2013).

Organizations have to take measures for packing material, product end-of-life material, green consumption of the product during its life cycle (Barve and Muduli, 2013). A strategic approach and roadmap for legislative compliance have to be planned and followed for green manufacturing (Bey et al., 2013). Organizations have to react positively to government regulation and legislation for managing environmental practices (Montabon et al., 2007). A comprehensive information technology solution must be designed for implementing, monitoring, and updating EMS (Burke and Gaughran, 2006).

Organizations also have to follow laws for corporate ecological responsiveness, for purchase and supply chain management

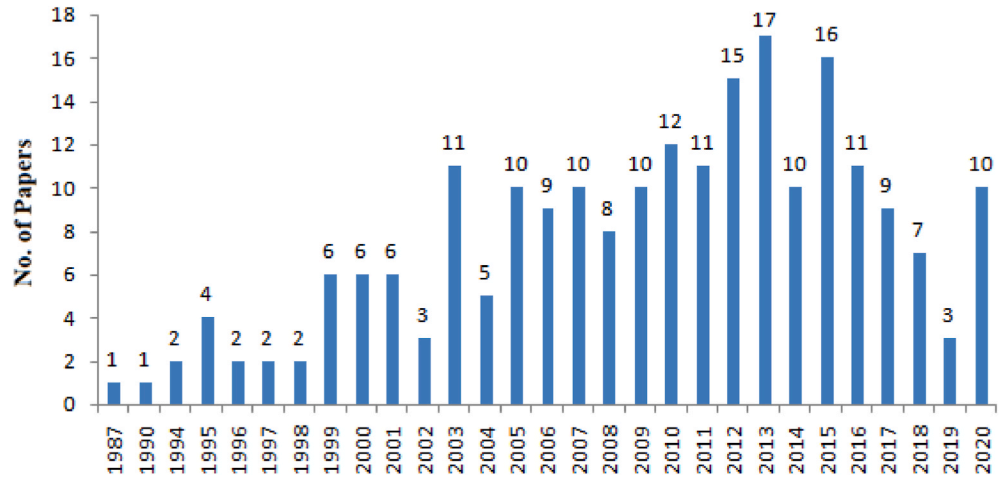

Fig. 12. Yearwise distribution of the papers included in the study.

sustainability (Giunipero et al., 2012). Organizations can minimize or avoid expensive retrofit costs by working in compliance with sustainability legislation (Lampe et al., 1991). The legislation associated with sustainability-related issues has the greatest impact on organizational business success and way of working (Rehman et al., 2016; Maurice Berns, 2009).

More systematic and integrated green supply chain management (GSCM) lowers environmental impact and risk, and increases ecological efficiency. It is the "win-win" strategy for getting profit and market share (Van Hoek, 1999). Product recovery, eco-design of the product, i.e., design for dismantling, recycling at the end-of-life of the product have taken place due to the legislation (Nunes and Bennett, 2010).

Product manufacturers have to follow responsibility for product reverse logistics for sustainable manufacturing (Rahimifard et al., 2009). Product design must be done under legislation and regulations (Srivastava, 2007). Employment procedures must also be done as per legislation (Goodman, 1998). Employees' health and safety must be of prime importance while designing the workplace and organization (Vickers et al., 2005).

"For organizations that go beyond compliance, legislation is not the main catalyst in shaping corporate behavior" (Williamson et al., 2006).

6.2. Future legislation

Future legislation is the expected development and enforcement of legislation for (i) planet protection, (ii) conserving resources, (iii) green product and process design, (iv) green supply chain management, (v) environmental strategies and environmental management, (vi) sustainable manufacturing, (vii) green purchasing, (viii) corporate sustainable manufacturing practices, (ix) circular economy and green operations, (x) sustainable product recovery and recycle, (xi) employees health and safety, (xii) social well being, (xiii) workplace health and safety (Vickers et al., 2005), (xiv) pollution control norms, (xv) landfill taxes, emission trading, polluted water discharge norms, eco-label (Rehman et al., 2016; Rehman and Shrivastava, 2013).

At the forefront, future legislative demands (Bey et al., 2013) and future environmental legislation for GSCM (Holt and Ghobadian, 2009) play a vital role in technology up-gradation, innovation (Gandhi et al., 2018). The expected development of future strict laws, and an increased level of enforcement cause the organizations to be ready for future improved legislations (Mittal and Sangwan, 2014b).

Legislation for green management regarding the municipal water supply to the industries for the safe local environment (Lee, 2009), changes in the legislative framework, and benefits of government policies to the environmentally-conscious industrial units influence the development of eco-industrial parks (Tudor et al., 2007). In the long run, customer satisfaction would be affected by organizational environmental practices. These practices will be further affected by the development of future legislation related to the business environmental laws, regulations, and enforcement. To reduce the risk of failure, and to run the business in line with the development of environmental laws, organizations are moving for environmental engagement in operational, strategic, and tactical planning (Krishna Moorthy et al., 2012).

6.3. Incentives

Incentives are various investment subsidies, concessions, Grant, R&D support, tax benefits by govt. to the industries for the adoption of a manufacturing system (Mittal et al., 2017). Incentives, viz. (i) incentives to use less energy, by pricing, taxes and other benefits (Agan et al., 2013), (ii) product take-back and supply chain incentives (Fleischmann et al., 2001), (iii) incentives by the local government (Aboelmaged, 2018), (iv) capital rebate for purchase of recycle machineries, (v) exemption on import duties and sales tax for recycle machineries, (vi) tax exemptions and investment tax allowance for conducting proper storage, treatment, disposal of toxic and hazardous waste, (vii) tax exemptions and investment tax allowance for waste recycling, and energy conservation (GPNM, 2003), (viii) financial incentives or grants by government and international organizations, (ix) tax reductions for green supply chain initiatives (ElTayeb et al., 2010), (x) positive supportive working environment and soft loans under green technology financing scheme, (xi) grants, rebates, tax concessions and other economic benefits under green technology financing scheme (Gandhi et al., 2018; Ghazilla et al., 2015), (xii) incentives for green supply chain collaboration and management with the supplier, (xiii) rewards for green knowledge management, eco-innovation, (xiv) remanufacturing balanced incentive, (xv) incentives for proactive environmental management initiatives and strategies (Gunasekaran et al., 2015), (xvi) incentives for green purchasing practices, (xvii) monetary incentives from buyers for disclosure of carbon footprint (Hsu et al., 2013), (xviii) import duty and sales tax exemption for green concept equipment (Krishna Moorthy et al., 2012), (xix) incentives in allotment of land (Mittal and Sangwan, 2014b), (xx) financial support, tax cut for infrastructure development for environmental friendly industrial complexes (Lee, 2008), (xxi) incentives for industries eco-initiatives, creation of networks of by-product exchange as well as for circular economy, (xxii) penalties for non eco-industrial initiatives (Mathews and Tan, 2011), (xxiii) incentives for integrating remanufacturing and reverse logistics in supply chain design (Savaskan et al., 2004), (xxiv) tax reduction, financial reward to comply with environmental regulations (Huang et al., 2015), (xxv) grants, loans and tax concessions for the use of energy efficiency measures (Bradford and Fraser, 2008), (xxvi) tax (sales, income, state and federal) concessions and non-monetary incentives, viz. preferential access to high occupancy lanes and parking, etc. for hybrid electric vehicles (Chandra et al., 2010), etc. all these benefits affects the adoption of ISGLSAMS by the organizations.

For example, electronics organizations, viz. laptops, computers, home appliances manufacturers experienced significant pressures and incentives to implement green supply chain management at the end-of-life of their products due to short product life cycles (Ninlawan et al., 2010). It is also observed that efficiency gains, incentives (Wackernagel and Rees, 1996), modular manufacturing (Kamali and Hewage, 2017) also work for the resource conservations.

Environmental awards can also be an incentive for the organization as it influences the organizational image in the community and society. The reward of an excellent organization also increases the business base with the supply chain members (Zhu et al., 2007).

6.4. Public and peer pressure

Pressure from local communities, local administrations, society, trade & business associations, networks, government, investors, politicians, NGOs, media, insurance companies, banks, stakeholders also affects the adoption of ISGLSAMS. Organizations have to reduce environmental burdens (Zhu et al., 2007). Public and peer pressure for (i) reducing the environmental impacts of industrial operations, (ii) reducing the risk to health and safety of the community (Corbett and Klenindorfer, 2009), (iii) sustainable manufacturing (Kolk, 2010), (iv) environmental conscious manufacturing (Gandhi et al., 2018; Mittal and Sangwan, 2014b) causes most companies to review their environmental strategies and practices within their supply chain (Kamolkittiwong, 2015).

(i) Green product, green process innovation and practices (Guoyou et al., 2013), (ii) corporate sustainability (Lozano, 2015), (iii) design and implement corporate social responsibility (Maon et al., 2009) and sustainable communities (Moon, 2007) are some major requirements from the organization.

The public and community exert significant pressure on the (i) legislation, (ii) buying behavior, (iii) shutdown of future development, (iv) third party, and citizen suits, etc (Rehman and Shrivastava, 2011). As incomes and education grow, the public and community become more demanding for the environmentally responsible performance of the organizations (Berry and Randinelli, 1998). Community allows direct interaction among different clients and the organization, thus affecting the business success (Cabrita et al., 2016). Public and community pressure drive (i) organizational environmental performance, and environmental standards, (ii) force government to pass new legislation, (iii) cause closure and relocation of plant, (iv) preservation of natural resources of the region, (v) cost-efficiency considerations, and (vi) responsibility for waste management from the public to producers (Robins and Kumar, 1999).

Organizations have to redefine their business and industry ecosystems for the exchange and utilization of the wastes generated by other organizations (Sharma and Henriques, 2005). Design of product and production system for sustainability, sustainable production and consumption (Spangenberg, 2013), and community protection (Williamson et al., 2006) are essential for long-term survival.

6.5. Cost benefits

Cost savings against rising energy and material prices, high labor and inventory cost, waste production, and quick responsiveness by a cost-effective system in an unpredictable market, is also a prominent driver for the adoption of ISGLSAMS.

ISGLSAMS causes reduced cost due to (i) lean manufacturing via improved use of resources (Kumar et al., 2013; Achanga et al., 2006), (ii) conservation of resources (less material, water, or energy), (iii) high efficiency of the equipments (Agan et al., 2013), (iv) high quality, flexibility, quick responsiveness, (v) increased service level, market qualification for volatile and unpredictable market (Agarwal et al., 2006), (vi) waste reduction and reduced cost of poor quality, (vii) customer retention, (viii) social, economical, financial sustainability (Cherrafi et al., 2016), (ix) sustainable profitability due to cost saving and environmental consciousness (Gandhi et al., 2018), (x) 6R-based circular economy life cycle cost benefits (Jawahir and Bradley, 2016), (xi) reduced cost of waste generation due to consistent process performance (Mena et al., 2002), (xii) reduced cost of loss (or loss function) to the society due to less deviation from target performance, (xiii) economic supply chain (Knowles et al., 2005), (xiv) effective and efficient material handling, (xv) avoidance of non-value added processes (Kumar et al., 2013), (xvi) long term cost benefits of buying newer energy efficient technology (Mittal and Sangwan, 2014a), (xvii) system optimization (Moreton, 2003), (xviii) reduced R&D and project management cost (Kwak and Anbari, 2006), (xix) standardization, new opportunities, better environmental image, product postponement, economy of scale (Mollenkopf et al., 2010), (xx) reduced pollution penalties and risk, (xxi) reduced costs of non-compliance, cost-to-fill, (xxii) benefits from continuous improvement opportunities, and low product introduction cost, (xxiii) fewer stock buffers and inventory, less rework, improved quality/cost performance (Piercy and Rich, 2015), (xxiv) reduced liability cost through employees health and safety (Melnyk et al., 2003), (xxv) reduced packing cost, energy cost, recycling cost due to reuse and energy efficient system (Nidumolu et al., 2009), (xxvi) improved plant utilization, service responsiveness, and profit margin (Cabrita et al., 2016), (xxvii) cost benefits due to fast and efficient learning organization, reduce risks, better serving of customized parts, alliances with other organizations for complementary resources and expertise (Sharp et al., 1999), (xxviii) reductions in indirect costs and overhead (Swink and Jacobs, 2012), (xxix) cost savings due to customer retention and market share in lieu of agility (Yusuf et al., 1999) and leanness (Zhou, 2016), (xxx) shared costs and benefit among supply chain partners (Yusuf et al., 2004), (xxxi) decreased cost of materials purchasing, cost of energy consumption, fee for waste treatment and waste discharge, and fine for environmental accidents (Zhu et al., 2010), (xxxii) cost benefits due to environmental, social and ethical compliance throughout the supply chains and product life cycle (i.e., design for 6Rs of sustainability; as major costs are determined during the product design stage) (Tseng et al., 2013), (xxxiii) reduced forecast error cost (Stratton and AuthorAnonymous, 2003) due to leagility, etc.

Virtual groups in leagile system, also reduce the cost of disruption, handling, and transportation costs (Stratton and AuthorAnonymous, 2003). Workforce training and education are also considered as an investment than cost (Irani et al., 1997) in ISGLSAMS.

Also when an organization goes beyond legislation compliance then the organization becomes more attractive to stakeholders, customers, employees, society, suppliers, communities, and socially responsible investors. This gives direct and indirect tangible and intangible benefits to the organization and its stakeholders (Cowe, 2003). A good business case can be built around stakeholders as the organization becomes more attractive to its wider stakeholders (Williamson et al., 2006).

6.6. Competition

Competition for the best-in-class plant performance for high product quality, high efficiency, responsiveness, and potential new market opportunities in a sustainable way is also driving the organizations towards ISGLSAMS and strategy.

The environmental competency of the organization provides strategic leverage against competitive pressure (Porter and Linde, 1995) and gives competitive advantages (Agan et al., 2013). There are various competition in the business, viz. (i) competition for getting knowledge on how their customers and suppliers in the value chain conduct business, (ii) competition for closer relationship between customers, suppliers and other relevant parties, (iii) competition for shorten the production cycle time, (iv) competition for continuous improvement, performance measurement system, business best practices (Agus and Hajinoor, 2012), (v) competition for reducing cost, non-value added activities, improving productivity, quality, satisfy customer needs, fast response, zero rejection, and flexibility (Bhamu and Sangwan, 2014), (vi) competition for maximizing the value of wealth creation for the society, green supply chain management, R & D activities, green image (Bhool and Narwal, 2013), (vii) competition for learning and operations competencies, customized individual products, mass customization, capability to produce a range and mix of volumes, delivery requirements (Brown and Bessant, 2003), (viii) competition for reduced human efforts (Gandhi et al., 2018), efficient production (Ghosh, 2013), ecological responsiveness (Giunipero et al., 2012), (ix) competition for capabilities of addressing customer requirements, customer-designed products and services, cost leadership, differentiation (Hallgren and Olhager, 2009), (x) competition for environmental management capability and behavior (Hofer et al., 2012a), (xi) competition for manufacturing competitive responsiveness (Jin-Hai et al., 2003), and sustainable manufacturing (Jovane et al., 2008), (xii) competition for human resources training (Mittal and Sangwan, 2014a) to prosper in the competitive environment (Li et al., 2003), (xiii) competition for sustainable innovation, sustainable competitive advantage and sustainable business model (Nidumolu et al., 2009), (xiv) competition for sustainable global supplier management (Reuter et al., 2010), (xv) competition for knowledge-based assets and customer channels (Cabrita et al., 2016), (xvi) competition for multifaceted performance requirements, management and operational framework, business structure, strategy, technology used, (xvii) competition for responsiveness to market conditions, social events and competitor actions (Sharifi et al., 2001), (xviii) competition for global market and niche market products (Sharp et al., 1999) (xix) competition for organizational competitive position (Sohal and Egglestone, 1994) and strategic competitive reconfigurable manufacturing system (Tseng and Lin, 2011), (xx) competition for better operational, market and financial performance (Vázquez-Bustelo et al., 2007), (xxi) competition for CSR (Williamson et al., 2006), (xxii) competition over environmentally sensitive customers, i.e., environmental performance of product (Yalabik and Fairchild, 2011), (xxiii) competition for beyond compliance manufacturing (Arora and Gangopadhyay, 1995), (xxiv) competition for leagile supply chain (Naylor et al., 1999), (xxv) competition for market leadership, i.e., becoming the creator of changes than market follower (Zhang, 2011), (xxvi) competition for business success (Sharifi and Zhang, 2000), (xxvii) competition for competitors' green strategies (Zhu and Sarkis, 2006) etc.

Organizations have to consider all these competitions while planning to survive or to lead in the competitive business market. All these competitive requirements can only be achieved by ISGLSAMS. Organizations have to invest in ISGLSAMS tools and practices, and transform these investments into sources of competitive advantage.

6.7. Customer demand

Various demands by the customers, viz. demand for (i) green product (Guoyou et al., 2013), (ii) green processes (Ghazilla et al., 2015), (iii) designing value (Womack et al., 1990) or voice of the customer in the product and supply chain (Chiarini, 2011), (iv) environmental labelling of the product (Bey et al., 2013), (v) reliable and prompt deliveries for product variety, (vi) changes in supply schedule (Singh Sangwan et al., 2014), (vii) improved service level, cost reduction (Agarwal et al., 2006), (viii) customers' information system (Bhamu and Sangwan, 2014), (ix) heterogeneous sustainable supply chain (Christopher and Towill, 2001) with demands for packing, consumer goods, innovative products, energy efficient equipment, cost efficiency, environmental sustainability (Foerstl et al., 2015; Guoyou et al., 2013), (x) environment performance requirement and responsiveness (Govindan et al., 2015), (xi) end-user demand for environmentally friendly products (Mittal and Sangwan, 2014b), (xii) lean, green, leagile (Mason-Jones et al., 2000) global supply chains (Mollenkopf et al., 2010), (xiii) quality with no waste (Nordin et al., 2010), (xiv) ever changing product need (Sharp et al., 1999) in stable and unstable market, (xv) delivery system (Stratton and AuthorAnonymous, 2003) (xvi) customized products and services (Sharifi and Zhang, 2001), (xvii) quick changeovers (Suzaki, 1987), (xviii) penalties and safety risks for non-green products (Yalabik and Fairchild, 2011), (xix) volume flexibility of the customer orders (Yusuf et al., 2003), etc. put the pressure on the organizations to opt for ISGLSAMS.

6.8. Supply chain pressure

Various supply chain pressures, viz. (i) reduce packaging and waste, (ii) suppliers assessment based on environmental performance, (iii) development of more eco-friendly products, (iv) reduction of carbon emissions associated with the transportation (Walker et al., 2008), (v) organization purchasing priority decisions and long-term relationships with suppliers (Gilbert, 2001), (vi) reduce environmental risk, (vii) reduce sources of waste and pollution from the entire supply chain, (viii) green design or design-for-environment, green purchasing, green manufacturing, (ix) closed-loop supply chains or reverse logistics, (x) disposal of the organizational goods and service, end-of-life management, (xi) product stewardship, resource saving, (x) harmful material or waste reduction (Srivastava, 2007; Zsidisin and Siferd, 2001; Beamon, 1999), (xi) forward and reverse logistics to reduce environmental risks (Diabat and Govindan, 2011), (xii) holistic approach for improvement of the environmental performance of total supply chain (Olugu et al., 2010), (xiii) minimization of product or service environmental and social impacts or footprint (Rettab B, 2008), (xiv) green purchasing adoption from EMS and ISO 14001 certified organizations (ElTayeb et al., 2010), (xv) overall sustainability, and socially responsible purchasing (Carter and Jennings, 2002), (xvi) proactive sustainable supply management, increase revenue, lower costs, (xvii) reduce assets and resources, (xviii) improve sustainable performance, social values, (xix) improve competitive advantage though sustainable practices, (xx) reduce organization and supply chain's carbon footprint (Giunipero et al., 2012; Linton et al., 2007), (xxi) proactive and value seeking supply chain (Van Hoek, 1999), (xxii) leagile supply chain structure (Hallgren and Olhager, 2009), (xxiii) regulation for green supply chain management (Hitchcock, 2012), (xxiv) compliance with legislation in global markets for green manufacturing (Mittal and Sangwan, 2014b), reuse, remanufacturing, and recycling (Wells and Seitz, 2005), reduce landfills by collecting them for economic value recovery (Hsu et al., 2013), process optimizations across the supply chain for environment (IEA, 2007), (xxv) long term and strategic collaborations among the supply chain members for green partnership (Liu et al., 2012), green procurement (supplier selection, 3Rs based), green manufacture (hazardous substance control, energy efficient technology, 3Rs, waste minimization, better use of resources), green distribution (green logistics, green packaging), green logistics (final treatment/landfill, disassembly/recycle plants, waste collectors) (Ninlawan et al., 2010), (xxvi) quick and effective response to changing customer needs and market (xxvii) capability to adapt to new risk environment (Cabrita et al., 2016; Swafford et al., 2006), (xxviii) environment performance with enhanced energy savings, productivity, increased resource efficiency, business performance gains, ISO 14001 certification, (xxviii) cooperation with customers for product take back, sharing design specification to suppliers (Zhu et al., 2011), etc. demand for ISGLSAMS and ISGLSA supply chain.

6.9. Top management commitment

Top management commitment for (i) quality (Basu, 2004), (ii) better environmental performance in manufacturing (Bey et al., 2013), (iii) green purchasing and GSCM (Yen and Yen, 2012; Diabat and Govindan, 2011), (iv) green practices, (v) fund approval for clean technologies, (vi) motivation, support, recognition and award for of new ideas from employees for sustainable manufacturing (Dubey et al., 2015a), (vii) cost leadership, and differentiation and market responsiveness (Hallgren and Olhager, 2009), (viii) providing resources, time, money, effort and leadership (Moktadir et al., 2018; Sim and Rogers, 2008), (ix) building effective work culture, motivation and continue enthusiasm of employees towards goals, (x) strengthen customer and supplier relation, and departmental relations and teamwork, (xi) to open more opportunities for improvement, increase adaptability or ability to make changes, (xii) ability to sustain, develop sense of responsibility among employees (Al-Najem and Dhakal, 2012; Meredith and Ristroph, 1991), (xiii) building clear vision, strategy (Salonitis and Tsinopoulos, 2016; Kwak and Anbari, 2006), etc. to enhance the organizational operational, environment, economic, financial, market, social, and ethical performance drive the organization for ISGLSAMS.

ISGLSAMS will (i) influence competitive advantages, continuous improvement, improvement in stakeholders enrichment, and green supply chain performance (Minhaj et al., 2013), (ii) drive sustainability strategies, nurtures strong corporate values, establish the role of the organization in society (Giunipero et al., 2012), (iii) enhance competency, flexibility, reconfiguration, responsiveness, speed of the organization (Dubey and Gunasekaran, 2015), (iv) nurtures strong ethics and social values (Mittal and Sangwan, 2014b), (v) encourage shared responsibilities (Sohal and Egglestone, 1994), inter-disciplinary cross--functional cooperation (Zhu et al., 2007), ethical values for to be socially, economically and ecologically sustainable, (vi) increase the commitment of the suppliers and supply chain members (Mittal et al., 2017; Walker et al., 2008).

6.10. Technological changes

Technological development and requirements, viz. (i) more value-added products (Agus and Hajinoor, 2012), (ii) more reliable environmentally sound technologies, with control standards for toxic release inventory, (iii) end-of-pipe technology for recycling (Bergmiller et al., 2009; Florida, 1996), (iv) reconfigurable soft and hard manufacturing technologies, viz. flexible CNC machine tools, robotics, computer-integrated manufacturing, etc. (Koren et al., 2011; Bi et al., 2008; Wiendahl et al., 2007), (v) information and telecommunication technologies for reverse logistics, and services to store, process and transmit information and data (Gallouj, 2015; Daugherty et al., 2005; Brito et al., 2003), (vi) technologies for improving logistics, operational efficiency, service responsiveness and strategic contribution (Richey et al., 2005), (vii) tools and technologies for socially responsible decision making practices for sustainable design and manufacturing (Dornfeld, 2014), (viii) pollution prevention technologies than pollution control technologies (Fernando and Wah, 2017), (ix) direct digital or additive manufacturing (DDM) as sustainable technology due to minimal waste products and energy consumption (Frazier, 2014), (x) advanced technologies with energy and resource efficiency, (xi) sustainable manufacturing for improved environmental friendliness, reduced cost, reduced power consumption, reduced wastes, enhanced operational safety, and improved personnel health (Jayal et al., 2010), (xii) technologies with new functionalities (Mehrabi et al., 2000), competency, modularity, scalability, integrability, convertibility, diagnosability flexibility, reconfiguration, responsiveness and speed (Dubey and Gunasekaran, 2015), (xiii) advanced technologies with more applications and specialized or customized facilities (Richey et al., 2005), (xiv) renewable technologies, (xv) nano, bio, material technologies (Sezen and Çankaya, 2013), etc. provide the successful platform to the organizations to move to ISGLSAMS and ISGLSA manufacturing strategy.

6.11. Availability of organizational resources

Availability of an organizational resources viz. (i) lean resources, lean and six sigma knowledge and skill (Karim and Arif-Uz-Zaman, 2013; Koch et al., 2004), (ii) agile reconfigurable resources and system (Brown and Bessant, 2003; Mehrabi et al., 2000), (iii) clean technologies (Leonidou et al., 2015; Mittal and Sangwan, 2014b), environmental resources for green products (Hafeez et al., 2002), (iv) sustained business processes and functions, (v) process integration and external collaboration (Chofreh et al., 2014), (vi) management skill, funds (Leonidou et al., 2015; Mittal and Sangwan, 2014b), (vii) hard and soft technologies, information technology, dynamic sensing and enabling technologies, viz. robotics, CNC, electronic commerce, enterprise resource planning (ERP), extended ERP or ERP II, SAP, real-time communication systems, group technology layout, cloud computing, near net shape technologies, rapid prototyping, AGVs, AS/RS, EDI, artificial intelligence/expert systems, CAD/CAM, FMS, CIM, CMM, CAPP, MRP, MRP-II, high speed machining, data acquisition (Ghobakhloo and Azar, 2018; Dubey and Gunasekaran, 2015; Gunasekaran, 1998), (viii) strategic resource planning or resource-based view of the organization for resource deployment to strengthen sustainable competitive advantage (Shibin et al., 2017; Ngamsirijit, 2011; Hart, 1995) etc., drive the organization for the ISGLSAMS.

6.12. Organizational image

Organizational image is the perception about the organization in the market for social, environmental, market, and financial performance. Organizational initiatives for (i) green design, product recycling, green supply chain management, environment performance assessment (Shen et al., 2013), (ii) high environmental performance (Hall, 2000), (iii) eco labeling of products, reverse logistics practices (Bhool and Narwal, 2013), (iv) organizational ability to develop green product and process innovations (Chiou et al., 2011), (v) meeting regulatory requirements, product stewardship (Rusinko, 2007), (vi) low customer complaints, six sigma (Raisinghani et al., 2005), (vii) world class quality (Fontenot et al., 1994), high customer satisfaction (Behara et al., 1995), (viii) reduced business waste, CO_2 emissions (Ghazilla et al., 2015; Azevedo et al., 2012; Ninlawan et al., 2010), (ix) development of visible learning platform for other industries (Rehman et al., 2016), (x) achievements of other market and social benefits due to sustainable manufacturing (Nordin et al., 2014; Hall and Wagner, 2012; Nidumolu et al., 2009), (xi) cost efficient eco-efficiency product, (xii) improved relationships with local communities, access to new green markets (Shrivastava, 1995), (xiii) enhanced relationship with stakeholders (Massoud et al., 2010), (xiv) positive public perception about organization (Mittal and Sangwan, 2014b), (xv) improved product image, brand value, goodwill, (xvi) enhanced publicity, improve work environment (Abdul-Rashid et al., 2017b), (xvii) corporate social responsibility initiatives (Gandhi et al., 2018), (xviii) organizational ability to quickly responding to the changes in the business environment (Sharifi and Zhang, 2001), (xix) sustainability (Helleno et al., 2017) and social responsible performance (Jayaraman et al., 2012; Luo and Bhattacharya, 2006), (xx) CSR activities for social upliftment (Draper, 2000), etc. affect the organization corporate image (Agan et al., 2013), public image (Rusinko, 2007), customer image and loyalty (Jayaraman et al., 2012; Luo and Bhattacharya, 2006).

Improved organizational image motivates the organization, employees, and supply chain partners to improve sustainability performance (Rao and Holt, 2005; Hall, 2000). It also enhances the competitive advantage, marketing and market exposure (Sharifi and Zhang, 2001), and customer loyalty to buy proactively an organization's products (Jayaraman et al., 2012; Luo and Bhattacharya, 2006).

6.13. Fragmentation of mass markets into multiple niche markets

Due to ever-changing customers' needs and fragmented market requirements, organizations have to proactively respond to these requirements (Yusuf et al., 1999) in an economic (Womack et al., 1990) and sustainable way (Kemp and Schot, 2000). Customers need a broad range of products concerning changes in price, quality, design, and functional specifications (New, 1992). The market is fragmented based on the heterogeneity of needs, viz. (i) diverse regional needs concerning language, environment, government regulations, (ii) different market segments, i.e., personal, educational, governmental, or business, (iii) variety generation due to rapid technology changeovers, (iv) variety due to price discrimination need. In the consumer market, products and services are being customized as per the requirements of the customer and government regulations. The product variety is generally introduced at the design and manufacturing stage. Organizations are now making a profit through the economy of scope rather than economy of scale (Jin-Hai et al., 2003).

Organizations can introduce the variety in (i) different parts and subassemblies of the product, (ii) different elements and sub-elements of services, through functional, ergonomic, aesthetic, assembly, disassembly variations, and (iii) as well as through personal functional need and mass customization (AlGeddawy and ElMaraghy, 2012; Wiendahl et al., 2007).

Variety can also be managed by distinct characteristics including modularity, integrability, customization, convertibility, diagnosability, system capability, flexibility (in hardware, software, and controls) (Mehrabi et al., 2000) along with variable combinations of hardware, information, and intelligence (Adeleye and Yusuf, 2006). The market can also be a green and premium market segment (Bonini and Oppenheim, 2008), green and niche (Driessen et al., 2013). Organizations have to focus on sustainable manufacturing of green products for a particular market or customer (Maniatis, 2016) in an agile manner (Kemp and Schot, 2000). Specialized needs are generally rewarded with premium prices. Also, the organizations have to be responsive to the customization of competitors or multiple-niche competition (Booth, 1996).

Organizations may use make-to-order personalized modules that allow customers to create the concept and design the products or services. It differentiates the value of the product or services as per customer requirement, viz. in the automobile vehicle models, the customer has the choices on the power train and interior combinations (Hu, 2013; AlGeddawy and ElMaraghy, 2012). Following strategies are used for generating the variety (i) family architecture (functional modules are shared among the family products), here the customer choose the combination of the different module variants for assemble-to-order strategy, (ii) reconfigurable product and manufacturing systems, and (iii) delayed differentiation (a generic or family product are manufactured then is later differentiated into a specific end-product.) (Hu, 2013; AlGeddawy and ElMaraghy, 2012).

Mass customization or variety requirements also occur due to shorter product life cycles or low-cost variety (Bruccoleri et al., 2005) or due to sustainable requirements (Chen et al., 2019), viz. electric-powered cars (Ginsberg and Bloom, 2004).

Thus fragmentation of mass markets into multiple niche markets is one of the important drivers for the adoption of ISGLSAMS. Organizations have to set a strategic path (Li, 2000; Vokurka and Fliedner, 1997) for winning in the market (New, 1992).

Table 9 briefly outlines the various drivers, identified through a literature survey, at the various levels for the adoption of ISGLSAMS and strategy.

Even after the various drivers, there may be various barriers to the adoption of ISGLSAMS. Strategic planning and collaborative efforts are essential to overcome those barriers. Fig. 13 shows a proposed research framework to study the effects of drivers on barriers and various performance outcomes. The above drivers can be further classified into planet context, organization text, and technology context. The government, organizations, and policymakers have to focus on all aspects of drivers for getting the desired outcomes and business goals. It is also observed that the effect of the individual driver or interaction of drivers on the early adoption of ISGLSAMS and system performance can be studied.

Table 9
Drivers to ISGLSAMS.

Driver	Description	References
Government regulation and Current legislation	Presence of legislation for planet protection, conserving resources, green supply chain management, green product design, environmental processes, environmental strategies, environmental management, sustainable manufacturing, green purchasing, corporate sustainable manufacturing practices and circular economy, green operations, sustainable product recovery, and recycling, employees health and safety, social well being.	(D'Souza et al., 2020; Goyal and Agrawal, 2020; Orji and Liu, 2020; Zarte et al., 2019; Gandhi et al., 2018; Seth et al., 2018; Somsuk and Laosirihongthong, 2017; Abdul-Rashid et al., 2017; Mwanza and Mbohwa, 2017; Fargani et al., 2016; Shankar et al., 2016; Dubey et al., 2015; Gupta et al., 2015; Lozano, 2015; Siemieniuch et al., 2015; Mittal and Sangwan, 2014b, 2014a; Rehman et al., 2014; Agan et al., 2013; Barve and Muduli, 2013; Bey et al., 2013; Zhu and Geng, 2013; Abu Seman, 2012; Giunipero et al., 2012; Yalabik and Fairchild, 2011; Zhang, 2011; Nunes and Bennett, 2010; Agamuthu et al., 2009; Berns et al., 2009; Holt and Ghobadian, 2009; Rahimifard et al., 2009; Srivastava, 2007; Montabon et al., 2007; Zhang and Sharifi, 2007; Williamson et al., 2006; Burke and Gaughran, 2006; Vickers et al., 2005; Van Hoek, 1999; Lampe et al., 1991)
Future legislation	Expected development and enforcement of legislation for planet protection, conserving resources, green supply chain management, green product design, environmental processes, environmental strategies, environmental management, sustainable manufacturing, green purchasing, corporate sustainable manufacturing practices and circular economy, green operations, sustainable product recovery and recycling, employees health and safety, social well being, etc.	(Gandhi et al., 2018; Siemieniuch et al., 2015; Mittal and Sangwan, 2014b; Bey et al., 2013; Krishna Moorthy et al., 2012; Holt and Ghobadian, 2009; Lee, 2009; Tudor et al., 2007)
Incentives	Investment subsidies, Grant, R&D support by govt., tax benefits for the adoption of ISGLSAMS.	(Orji and Liu, 2020; Latapí et al., 2020; Seth et al., 2018; Aboelmaged, 2018; Gandhi et al., 2018; Ghazilla et al., 2015; Gunasekaran et al., 2015; Huang et al., 2015; Mittal and Sangwan, 2014a; Agan et al., 2013; Hsu et al., 2013; Krishna Moorthy et al., 2012; Mathews and Tan, 2011; Zhang, 2011; Ninlawan et al., 2010; Nunes and Bennett, 2010; Chandra et al., 2010; ElTayeb et al., 2010; Bradford and Fraser, 2008; Lee, 2008; Zhu et al., 2007; Savaskan et al., 2004; GPNM, 2003; Fleischmann

(continued on next page)

Table 9 (*continued*)

Driver	Description	References
		et al., 2001; Wackernagel and Rees, 1996)
Public and Peer pressure	Pressure from local communities, society, trade & business associations, networks, government, investors, and stakeholders for the adoption of ISGLSAMS.	(Yadav et al., 2020; D'Souza et al., 2020; Goyal and Agrawal, 2020; Latapí et al., 2020; Orji and Liu, 2020; Gandhi et al., 2018; Seth et al., 2018; Somsuk and Laosirihongthong, 2017; Abdul-Rashid et al., 2017a; Mwanza and Mbohwa, 2017; Cabrita et al., 2016; Shankar et al., 2016; Siemieniuch et al., 2015; Dubey et al., 2015c; Kamolkittiwong, 2015; Lozano, 2015; Mittal and Sangwan, 2014b; Rehman et al., 2014; Spangenberg, 2013; Guoyou et al., 2013; Zhu and Geng, 2013; Zhang, 2011; Rehman and Shrivastava, 2011; Kolk, 2010; Corbett and Klenindorfer, 2009; Maon et al., 2009; Zhang and Sharifi, 2007; Moon, 2007; Zhu et al., 2007; Williamson et al., 2006; Sharma and Henriques, 2005; Robins and Kumar, 1999; Berry and Randinelli, 1998)
Cost benefits	Cost savings obtained by the adoption of ISGLSAMS against rising material & energy prices, high labor & inventory cost, waste production.	(Goyal and Agrawal, 2020; Latapí et al., 2020; Orji and Liu, 2020; Gandhi et al., 2018; Koren et al., 2018; Abdul-Rashid et al., 2017a; Almanei et al., 2017; Mwanza and Mbohwa, 2017; Somsuk and Laosirihongthong, 2017; Cabrita et al., 2016; Cherrafi et al., 2016; Jawahir and Bradley, 2016; Shankar et al., 2016; Zhou, 2016; Dubey et al., 2015c; Piercy and Rich, 2015; Mittal and Sangwan, 2014a; Rehman et al., 2014; Tseng et al., 2013; Agan et al., 2013; Kumar et al., 2013; Swink and Jacobs, 2012; Zhang, 2011; Mollenkopf et al., 2010; Zhu et al., 2010; Nidumolu et al., 2009; Williamson et al., 2006; Achanga et al., 2006; Agarwal et al., 2006; Kwak and Anbari, 2006; Knowles et al., 2005; Yusuf et al., 1999, 2004; Stratton and AuthorAnonymous, 2003; Cowe, 2003; Melnyk et al., 2003; Moreton, 2003; Prince and Kay, 2003; Yusuf and Adeleye, 2002; Mena et al., 2002; Sharp et al., 1999; Irani et al., 1997)
Competition	Best-in-class plant performances, high product quality, high efficiency, and potential new market opportunities by using ISGLSAMS.	(Yadav et al., 2020; D'Souza et al., 2020; Goyal and Agrawal, 2020; Latapí et al., 2020; Orji and Liu, 2020; Almanei et al., 2017, 2018; Gandhi et al., 2018; Abdul-Rashid et al., 2017a; Somsuk and Laosirihongthong, 2017; Cabrita et al., 2016; Kumar et al., 2016; Shankar et al., 2016; Dubey et al., 2015c; Gupta et al., 2015; Hartini and Ciptomulyono, 2015; Bhamu and Sangwan, 2014; Mittal and Sangwan, 2014a; Rehman et al., 2014; Agan et al., 2013; Bhool and Narwal, 2013; Ghosh, 2013; Zhu and Geng, 2013; Agus and Hajinoor, 2012; Giunipero et al., 2012; Hofer et al., 2012a; Yalabik and Fairchild, 2011; Zhang, 2011; Tseng and Lin, 2011; Reuter et al., 2010; Hallgren and Olhager, 2009; Nidumolu et al., 2009; Jovane et al., 2008; Vázquez-Bustelo et al., 2007; Zhang and Sharifi, 2007; Vázquez-Bustelo and Avella, 2006; Williamson et al., 2006; Zhu and Sarkis, 2006; Brown and Bessant, 2003; Jin-Hai et al., 2003; Li et al., 2003; Yusuf and Adeleye, 2002; Sharifi et al., 2001; Sharifi and Zhang, 2000; Naylor et al., 1999; Sharp et al., 1999; Arora and Gangopadhyay, 1995; Sohal and Egglestone, 1994)
Customer demand	Customers demand a quick response, low cost, high variety, high quality, and reliable delivery of green and sustainable products.	(Yadav et al., 2020; D'Souza et al., 2020; Zameer et al., 2020; Nielsen, 2020; Orji and Liu, 2020; Farias et al., 2019; Somsuk and Laosirihongthong, 2017; Abdul-Rashid et al., 2017a; Almanei et al., 2017; Shankar et al., 2016; Foerstl et al., 2015; Ghazilla et al., 2015; Govindan et al., 2015; Bhamu and Sangwan, 2014; Mittal and Sangwan, 2014b; Singh Sangwan et al., 2014; Agan et al., 2013; Bey et al., 2013; Guoyou et al., 2013; Yalabik and Fairchild, 2011; Chiarini, 2011; Zhang, 2011; Mollenkopf et al., 2010; Nordin et al., 2010; Zhang and Sharifi, 2007; Agarwal et al., 2006; Stratton and AuthorAnonymous, 2003; Yusuf et al., 2003; Christopher and Towill, 2001; Sharifi and Zhang, 2001; Mason-Jones et al., 2000; Sharp et al., 1999; Womack et al., 1990; Suzaki, 1987)
Supply chain pressure	The demand of suppliers, distributors, original equipment manufacturers (OEM) for ISGLSAMS.	(Yadav et al., 2020; Orji and Liu, 2020; Abdul-Rashid et al., 2017a; Almanei et al., 2017; Somsuk and Laosirihongthong, 2017; Cabrita et al., 2016; Shankar et al., 2016; Gupta et al., 2015; Mittal and Sangwan, 2014b; Hsu et al., 2013; Zhu and Geng, 2013; Giunipero et al., 2012; Hitchcock, 2012; Liu et al., 2012; Diabat and Govindan, 2011; Zhu et al., 2011; ElTayeb et al., 2010; Ninlawan et al., 2010; Olugu

(*continued on next page*)

Table 9 (*continued*)

Driver	Description	References
		et al., 2010; Hallgren and Olhager, 2009; Walker et al., 2008; Rettab B, 2008; Srivastava, 2007; IEA, 2007; Linton et al., 2007; Swafford et al., 2006; Williamson et al., 2006; Wells and Seitz, 2005; Carter and Jennings, 2002; Gilbert, 2001; Zsidisin and Siferd, 2001; Van Hoek, 1999; Beamon, 1999)
Top management commitment	Management dedication to enhancing the organization's economic, environmental, market, social and ethical performance.	(Goyal and Agrawal, 2020; Orji and Liu, 2020; Seth et al., 2018; Moktadir et al., 2018; Somsuk and Laosirihongthong, 2017; Almanei et al., 2017; Mittal et al., 2017; Salonitis and Tsinopoulos, 2016; Shankar et al., 2016; Dubey et al., 2015a; Rehman et al., 2014; Mittal and Sangwan, 2014b; Bey et al., 2013; Minhaj et al., 2013; Al-Najem and Dhakal, 2012; Giunipero et al., 2012; Yen and Yen, 2012; Diabat and Govindan, 2011; Sim and Rogers, 2008; Walker et al., 2008; Zhu et al., 2007; Kwak and Anbari, 2006; Basu, 2004; Sohal and Egglestone, 1994; Meredith and Ristroph, 1991)
Technological changes	Development of reconfigurable-agile-clean technologies and processes.	(Orji and Liu, 2020; Song et al., 2020; Seth et al., 2018; Fernando and Wah, 2017; Mwanza and Mbohwa, 2017; Ribeiro et al., 2016; Jawahir and Bradley, 2016; Kumar et al., 2016; Dubey et al., 2015c; Gallouj, 2015; Rehman et al., 2014; Dornfeld, 2014; Frazier, 2014; Sezen and Çankaya, 2013; Agus and Hajinoor, 2012; Koren et al., 2011; Zhang, 2011; Jayal et al., 2010; Bergmiller et al., 2009; Bi et al., 2008; Wiendahl et al., 2007; Zhang and Sharifi, 2007; Richey et al., 2005; Daugherty et al., 2005; Brito et al., 2003; Mehrabi et al., 2000; Florida, 1996)
Availability of organization resources	Availability of organization resources to support ISGLSAMS.	(Nkrumah et al., 2021; Orji and Liu, 2020; Ghobakhloo and Azar, 2018; Shibin et al., 2017; Leonidou et al., 2015; Dubey and Gunasekaran, 2015; Mittal and Sangwan, 2014b; Chofreh et al., 2014; Karim and Arif-Uz-Zaman, 2013; Hofmann et al., 2012; Ngamsirijit, 2011; Jabbour and Santos, 2008; Cao and Dowlatshahi, 2005; Koch et al., 2004; Brown and Bessant, 2003; Crocitto and Youssef, 2003; Hafeez et al., 2002; Yusuf and Adeleye, 2002; Mehrabi et al., 2000; Gunasekaran, 1998; Hart, 1995)
Organization image	Perception about the organization in the market for social, environmental, market, and financial performance.	(D'Souza et al., 2020; Goyal and Agrawal, 2020; Kumar et al., 2020; Latapí et al., 2020; Orji and Liu, 2020; Seth et al., 2018; Gandhi et al., 2018; Koren et al., 2018; Abdul-Rashid et al., 2017b, 2017a; Almanei et al., 2017; Helleno et al., 2017; Mwanza and Mbohwa, 2017; Somsuk and Laosirihongthong, 2017; Rehman et al., 2014, 2016; Dubey et al., 2015c; Ghazilla et al., 2015; Hartini and Ciptomulyono, 2015; Mittal and Sangwan, 2014b; Nordin et al., 2014; Agan et al., 2013; Bhool and Narwal, 2013; Shen et al., 2013; Azevedo et al., 2012; Hall and Wagner, 2012; Jayaraman et al., 2012; Chiou et al., 2011; Massoud et al., 2010; Ninlawan et al., 2010; Nidumolu et al., 2009; Rusinko, 2007; Luo and Bhattacharya, 2006; Williamson et al., 2006; Rao and Holt, 2005; Raisinghani et al., 2005; Sharifi and Zhang, 2001; Draper, 2000; Hall, 2000; Behara et al., 1995; Shrivastava, 1995; Fontenot et al., 1994)
Fragmentation of mass markets into multiple niche markets	Fragmentation of mass markets into small multiple markets for a particular product or need.	(Chen et al., 2019; Maniatis, 2016; Driessen et al., 2013; Hu, 2013; AlGeddawy and ElMaraghy, 2012; Zhang, 2011; Bonini and Oppenheim, 2008; Wiendahl et al., 2007; Zhang and Sharifi, 2007; Adeleye and Yusuf, 2006; Bruccoleri et al., 2005; Ginsberg and Bloom, 2004; Brown and Bessant, 2003; Jin-Hai et al., 2003; Li, 2000; Mehrabi et al., 2000; Kemp and Schot, 2000; Yusuf et al., 1999; Vokurka and Fliedner, 1997; Booth, 1996; New, 1992; Womack et al., 1990)

Simultaneous achievement of leanness, agility, sustainability along with corporate social responsibility is the key requirement for long-term business success, customer loyalty, and competitiveness. This requirement can be obtained in an integrated manner by ISGLSAMS. In ISGLSAMS, (i) leanness focuses on resource efficiency and high performance, (ii) agility focuses on capabilities to respond quickly to ever-changing customers' requirements, (iii) sustainability focuses on planet protection and persevering resources for the future generation, and (iv) corporate social responsibility for social uplift and welfare (Mittal et al., 2017; Nieuwenhuis and Katsifou, 2015; Katayama and Bennett, 1999). Quick response to various needs sustainably and economically, puts high pressure on the organizations to opt for ISGLSAMS and to produce ISGLSA products (Elmoselhy, 2015a; Nieuwenhuis and Katsifou, 2015).

Fig. 14 shows the suggested performance measurement framework for manufacturing organizations based on the integration of sustainable, green, lean, six sigma, and agile manufacturing strategies. This framework is designed by locating factors successively on a hierarchy and incorporating potential relationships among these factors. An organizational performance may be compared from top to bottom, and performance may be measured by a bottom-up approach. An organizational ISGLSAMS performance may be calculated by the relative weight of each

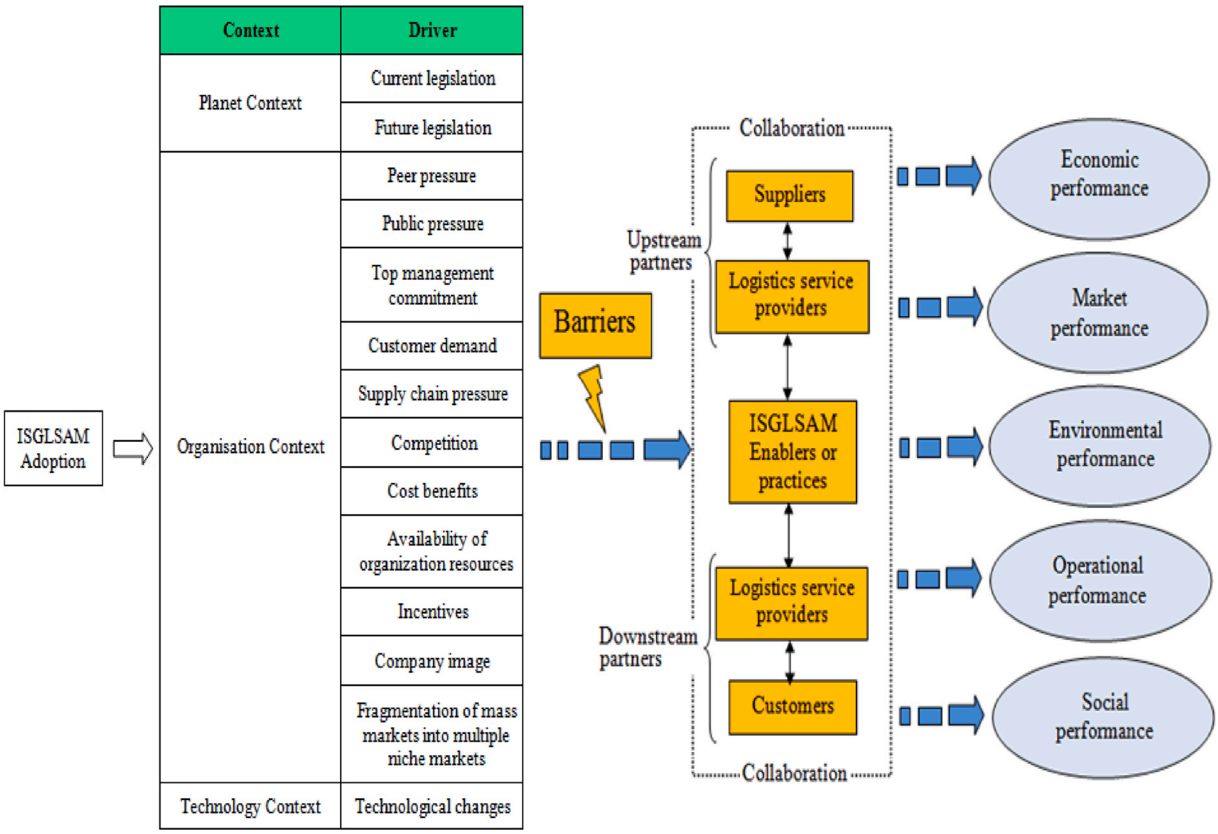

Fig. 13. Research framework.

factor on the overall performance of the organization. A ranking mechanism may be developed to assess how much the alternative factors are fulfilled by the organization. Then, the score can be calculated and accumulated upward for each factor until reaching the organization's performance level. The following simple formula can be used.

$$Q_{jh} = w_{jh} \sum_{i} w_{il} Q_{il} \ \forall j \in h$$

Where, Q_{jh} and w_{jh} represent the weighted score of factor j on level h and its weight, respectively. Q_{il} and w_{il} are those of the related factors on the lower level l.

The organization has to map its current state and proposed state by identifying potential factors and practices. By mapping the current state, the organization has to find the improvement opportunities and pathways in their product, process, system, and supply chain design for ISGLSAMS.

Thus to achieve a competitive advantage in the unpredictable market, the organization's manufacturing system and strategy should be ISGLSA. Organizations should strategically plan for coupling and decoupling points for leagility (Elmoselhy, 2015a; Nieuwenhuis and Katsifou, 2015). Strategic planning provides the direction, roadmap, and control mechanisms for defining, developing, and implementing the planned or selected strategy in an industry-specific context (Stump et al., 2012).

Companies and government must use common and area-specific drivers for driving the organization for the adoption of ISGLSAMS, and its benchmarking practices. Also designing the coupling or interaction effect of the drivers on the system will lead to enormous social, environmental, and business benefits.

7. Future research areas

As evident from the literature, various manufacturing strategy like lean, agile, green, JIT, FMS, reconfigurable manufacturing system, world-class manufacturing, automation strategy, sustainable manufacturing, CIM, and virtual enterprise strategy has been the topic of interest for researchers in the recent past. It is observed through the literature review that for the adoption of any manufacturing strategy, there are always various internal and external drivers. Process design, product design, personal elements, and manufacturing planning are always pillars for that. Management leadership style, organizational structure, organizational culture, infrastructure, implementation policies, and organizational planning should be in line with organizational manufacturing strategic objectives and competing priorities. The key competing priorities for the business success for any organization are cost, quality, sustainability, flexibility, delivery, and variety. These priorities can be fulfilled by ISGLSAMS. For implementing the ISGLSAMS, an organization has to strategically plan and implement various enablers. Herein, are a few issues, concerning drivers for the adoption of ISGLSAMS, which may require further research exploration.

- Ranking of drivers for their effect on the adoption of ISGLSAMS.
- Study and ranking of the coupling or interaction effects of drivers on the adoption of ISGLSAMS.
- ISM modeling and MICMAC analysis of drivers of ISGLSAMS.
- Ranking of drivers for Multi-criteria performance outcomes using multi-criteria decision-making methods.
- Study of the individual effect of a driver on organization financial, environmental, sustainable, economic, and market performance using structural equation modeling.
- Study of the coupling effect of drivers on various performance outcomes for sector-specific manufacturing systems.
- Study of the individual effect of a driver to overcome the barriers for sector-specific manufacturing system.
- Study of the coupling effect of drivers to overcome the barriers for sector-specific manufacturing systems.

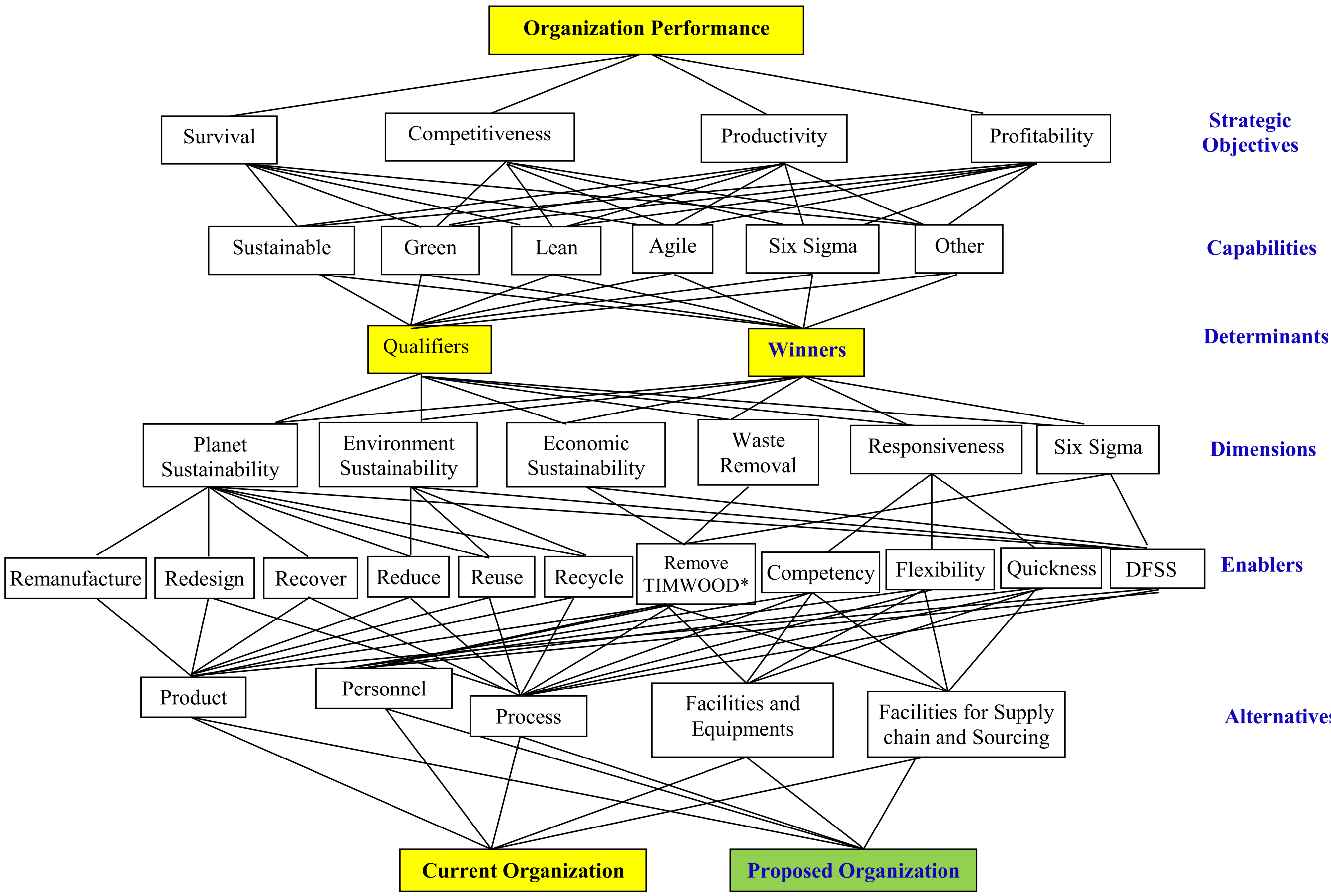

Fig. 14. Suggested performance measurement framework for manufacturing organization based on the integration of sustainable, green, lean, six sigma and agile manufacturing strategies
TIMWOOD* - Transport, Inventory, Motion, Waiting, Over-processing, Over-production, Defect. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

- Study of benchmarking practices on the further development of drivers.
- Study of drivers on business supply chain practices, reverse logistics, and business innovations.

8. Conclusion

The paper identifies, through a literature survey, various drivers for the adoption of an integrated sustainable green lean six sigma agile manufacturing system (ISGLSAMS). The selection of papers to be included in the literature review is done as per (Moher et al., 2009a,b), involving (a) identification of the papers; (b) screening; (c) eligibility; and (d) inclusion steps on the Web of Science and Google Scholar database. Through study, it is observed that it is feasible to design an ISGLSAMS industrial house with strategic planning of coupling and decoupling points. The study also contributes to academics, managers, decision-makers, researchers, supply chain members, stakeholders, and government officials in a better understanding of.

- the directions in the implementation of ISGLSAMS research.
- the directions of design of drivers for product, process, and system design for ISGLSAMS.
- the directions of design of drivers for ISGLSA supply chain design.
- a more sustainable manufacturing system to meet all stakeholders' needs.
- the directions of research design of drivers for system performance outcomes.
- various soft and hard practices of ISGLSAMS.
- development of a proposed performance adoption model for an enterprise for ISGLSAMS.
- proposed performance measurement and benchmark framework for ISGLSAMS implementation with a system view of the whole supply chain.

The government, manufacturing organization, and policymakers as a team must focus on all aspects of the drivers for getting the desired outcomes from a business-specific unit. It is also observed that the effect of the individual driver can be studied for its effect on system performance as well as on the early adoption of ISGLSAMS. The government, manufacturing organization, and policymakers must use common and area-specific drivers and associated sub-clauses for driving the organization for the adoption of ISGLSAMS, and ISGLSAMS benchmarking practices. Also designing the coupling or interaction effect of the drivers on the system will lead to enormous social, environmental, and business benefits. This study also contributes to a better understanding of the directions of ISGLSAMS research and its various soft and hard practices for the business' sustainable, market, economic and environmental performance. Social acceptance, cost-leadership, product mix flexibility, quick responsiveness can only be viable through hybridizing lean and agile manufacturing along with sustainable, green, and six sigma manufacturing strategies. ISGLSA manufacturing strategy must exist at all four levels, i.e., strategic, tactical, operational, and whole supply chain level. A proposed performance measurement framework will provide the path for the continuous innovation and benchmarking practices for ISGLSMAS.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

Abdul-Rashid, S.H., Sakundarini, N., Ariffin, R., Ramayah, T., 2017a. Drivers for the adoption of sustainable manufacturing practices: a Malaysia perspective. Int. J. Precis. Eng. Manuf. 18, 1619–1631. https://doi.org/10.1007/s12541-017-0191-4.

Abdul-Rashid, S.H., Sakundarini, N., Raja Ghazilla, R.A., Thurasamy, R., 2017b. The impact of sustainable manufacturing practices on sustainability performance: empirical evidence from Malaysia. Int. J. Oper. Prod. Manag. 37, 182–204. https://doi.org/10.1108/IJOPM-04-2015-0223.

Aboelmaged, M., 2018. The drivers of sustainable manufacturing practices in Egyptian SMEs and their impact on competitive capabilities: a PLS-SEM model. J. Clean. Prod. 175, 207–221. https://doi.org/10.1016/j.jclepro.2017.12.053.

Abu Seman, N.A., 2012. Green supply chain management: a review and research direction. Int. J. Manag. Value Supply Chain. 3, 1–18. https://doi.org/10.5121/ijmvsc.2012.3101.

Achanga, P., Shehab, E., Roy, R., Nelder, G., 2006. Critical success factors for lean implementation within SMEs. J. Manuf. Technol. Manag. 17, 460–471. https://doi.org/10.1108/17410380610662889.

Adeleye, E.O., Yusuf, Y.Y., 2006. Towards agile manufacturing: models of competition and performance outcomes. Int. J. Agil. Syst. Manag. 1, 93–110. https://doi.org/10.1504/IJASM.2006.008861.

Agamuthu, P., Khidzir, K.M., Hamid, F.S., 2009. Drivers of sustainable waste management in Asia. Waste Manag. Res. 27, 625–633. https://doi.org/10.1177/0734242X09103191.

Agan, Y., Acar, M.F., Borodin, A., 2013. Drivers of environmental processes and their impact on performance: a study of Turkish SMEs. J. Clean. Prod. 51, 23–33. https://doi.org/10.1016/j.jclepro.2012.12.043.

Agarwal, A., Shankar, R., Tiwari, M.K., 2006. Modeling the metrics of lean, agile and leagile supply chain: an ANP-based approach. Eur. J. Oper. Res. 173, 211–225. https://doi.org/10.1016/j.ejor.2004.12.005.

Agus, A., Hajinoor, M.S., 2012. Lean production supply chain management as driver towards enhancing product quality and business performance. Int. J. Qual. Reliab. Manag. 29, 92–121. https://doi.org/10.1108/02656711211190891.

Al-Najem, M., Dhakal, H.N., 2012. The role of culture and leadership in lean transformation: a review and assessment model. Int. J. Lean Think. 3, 119–138.

AlGeddawy, T., ElMaraghy, H., 2012. Product variety management in design and manufacturing: challenges and strategies. Enabling Manuf. Compet. Econ. Sustain. 518–523. https://doi.org/10.1007/978-3-642-23860-4_85.

Almanei, M., Salonitis, K., Tsinopoulos, C., 2018. A conceptual lean implementation framework based on change management theory. Procedia CIRP 72, 1160–1165. https://doi.org/10.1016/j.procir.2018.03.141.

Almanei, M., Salonitis, K., Xu, Y., 2017. Lean implementation frameworks: the challenges for SMEs. Procedia CIRP 63, 750–755. https://doi.org/10.1016/j.procir.2017.03.170.

Andersson, R., Eriksson, H., Torstensson, H., 2006. Similarities and differences between TQM, six sigma and lean. TQM Mag. 18, 282–296. https://doi.org/10.1108/09544780610660004.

Antony, J., 2006. Six sigma for service processes. Bus. Process Manag. J. 12, 234–248. https://doi.org/10.1108/14637150610657558.

Antony, J., Antony, F.J., Kumar, M., Cho, B.R., 2007. Six sigma in service organisations: benefits, challenges and difficulties, common myths, empirical observations and success factors. Int. J. Qual. Reliab. Manag. 24, 294–311. https://doi.org/10.1108/02656710710730889.

Arendt, S., Brettel, M., 2010. Understanding the Influence of Corporate Social Responsibility on Corporate Identity, Image, and Firm Performance 48, pp. 1469–1492. https://doi.org/10.1108/00251741011090289.

Arora, S., Gangopadhyay, S., 1995. Toward a theoretical model of voluntary overcompliance. J. Econ. Behav. Organ. 28, 289–309. https://doi.org/10.1016/0167-2681(95)00037-2.

Azevedo, S.G., Carvalho, H., Duarte, S., Cruz-Machado, V., 2012. Influence of green and lean upstream supply chain management practices on business sustainability. IEEE Trans. Eng. Manag. 59, 753–765. https://doi.org/10.1109/TEM.2012.2189108.

Badurdeen, F., Iyengar, D., Goldsby, T.J., Metta, H., Gupta, S., Jawahir, I.S., 2009. Extending total life-cycle thinking to sustainable supply chain design. Int. J. Prod. Lifecycle Manag. 4, 49–67. https://doi.org/10.1504/IJPLM.2009.031666.

Banawi, A., Bilec, M.M., 2014. A framework to improve construction processes: integrating lean, green and six sigma. Int. J. Constr. Manag. 14, 45–55. https://doi.org/10.1080/15623599.2013.875266.

Banihashemi, S.A., 2011. Improving supply chain performance: the strategic integration of lean and agile supply chain. Afr. J. Bus. Manag. 5, 7557–7563. https://doi.org/10.5897/AJBM11.596.

Barve, A., Muduli, K., 2013. Modelling the challenges of green supply chain management practices in Indian mining industries. J. Manuf. Technol. Manag. 24, 1102–1122. https://doi.org/10.1108/JMTM-09-2011-0087.

Basu, R., 2004. Six-Sigma to operational excellence: role of tools and techniques. Int. J. Six Sigma Compet. Advant. 1, 44–64. https://doi.org/10.1504/IJSSCA.2004.005277.

Baumer-Cardoso, M.I., Campos, L.M.S., Portela Santos, P.P., Frazzon, E.M., 2020. Simulation-based analysis of catalyzers and trade-offs in Lean & Green manufacturing. J. Clean. Prod. 242, 118411. https://doi.org/10.1016/j.jclepro.2019.118411.

Beamon, B.M., 1999. Designing the green supply chain. Logist. Inf. Manag. 12, 332–342. https://doi.org/10.1108/09576059910284159.

Behara, R.S., Gresham, A., Fontenot, G.F., 1995. Customer satisfaction measurement and analysis using six sigma. Int. J. Qual. Reliab. Manag. 12, 9–18. https://doi.org/10.1108/02656719510084745.

Belekoukias, I., Garza-Reyes, J.A., Kumar, V., 2014. The impact of lean methods and tools on the operational performance of manufacturing organisations. Int. J. Prod. Res. 52, 5346–5366. https://doi.org/10.1080/00207543.2014.903348.

Bendell, T., 2006. A review and comparison of six sigma and the lean organisations. TQM Mag. 18, 255–262. https://doi.org/10.1108/09544780610659989.

Bergmiller, G., McCright, P., 2009. Parallel models for lean and green operations. Ind. Eng. Res. Conf. 1138–1143.

Bergmiller, G.G., 2006. Lean manufacturers transcendence to green manufacturing: correlating the diffusion of lean and green manufacturing systems, 2006 Diss. Abstr. Int. 68 (1 Suppl. B), 294, 294.

Bergmiller, G.G., Mccright, P.R., Florida, S., 2009. Lean manufacturers ' transcendence to green manufacturing. Ind. Eng. Res. Conf. 1144–1148.

Berns, M., Townend, A., Zayna, K., Balagopal, B., Reeves, M., Hopkins, M., Kruschwitz, N., 2009. The Business of Sustainability: Findings and Insights from the First Annual Business of Sustainability Survey and the Global Thought Leaders, Research Project. MIT Sloan Manag. Rev.

Berry, M.A., Randinelli, D.A., 1998. Proactive corporate environmental management. Acedemy Manag. Exec. 12, 38–50.

Bey, N., Hauschild, M.Z., McAloone, T.C., 2013. Drivers and barriers for implementation of environmental strategies in manufacturing companies. CIRP Ann. - Manuf. Technol. 62, 43–46. https://doi.org/10.1016/j.cirp.2013.03.001.

Bhamu, J., Sangwan, K.S., 2014. Lean manufacturing: literature review and research issues. Int. J. Oper. Prod. Manag. 34, 876–940. https://doi.org/10.1108/IJOPM-08-2012-0315.

Bhasin, S., 2008. Lean and performance measurement. J. Manuf. Technol. Manag. 19, 670–684. https://doi.org/10.1108/17410380810877311.

Bhatt, Y., Ghuman, K., Dhir, A., 2020a. Sustainable manufacturing. Bibliometrics and content analysis. J. Clean. Prod. 260 https://doi.org/10.1016/j.jclepro.2020.120988.

Bhatt, Y., Ghuman, K., Dhir, A., 2020b. Sustainable manufacturing. Bibliometrics and content analysis. J. Clean. Prod. 260, 120988 https://doi.org/10.1016/j.jclepro.2020.120988.

Bhool, R., Narwal, M.S., 2013. An analysis of drivers affecting the implementation of green supply chain management for the Indian manufacturing industries. Int. J. Res. Eng. Technol. 2, 242–254.

Bi, Z.M., Lang, S.Y.T., Shen, W., Wang, L., 2008. Reconfigurable manufacturing systems: the state of the art. Int. J. Prod. Res. 46, 967–992. https://doi.org/10.1080/00207540600905646.

Bonini, S., Oppenheim, J., 2008. Helping "Green"products Grow, 1–8. McKinsey Q.

Booth, R., 1996. Agile manufacturing. Eng. Manag. J. 6, 105–112. https://doi.org/10.1049/em:19960206.

Bradford, J., Fraser, E.D.G., 2008. Local authorities, climate change and small and medium enterprises: identifying effective policy instruments to reduce energy use and carbon emissions. Corp. Soc. Responsib. Environ. Manag. 15, 156–172. https://doi.org/10.1002/csr.151.

Breyfogle, F.W., 1999. Implementing Six Sigma: Smarter Solutions Using Statistical Methods. John Wiley & Sons Press, Hoboken, NJ, USA.

Brito, M.P. De, Dekker, R., Flapper, S.D.P., 2003. Reverse Logistics – a Review of Case Studies REPORT SERIES 29.

Brown, S., Bessant, J., 2003. The manufacturing strategy-capabilities links in mass customisation and agile manufacturing - an exploratory study. Int. J. Oper. Prod. Manag. 23, 707–730. https://doi.org/10.1108/01443570310481522.

Bruccoleri, M., Lo Nigro, G., Perrone, G., Renna, P., Noto La Diega, S., 2005. Production planning in reconfigurable enterprises and reconfigurable production systems. CIRP Ann. - Manuf. Technol. 54, 433–436. https://doi.org/10.1016/S0007-8506(07)60138-3.

Budiono, S.H.D., Nurcahyo, R., Habiburrahman, M., 2021. Relationship between manufacturing complexity, strategy, and performance of manufacturing industries in Indonesia. Heliyon 7, e07225. https://doi.org/10.1016/j.heliyon.2021.e07225.

Burke, S., Gaughran, W.F., 2006. Intelligent environmental management for SMEs in manufacturing. Robot. Comput. Integrated Manuf. 22, 566–575. https://doi.org/10.1016/j.rcim.2005.11.008.

Cabrita, M. do R., Duarte, S., Carvalho, H., Cruz-Machado, V., 2016. Integration of lean, agile, resilient and green paradigms in a business model perspective: theoretical foundations. IFAC-PapersOnLine 49, 1306–1311. https://doi.org/10.1016/j.ifacol.2016.07.704.

Calia, R.C., Guerrini, F.M., de Castro, M., 2009. The impact of six sigma in the performance of a pollution prevention program. J. Clean. Prod. 17, 1303–1310. https://doi.org/10.1016/j.jclepro.2009.05.001.

Cao, Q., Dowlatshahi, S., 2005. The impact of alignment between virtual enterprise and information technology on business performance in an agile manufacturing environment. J. Oper. Manag. 23, 531–550. https://doi.org/10.1016/j.jom.2004.10.010.

Carter, C.R., Jennings, M.M., 2002. Social responsibility and supply chain relationships. Transp. Res. Part E Logist. Transp. Rev. 38, 37–52. https://doi.org/10.1016/S1366-5545(01)00008-4.

Chandra, A., Gulati, S., Kandlikar, M., 2010. Green drivers or free riders? An analysis of tax rebates for hybrid vehicles. J. Environ. Econ. Manag. 60, 78–93. https://doi.org/10.1016/j.jeem.2010.04.003.
Chen, Y.S., Lei, H.S., Hsu, W.C., 2019. A study on the sustainable development strategy of firms: niche and social network theory. Sustain. Times 11, 1–25. https://doi.org/10.3390/su11092593.
Cherrafi, A., Elfezazi, S., Chiarini, A., Mokhlis, A., Benhida, K., 2016. The integration of lean manufacturing, Six Sigma and sustainability: a literature review and future research directions for developing a specific model. J. Clean. Prod. 139, 828–846. https://doi.org/10.1016/j.jclepro.2016.08.101.
Chiarini, A., 2014. Sustainable manufacturing-greening processes using specific Lean Production tools: an empirical observation from European motorcycle component manufacturers. J. Clean. Prod. 85, 226–233. https://doi.org/10.1016/j.jclepro.2014.07.080.
Chiarini, A., 2011. Integrating lean thinking into ISO 9001: a first guideline. Int. J. Lean Six Sigma 2, 96–117. https://doi.org/10.1108/20401461111135000.
Chikán, A., Czakó, E., Kiss-Dobronyi, B., Losonci, D., 2022. Firm competitiveness: a general model and a manufacturing application. Int. J. Prod. Econ. 243 https://doi.org/10.1016/j.ijpe.2021.108316.
Chiou, T.Y., Chan, H.K., Lettice, F., Chung, S.H., 2011. The influence of greening the suppliers and green innovation on environmental performance and competitive advantage in Taiwan. Transp. Res. Part E Logist. Transp. Rev. 47, 822–836. https://doi.org/10.1016/j.tre.2011.05.016.
Chofreh, A.G., Goni, F.A., Shaharoun, A.M., Ismail, S., Klemeš, J.J., 2014. Sustainable enterprise resource planning: imperatives and research directions. J. Clean. Prod. 71, 139–147. https://doi.org/10.1016/j.jclepro.2014.01.010.
Christiansen, P.E., Kotzab, H., Mikkola, J.H., 2007. Coordination and sharing logistics information in leagile supply chains. Int. J. Procure. Manag. 1, 79. https://doi.org/10.1504/IJPM.2007.015356.
Christopher, M., Towill, D., 2001. An integrated model for the design of agile supply chains. Int. J. Phys. Distrib. Logist. Manag. 31, 235–246. https://doi.org/10.1108/09600030110394914.
Christopher, M., Towill, D.R., 2000. Supply chain migration from lean and functional to agile and customised. Supply Chain Manag. 5, 206–213. https://doi.org/10.1108/13598540010347334.
Corbett, C.J., Klenindorfer, P.R., 2009. Environmental management and operations management: introduction to Part 1 (manufacturing and ecologistics). Prod. Oper. Manag. 10, 107–111. https://doi.org/10.1111/j.1937-5956.2001.tb00072.x.
Cowe, R., 2003. Behave Responsibly, by Order of the Law, 132. New Statesman.
Crocitto, M., Youssef, M., 2003. The human side of organizational agility. Ind. Manag. Data Syst. 103, 388–397. https://doi.org/10.1108/02635570310479963.
D'Souza, C., McCormack, S., Taghian, M., Chu, M.T., Sullivan Mort, G., Ahmed, T., 2020. An empirical examination of sustainability for multinational firms in China: implications for cleaner production. J. Clean. Prod. 242, 118446 https://doi.org/10.1016/j.jclepro.2019.118446.
Dangayach, G., Deshmukh, S., 2003. Evidence of manufacturing strategies in Indian industry: a survey. Int. J. Prod. Econ. 83, 279–298. https://doi.org/10.1016/S0925-5273(02)00372-9.
Dangayach, G.S., Deshmukh, S.G., 2001. Manufacturing strategy. Literature review and some issues. Int. J. Oper. Prod. Manag. 21, 884–932. https://doi.org/10.1108/01443570110393414.
Dangelico, R.M., Pujari, D., 2010. Mainstreaming green product innovation: why and how companies integrate environmental sustainability. J. Bus. Ethics 95, 471–486. https://doi.org/10.1007/s10551-010-0434-0.
Das, B., Venkatadri, U., Pandey, P., 2014. Applying lean manufacturing system to improving productivity of airconditioning coil manufacturing. Int. J. Adv. Manuf. Technol. 71, 307–323. https://doi.org/10.1007/s00170-013-5407-x.
Daugherty, P.J., Richey, R.G., Genchev, S.E., Chen, H., 2005. Reverse logistics: superior performance through focused resource commitments to information technology. Transp. Res. Part E Logist. Transp. Rev. 41, 77–92. https://doi.org/10.1016/j.tre.2004.04.002.
Deif, A.M., 2011. A system model for green manufacturing. J. Clean. Prod. 19, 1553–1559. https://doi.org/10.1016/j.jclepro.2011.05.022.
Demeter, K., 2003. Manufacturing strategy and competitiveness. Int. J. Prod. Econ. 81–82, 205–213. https://doi.org/10.1016/S0925-5273(02)00353-5.
Dennis, P., 2007. Lean Production Simplified. Productivity Press, New York.
Despeisse, M., Mbaye, F., Ball, P.D., Levers, A., 2012. The emergence of sustainable manufacturing practices. Prod. Plann. Control 23, 354–376. https://doi.org/10.1080/09537287.2011.555425.
Diabat, A., Govindan, K., 2011. An analysis of the drivers affecting the implementation of green supply chain management. Resour. Conserv. Recycl. 55, 659–667. https://doi.org/10.1016/j.resconrec.2010.12.002.
Domingo, R., Aguado, S., 2015. Overall environmental equipment effectiveness as a metric of a lean and green manufacturing system. Sustain. Times 7, 9031–9047. https://doi.org/10.3390/su7079031.
Doolen, T.L., Hacker, M.E., 2005. A review of lean assessment in organizations: an exploratory study of lean practices by electronics manufacturers. J. Manuf. Syst. 24, 55–67. https://doi.org/10.1016/S0278-6125(05)80007-X.
Dornfeld, D.A., 2014. Moving towards green and sustainable manufacturing. Int. J. Precis. Eng. Manuf. - Green Technol. 1, 63–66. https://doi.org/10.1007/s40684-014-0010-7.
Draper, S., 2000. Corporate nirvana is the future socially responsible? Ind. Soc.
Driessen, P.H., Hillebrand, B., Kok, R.A.W., Verhallen, T.M.M., 2013. Green new product development: the pivotal role of product greenness. IEEE Trans. Eng. Manag. 60, 315–326. https://doi.org/10.1109/TEM.2013.2246792.
Duarte, S., Cruz-Machado, V., 2013. Modelling lean and green: a review from business models. Int. J. Lean Six Sigma 4, 228–250. https://doi.org/10.1108/IJLSS-05-2013-0030.
Dubey, R., Bag, S., Ali, S.S., 2014. Green supply chain practices and its impact on organisational performance: an insight from Indian rubber industry. Int. J. Logist. Syst. Manag. 19, 20–42. https://doi.org/10.1504/IJLSM.2014.064029.
Dubey, R., Bag, S., Ali, S.S., Venkatesh, V.G., 2013. Green purchasing is key to superior performance : an empirical study rameshwar Dubey * surajit bag sadia samar ali. Int. J. Procure. Manag. 6, 187–210.
Dubey, R., Gunasekaran, A., 2015. Agile manufacturing: framework and its empirical validation. Int. J. Adv. Manuf. Technol. 76, 2147–2157. https://doi.org/10.1007/s00170-014-6455-6.
Dubey, R., Gunasekaran, A., Chakrabarty, A., 2015a. World-class sustainable manufacturing: framework and a performance measurement system. Int. J. Prod. Res. 53, 5207–5223. https://doi.org/10.1080/00207543.2015.1012603.
Dubey, R., Gunasekaran, A., Samar Ali, S., 2015b. Exploring the relationship between leadership, operational practices, institutional pressures and environmental performance: a framework for green supply chain. Int. J. Prod. Econ. 160, 120–132. https://doi.org/10.1016/j.ijpe.2014.10.001.
Dubey, R., Gunasekaran, A., Singh, T., 2015c. Building theory of sustainable manufacturing using total interpretive structural modelling. Int. J. Syst. Sci. Oper. Logist. 2, 231–247. https://doi.org/10.1080/23302674.2015.1025890.
Elkins, D.A., Huang, N., Alden, J.M., 2004. Agile manufacturing systems in the automotive industry. Int. J. Prod. Econ. 91, 201–214. https://doi.org/10.1016/j.ijpe.2003.07.006.
Elmoselhy, S.A., 2015a. Implementing the hybrid lean-agile manufacturing system strategically in automotive sector. SAE Int. J. Mater. Manuf. 8, 592–601. https://doi.org/10.4271/2015-01-9083.
Elmoselhy, S.A., 2015b. Hybrid lean-agile manufacturing system strategic facet in automotive sector. SAE Int. J. Mater. Manuf. 8, 153–171. https://doi.org/10.4271/2014-01-9104.
Elmoselhy, S.A.M., 2013. Hybrid lean-agile manufacturing system technical facet, in automotive sector. J. Manuf. Syst. 32, 598–619. https://doi.org/10.1016/j.jmsy.2013.05.011.
Elmoselhy, S.A.M., 2012. Implementation of the hybrid lean-agile manufacturing system strategic facet in automotive sector. Int. J. Adv. Eng. Technol. 5, 2231–1963.
Eltawy, N., Gallear, D., 2017. Leanness and agility: a comparative theoretical view. Ind. Manag. Data Syst. 117, 149–165. https://doi.org/10.1108/IMDS-01-2016-0032.
ElTayeb, T.K., Zailani, S., Jayaraman, K., 2010. The examination on the drivers for green purchasing adoption among EMS 14001 certified companies in Malaysia. J. Manuf. Technol. Manag. 21, 206–225. https://doi.org/10.1108/17410381011014378.
EPA, 2003. Lean Manufacturing and the Environment.
Fargani, H., Cheung, W.M., Hasan, R., 2016. An empirical analysis of the factors that support the drivers of sustainable manufacturing. Procedia CIRP 56, 491–495. https://doi.org/10.1016/j.procir.2016.10.096.
Farias, L.M.S., Santos, L.C., Gohr, C.F., Oliveira, L.C. de, Amorim, M.H. da S., 2019. Criteria and practices for lean and green performance assessment: systematic review and conceptual framework. J. Clean. Prod. 218, 746–762. https://doi.org/10.1016/j.jclepro.2019.02.042.
Faulkner, W., Badurdeen, F., 2014. Sustainable value stream mapping (Sus-VSM): methodology to visualize and assess manufacturing sustainability performance. J. Clean. Prod. 85, 8–18. https://doi.org/10.1016/j.jclepro.2014.05.042.
Fernando, Y., Wah, W.X., 2017. The impact of eco-innovation drivers on environmental performance: empirical results from the green technology sector in Malaysia. Sustain. Prod. Consum. 12, 27–43. https://doi.org/10.1016/j.spc.2017.05.002.
Fleischmann, M., Beullens, P., BLOEMHOF-RUWAARD, J.M., Van Wassenhove, L.N., 2001. The impact of product recovery on logistics network design. Prod. Oper. Manag. 10, 156–173.
Florida, R., 1996. Lean and green: the move to environmentally conscious manufacturing. Calif. Manag. Rev. 39, 80–105. https://doi.org/10.2307/41165877.
Foerstl, K., Azadegan, A., Leppelt, T., Hartmann, E., 2015. Drivers of supplier sustainability: moving beyond compliance to commitment. J. Supply Chain Manag. 51, 67–92. https://doi.org/10.1111/jscm.12067.
Fontenot, G., Behara, R., Gresham, A., 1994. Six sigma in customer satisfaction. Qual. Prog. 27, 73–76.
Frazier, W.E., 2014. Metal additive manufacturing: a review. J. Mater. Eng. Perform. 23, 1917–1928. https://doi.org/10.1007/s11665-014-0958-z.
Fullerton, R.R., Kennedy, F.A., Widener, S.K., 2014. Lean manufacturing and firm performance: the incremental contribution of lean management accounting practices. J. Oper. Manag. 32, 414–428. https://doi.org/10.1016/j.jom.2014.09.002.
Fullerton, R.R., Wempe, W.F., 2009. Lean manufacturing, non-financial performance measures, and financial performance. Int. J. Oper. Prod. Manag. 29, 214–240. https://doi.org/10.1108/01443570910938970.
Gallouj, F., 2015. Innovating in reverse : services and the reverse product cycle. Eur. J. Innovat. Manag. 1, 123–138.
Gandhi, N.S., Thanki, S.J., Thakkar, J.J., 2018. Ranking of drivers for integrated lean-green manufacturing for Indian manufacturing SMEs. J. Cleaner Production. Elsevier B.V. https://doi.org/10.1016/j.jclepro.2017.10.041.
Garbie, I.H., 2015. Integrating sustainability assessments in manufacturing enterprises: a framework approach. Int. J. Ind. Syst. Eng. 20, 343–368. https://doi.org/10.1504/IJISE.2015.069922.
Gardner, L., Colwill, J., 2016. A framework for the resilient use of critical materials in sustainable manufacturing systems. Procedia CIRP 41, 282–288. https://doi.org/10.1016/j.procir.2016.01.003.

Garetti, M., Taisch, M., 2012. Sustainable manufacturing: trends and research challenges. Prod. Plann. Control 23, 83–104. https://doi.org/10.1080/09537287.2011.591619.

Garza-Reyes, J.A., 2015. Green lean and the need for six sigma. Int. J. Lean Six Sigma 6, 226–248. https://doi.org/10.1108/IJLSS-04-2014-0010.

Ghazilla, R.A.R., Sakundarini, N., Abdul-Rashid, S.H., Ayub, N.S., Olugu, E.U., Musa, S. N., 2015. Drivers and barriers analysis for green manufacturing practices in Malaysian SMEs: a preliminary findings. Procedia CIRP 26, 658–663. https://doi.org/10.1016/j.procir.2015.02.085.

Ghobakhloo, M., Azar, A., 2018. Business excellence via advanced manufacturing technology and lean-agile manufacturing. J. Manuf. Technol. Manag. 29, 2–24. https://doi.org/10.1108/JMTM-03-2017-0049.

Ghosh, M., 2013. Lean manufacturing performance in Indian manufacturing plants. J. Manuf. Technol. Manag. 24, 113–122. https://doi.org/10.1108/17410381311287517.

Gilbert, S., 2001. Greening Supply Chain: Enhancing Competitiveness through Green Productivity. Tapei, Taiwan, pp. 1–6.

Ginsberg, J.M., Bloom, P.N., 2004. Choosing the right green marketing strategy. MIT Sloan Manag. Rev. 46.

Giunipero, L.C., Hooker, R.E., Denslow, D., 2012. Purchasing and supply management sustainability: drivers and barriers. J. Purch. Supply Manag. 18, 258–269. https://doi.org/10.1016/j.pursup.2012.06.003.

Goldsby, T.J., Martichenko, R., 2005. Lean Six Sigma Logistics: Strategic Development to Operational Success. J. Ross, Boca Raton.

Goodman, S.L., 1998. Is ISO 14001 an important element in business survival? Quality 32.

Govindan, K., Diabat, A., Madan Shankar, K., 2015. Analyzing the drivers of green manufacturing with fuzzy approach. J. Clean. Prod. 96, 182–193. https://doi.org/10.1016/j.jclepro.2014.02.054.

Goyal, A., Agrawal, R., 2020. Drivers in adoption of advanced manufacturing management system for environmental sustainability. SSRN Electron. J. https://doi.org/10.2139/ssrn.3562700.

GPNM, 2003. An Introductory Study on Green Purchasing Activities in Malaysia.

Gunasekaran, A., 1999. Agile manufacturing: a framework for research and development. Int. J. Prod. Econ. 62, 87–105. https://doi.org/10.1016/S0925-5273(98)00222-9.

Gunasekaran, A., 1998. Agile manufacturing: enablers and an implementation framework. Int. J. Prod. Res. 36, 1223–1247. https://doi.org/10.1080/002075498193291.

Gunasekaran, A., Subramanian, N., Rahman, S., 2015. Green supply chain collaboration and incentives: current trends and future directions. Transp. Res. Part E Logist. Transp. Rev. 74, 1–10. https://doi.org/10.1016/j.tre.2015.01.002.

Gunasekaran, A., Yusuf, Y.Y., 2002. Agile manufacturing: a taxonomy of strategic and technological imperatives. Int. J. Prod. Res. 40, 1357–1385. https://doi.org/10.1080/00207540110118370.

Guoyou, Q., Saixing, Z., Chiming, T., Haitao, Y., Hailiang, Z., 2013. Stakeholders' influences on corporate green innovation strategy: a case study of manufacturing firms in China. Corp. Soc. Responsib. Environ. Manag. 20, 1–14. https://doi.org/10.1002/csr.283.

Gupta, S., Dangayach, G.S., Singh, A.K., 2015. Key determinants of sustainable product design and manufacturing. Procedia CIRP 26, 99–102. https://doi.org/10.1016/j.procir.2014.07.166.

Hafeez, K., Zhang, Y.B., Malak, N., 2002. Core competence for sustainable competitive advantage: a structured methodology for identifying core competence. IEEE Trans. Eng. Manag. 49, 28–35. https://doi.org/10.1109/17.985745.

Hall, J., 2000. Environmental supply chain dynamics. J. Clean. Prod. 8, 455–471. https://doi.org/10.1016/S0959-6526(00)00013-5.

Hall, J., Wagner, M., 2012. Integrating sustainability into firms' processes: performance effects and the moderating role of business models and innovation. Bus. Strat. Environ. 21, 183–196. https://doi.org/10.1002/bse.728.

Hallgren, M., Olhager, J., 2009. Lean and agile manufacturing: external and internal drivers and performance outcomes. Int. J. Oper. Prod. Manag. 29, 976–999. https://doi.org/10.1108/01443570910993456.

Hariyani, D., Mishra, S., 2021. Organizational enablers for sustainable manufacturing and industrial ecology. Clean. Eng. Technol. 6, 100375 https://doi.org/10.1016/j.clet.2021.100375.

Harry, M.J., 1998. Six Sigma: a breakthrough strategy for profitability. Qual. Prog. 31, 60–64.

Hart, S.L., 1995. A natural-resource-based view of the firm. Acad. Manag. Rev. 20, 986–1014. https://doi.org/10.5465/amr.1995.9512280033.

Hartini, S., Ciptomulyono, U., 2015. The relationship between lean and sustainable manufacturing on performance: literature review. Procedia Manuf. 4, 38–45. https://doi.org/10.1016/j.promfg.2015.11.012.

Helleno, A.L., de Moraes, A.J.I., Simon, A.T., Helleno, A.L., 2017. Integrating sustainability indicators and Lean Manufacturing to assess manufacturing processes: application case studies in Brazilian industry. J. Clean. Prod. 153, 405–416. https://doi.org/10.1016/j.jclepro.2016.12.072.

Hitchcock, T., 2012. Low carbon and green supply chains: the legal drivers and commercial pressures. Supply Chain Manag. 17, 98–101. https://doi.org/10.1108/13598541211212249.

Hofer, C., Cantor, D.E., Dai, J., 2012a. The competitive determinants of a firm's environmental management activities: evidence from US manufacturing industries. J. Oper. Manag. 30, 69–84. https://doi.org/10.1016/j.jom.2011.06.002.

Hofer, C., Eroglu, C., Rossiter Hofer, A., 2012b. The effect of lean production on financial performance: the mediating role of inventory leanness. Int. J. Prod. Econ. 138, 242–253. https://doi.org/10.1016/j.ijpe.2012.03.025.

Hofmann, K.H., Theyel, G., Wood, C.H., 2012. Identifying firm capabilities as drivers of environmental management and sustainability practices - evidence from small and medium-sized manufacturers. Bus. Strat. Environ. 21, 530–545. https://doi.org/10.1002/bse.739.

Holt, D., Ghobadian, A., 2009. An empirical study of green supply chain management practices amongst UK manufacturers. J. Manuf. Technol. Manag. 20, 933–956. https://doi.org/10.1108/17410380910984212.

Hsu, C., Choon Tan, K., Hanim Mohamad Zailani, S., Jayaraman, V., 2013. Supply chain drivers that foster the development of green initiatives in an emerging economy. Int. J. Oper. Prod. Manag. 33, 656–688. https://doi.org/10.1108/IJOPM-10-2011-0401.

Hu, S.J., 2013. Evolving paradigms of manufacturing: from mass production to mass customization and personalization. Procedia CIRP 7, 3–8. https://doi.org/10.1016/j.procir.2013.05.002.

Huang, X., Tan, B.L., Ding, X., 2015. An exploratory survey of green supply chain management in Chinese manufacturing small and medium-sized enterprises: pressures and drivers. J. Manuf. Technol. Manag. 26, 80–103.

IEA, 2007. Tracking industrial energy efficiency and CO2 emissions. In: International Energy Association). OECD/IEA, Paris. https://doi.org/10.1007/978-3-642-29446-4_14.

Inman, R.A., Sale, R.S., Green, K.W., Whitten, D., 2011. Agile manufacturing: relation to JIT, operational performance and firm performance. J. Oper. Manag. 29, 343–355. https://doi.org/10.1016/j.jom.2010.06.001.

Irani, Z., Ezingeard, J.N., Grieve, R.J., 1997. Integrating the costs of a manufacturing it/is infrastructure into the investment decision-making process. Technovation 17, 695–706. https://doi.org/10.1016/S0166-4972(97)00060-6.

Jabbour, C.J.C., Santos, F.C.A., 2008. The central role of human resource management in the search for sustainable organizations. Int. J. Hum. Resour. Manag. 19, 2133–2154. https://doi.org/10.1080/09585190802479389.

Jawahir, I.S., Bradley, R., 2016. Technological elements of circular economy and the principles of 6R-based closed-loop material flow in sustainable manufacturing. Procedia CIRP 40, 103–108. https://doi.org/10.1016/j.procir.2016.01.067.

Jawahir, I.S., Dillon, J.O.W., 2007. Sustainable manufacturing processes: new challenges for developing predictive models and optimization techniques. In: 1st International Conference on Sustainable Manufacturing. Montreal, Canada.

Jawahir, I.S., Dillon, O.W., Rouch, K.E., Joshi, K.J., Jaafar, I.H., 2006. Total life-cycle considerations in product design for sustainability : a framework for comprehensive evaluation. In: 10th International Research/Expert Conference "Trends in the Development of Machinery and Associated Technology. Barcelona-Lloret de Mar, Spain, pp. 11–15, 10.1.1.402.3563.

Jayal, A.D., Badurdeen, F., Dillon, O.W., Jawahir, I.S., 2010. Sustainable manufacturing: modeling and optimization challenges at the product, process and system levels. CIRP J. Manuf. Sci. Technol. 2, 144–152. https://doi.org/10.1016/j.cirpj.2010.03.006.

Jayaram, J., Vickery, S., Droge, C., 2008. Relationship building, lean strategy and firm performance: an exploratory study in the automotive supplier industry. Int. J. Prod. Res. 46, 5633–5649. https://doi.org/10.1080/00207540701429942.

Jayaraman, V., Singh, R., Anandnarayan, A., 2012. Impact of sustainable manufacturing practices on consumer perception and revenue growth: an emerging economy perspective. Int. J. Prod. Res. 50, 1395–1410. https://doi.org/10.1080/00207543.2011.571939.

Jiang, C., Zhang, Y., Bu, M., Liu, W., 2018. The effectiveness of government subsidies on manufacturing innovation: evidence from the new energy vehicle industry in China. Sustainability 10, 1692. https://doi.org/10.3390/su10061692.

Jin-Hai, L., Anderson, A.R., Harrison, R.T., 2003. The evolution of agile manufacturing. Bus. Process Manag. J. 9, 170–189. https://doi.org/10.1108/14637150310468380.

Johansson, H.J., McHugh, P., Pendlebury, A.J., Wheeler, 1993. Business Process Reengineering: Breakpoint Strategies for Market Dominance. Wiley, Chichester, UK.

Joung, C.B., Carrell, J., Sarkar, P., Feng, S.C., 2013. Categorization of indicators for sustainable manufacturing. Ecol. Indicat. 24, 148–157. https://doi.org/10.1016/j.ecolind.2012.05.030.

Jovane, F., Yoshikawa, H., Alting, L., Boër, C.R., Westkamper, E., Williams, D., Tseng, M., Seliger, G., Paci, A.M., 2008. The incoming global technological and industrial revolution towards competitive sustainable manufacturing. CIRP Ann. - Manuf. Technol. 57, 641–659. https://doi.org/10.1016/j.cirp.2008.09.010.

Kaebernick, H., Kara, S., Sun, M., 2003. Sustainable product development and manufacturing by considering environmental requirements. Robot. Comput. Integrated Manuf. 19, 461–468. https://doi.org/10.1016/S0736-5845(03)00056-5.

Kamali, M., Hewage, K., 2017. Development of performance criteria for sustainability evaluation of modular versus conventional construction methods. J. Clean. Prod. 142, 3592–3606. https://doi.org/10.1016/j.jclepro.2016.10.108.

Kamolkittiwong, A., 2015. An analysis of drivers affecting green supply chain management implementation in electronics industry in Thailand. J. Econ. Bus. Manag. 3 https://doi.org/10.7763/joebm.2015.v3.299.

Karim, A., Arif-Uz-Zaman, K., 2013. A methodology for effective implementation of lean strategies and its performance evaluation in manufacturing organizations. Bus. Process Manag. J. 19, 169–196. https://doi.org/10.1108/14637151311294912.

Karuppiah, K., Sankaranarayanan, B., Ali, S.M., Chowdhury, P., Paul, S.K., 2020. An integrated approach to modeling the barriers in implementing green manufacturing practices in SMEs. J. Clean. Prod. 265, 121737 https://doi.org/10.1016/j.jclepro.2020.121737.

Katayama, H., Bennett, D., 1999. Agility, adaptability and leanness: a comparison of concepts and a study of practice. Int. J. Prod. Econ. 60–61, 43–51. https://doi.org/10.1016/S0925-5273(98)00129-7.

Kemp, Rene, Schot, J.H.R., 2000. Regime Shifts to Sustainability through Processes of Niche Formation: the Approach of SNM.

King, A.A., Lenox, M.J., 2001. Lean and green? An empirical examination of the relationship between lean production and environmental performance. Prod. Oper. Manag. 10, 244–256. https://doi.org/10.1111/j.1937-5956.2001.tb00373.x.

Klotz, L., Horman, M., Bodenschatz, M., 2007. A lean modeling protocol for evaluating green project delivery. Lean Constr. J. 3, 1–18.

Knowles, G., Whicker, L., Femat, J.H., Canales, F.D.C., 2005. A conceptual model for the application of Six Sigma methodologies to supply chain improvement. Int. J. Logist. Res. Appl. 8, 51–65. https://doi.org/10.1080/13675560500067459.

Koch, P.N., Yang, R.J., Gu, L., 2004. Design for six sigma through robust optimization. Struct. Multidiscip. Optim. 26, 235–248. https://doi.org/10.1007/s00158-003-0337-0.

Kolk, A., 2010. Trajectories of sustainability reporting by MNCs. J. World Bus. 45, 367–374. https://doi.org/10.1016/j.jwb.2009.08.001.

Koren, Y., Gu, X., Badurdeen, F., Jawahir, I.S., 2018. Sustainable living factories for next generation manufacturing. Procedia Manuf. 21, 26–36. https://doi.org/10.1016/j.promfg.2018.02.091.

Koren, Y., Jovane, F., Moriwaki, T., Ulsoy, A.G., 2011. Manufacturing technologies for machines of the future. Manuf. Technol. Mach. Futur. https://doi.org/10.1007/978-3-642-55776-7.

Krishna Moorthy, M., Kumar, M., Rahman, A., Campus, P., Lawrence Arokiasamy, M., 2012. Drivers for Malaysian SMEs to go green. Int. J. Acad. Res. Bus. Soc. Sci. 2, 74.

Krishnamurthy, R., Yauch, C.A., 2007. Leagile manufacturing: a proposed corporate infrastructure. Int. J. Oper. Prod. Manag. 27, 588–604. https://doi.org/10.1108/01443570710750277.

Kumar, A., Moktadir, A., Liman, Z.R., Gunasekaran, A., Hegemann, K., Rehman Khan, S. A., 2020. Evaluating sustainable drivers for social responsibility in the context of ready-made garments supply chain. J. Clean. Prod. 248, 119231 https://doi.org/10.1016/j.jclepro.2019.119231.

Kumar, N., Kumar, S., Haleem, A., Gahlot, P., 2013. Implementing lean manufacturing system: ISM approach. J. Ind. Eng. Manag. 6, 996–1012. https://doi.org/10.3926/jiem.508.

Kumar, V., Babu, G., Muthusamy, S., 2016. Assessing the awareness of the agile manufacturing for organizational change in Indian small manufacturing firms: an empirical investigation. J. Organ. Change Manag. 29, 713–731. https://doi.org/10.1108/JOCM-11-2015-0200.

Kwak, Y.H., Anbari, F.T., 2006. Benefits, obstacles, and future of six sigma approach. Technovation 26, 708–715. https://doi.org/10.1016/j.technovation.2004.10.003.

Lampe, M., Ellis, S.R., Drummond, C.K., 1991. In: What Companies Are Doing to Meet Environmental Protection Responsibilities: Balancing Legal, Ethical, and Profit Concerns. Proceedings of the International Association for Business and Society, pp. 527–537.

Latapí, A.M.A., Johannsdottir, L., Davidsdottir, B., 2020. Drivers that motivate energy companies to be responsible. A systematic literature review of Corporate Social Responsibility in the energy sector. J. Clean. Prod. 247, 119094 https://doi.org/10.1016/j.jclepro.2019.119094.

Lee, K.H., 2009. Why and how to adopt green management into business organizations?: the case study of Korean SMEs in manufacturing industry. Manag. Decis. 47, 1101–1121. https://doi.org/10.1108/00251740910978322.

Lee, S., 2008. Drivers for the participation of small and medium-sized suppliers in green supply chain initiatives. Supply Chain Manag. An Int. J. 13, 185–198. https://doi.org/10.1108/13598540810871235.

Leonidou, L.C., Christodoulides, P., Kyrgidou, L.P., Palihawadana, D., 2015. Internal drivers and performance consequences of small firm green business strategy: the moderating role of external forces. J. Bus. Ethics 140, 585–606. https://doi.org/10.1007/s10551-015-2670-9.

Li, J.H., Anderson, A., Harrison, R.T., 2003. The evolution of agile manufacturing. Evol. Agil. Manuf. 12.

Li, L.L.X., 2000. Manufacturing capability development in a changing business environment. Ind. Manag. Data Syst. 100, 261–270.

Liker, J.K., 1996. Becoming Lean. Free Press, New York.

Linderman, K., Schroeder, R.G., Zaheer, S., Choo, A.S., 2003. Six Sigma: a goal-theoretic perspective. J. Oper. Manag. 21, 193–203. https://doi.org/10.1016/S0272-6963(02)00087-6.

Linton, J.D., Klassen, R., Jayaraman, V., 2007. Sustainable supply chains: an introduction. J. Oper. Manag. 25, 1075–1082. https://doi.org/10.1016/j.jom.2007.01.012.

Liu, X., Yang, J., Qu, S., Wang, L., Shishime, T., Bao, C., 2012. Sustainable production: practices and determinant factors of green supply chain management of Chinese companies. Bus. Strat. Environ. 21, 1–16. https://doi.org/10.1002/bse.705.

Lozano, R., 2015. A holistic perspective on corporate sustainability drivers. Corp. Soc. Responsib. Environ. Manag. 22, 32–44. https://doi.org/10.1002/csr.1325.

Lucato, W.C., Vieira, M., Da Silva Santos, J.C., 2015. Eco-six sigma: integration of environmental variables into the six sigma technique. Prod. Plann. Control 26, 605–616. https://doi.org/10.1080/09537287.2014.949896.

Luo, X., Bhattacharya, C.B., 2006. Corporate social responsibility, customer satisfaction, and market value. J. Market. 70, 1–18. https://doi.org/10.1509/jmkg.70.4.001.

Madsen, H.L., 2020. Business model innovation and the global ecosystem for sustainable development. J. Clean. Prod. 247, 119102 https://doi.org/10.1016/j.jclepro.2019.119102.

Maniatis, P., 2016. Investigating factors influencing consumer decision-making while choosing green products. J. Clean. Prod. 132, 215–228. https://doi.org/10.1016/j.jclepro.2015.02.067.

Maon, F., Lindgreen, A., Swaen, V., 2009. Designing and implementing corporate social responsibility: an integrative framework grounded in theory and practice. J. Bus. Ethics 87, 71–89. https://doi.org/10.1007/s10551-008-9804-2.

Mason-Jones, R., Naylor, B., Towill, D.R., 2000. Lean, agile or leagile? Matching your supply chain to the marketplace. Int. J. Prod. Res. 38, 4061–4070. https://doi.org/10.1080/00207540050204920.

Mason-Jones, R., Towill, D.R., 1999. Using the information decoupling point to improve supply chain performance. Int. J. Logist. Manag. 10, 13–26. https://doi.org/10.1108/09574099910805969.

Massoud, M.A., Fayad, R., El-Fadel, M., Kamleh, R., 2010. Drivers, barriers and incentives to implementing environmental management systems in the food industry: a case of Lebanon. J. Clean. Prod. 18, 200–209. https://doi.org/10.1016/j.jclepro.2009.09.022.

Mast, J. de, Lokkerbol, J., 2012. An analysis of the Six Sigma DMAIC method from the perspective of problem solving. Int. J. Prod. Econ. 139, 604–614. https://doi.org/10.1016/j.ijpe.2012.05.035.

Mathews, J.A., Tan, H., 2011. Progress toward a circular economy in China: the drivers (and inhibitors) of eco-industrial initiative. J. Ind. Ecol. 15, 435–457. https://doi.org/10.1111/j.1530-9290.2011.00332.x.

Maurice Berns, A.T., 2009. Sustainability and competitive advantage. MIT Sloan Manag. Rev. 51, 19–20. https://doi.org/10.4018/978-1-5225-8182-6.ch080.

McCullen, P., Towill, D., 2001. Achieving lean supply through agile manufacturing. Integrated Manuf. Syst. 12, 524–533. https://doi.org/10.1108/EUM0000000006232.

Mehrabi, M.G., Ulsoy, A.G., Koren, Y., 2000. Reconfigurable manufacturing systems and their enabling technologies. Int. J. Manuf. Technol. Manag. 1, 114. https://doi.org/10.1504/IJMTM.2000.001330.

Melnyk, S.A., Sroufe, R.P., Calantone, R., 2003. Assessing the impact of environmental management systems on corporate and environmental performance. J. Oper. Manag. 21, 329–351. https://doi.org/10.1016/S0272-6963(02)00109-2.

Melton, T., 2005. The benefits of lean manufacturing: what lean thinking has to offer the process industries. Chem. Eng. Res. Des. 83, 662–673. https://doi.org/10.1205/cherd.04351.

Mena, C., Whicker, L., Templar, S., Bernon, M., 2002. Costing the supply chain. Manuf. Eng. 81, 225–228. https://doi.org/10.1049/me:20020505.

Meredith, P.H., Ristroph, J.H., 1991. Implementing JIT: the dimensions of culture, management, and human resources. In: Technology Management:The New International Language, pp. 448–451.

Minhaj, A.A.R., Shrivastava, R.R., Shrivastava, R.L., 2013. Validating green manufacturing (GM) framework for sustainable development in an Indian steel industry. Univers. J. Mech. Eng. 1, 49–61. https://doi.org/10.13189/ujme.2013.010204.

Mittal, V.K., Sangwan, K.S., 2014a. Development of a model of barriers to environmentally conscious manufacturing implementation. Int. J. Prod. Res. 52, 584–594. https://doi.org/10.1080/00207543.2013.838649.

Mittal, V.K., Sangwan, K.S., 2014b. Modeling drivers for successful adoption of environmentally conscious manufacturing. J. Model. Manag. 9, 127–140. https://doi.org/10.1108/JM2-03-2013-0011.

Mittal, V.K., Sangwan, K.S., 2014c. Prioritizing drivers for green manufacturing: environmental, social and economic perspectives. Procedia CIRP 15, 135–140. https://doi.org/10.1016/j.procir.2014.06.038.

Mittal, V.K., Sindhwani, R., Kalsariya, V., Salroo, F., Sangwan, K.S., Singh, P.L., 2017. Adoption of integrated lean-green-agile strategies for modern manufacturing systems. Procedia CIRP 61, 463–468. https://doi.org/10.1016/j.procir.2016.11.189.

Moher, D., Liberati, A., Tetzlaff, J., Altman, D.G., 2009a. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Med. 6 https://doi.org/10.1371/journal.pmed.1000097.

Moher, D., Liberati, A., Tetzlaff, J., Altman, D.G., Grp, P., 2009b. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement (reprinted from annals of internal medicine). Phys. Ther. 89, 873–880. https://doi.org/10.1371/journal.pmed.1000097.

Moktadir, M.A., Rahman, T., Rahman, M.H., Ali, S.M., Paul, S.K., 2018. Drivers to sustainable manufacturing practices and circular economy: a perspective of leather industries in Bangladesh. J. Clean. Prod. 174, 1366–1380. https://doi.org/10.1016/j.jclepro.2017.11.063.

Mollenkopf, D., Stolze, H., Tate, W.L., Ueltschy, M., 2010. Green, lean, and global supply chains. Int. J. Phys. Distrib. Logist. Manag. 40, 14–41. https://doi.org/10.1108/09600031011018028.

Montabon, F., Sroufe, R., Narasimhan, R., 2007. An examination of corporate reporting, environmental management practices and firm performance. J. Oper. Manag. 25, 998–1014. https://doi.org/10.1016/j.jom.2006.10.003.

Moon, J., 2007. The contribution of corporate social responsibility to sustainable development. Sustain. Dev. 15, 296–306. https://doi.org/10.1002/sd.346.

Moreton, M., 2003. Featured Company: Bechtel, 3. ASQ Six Sigma Forum Mag, p. 44.

Murray, J.Y., Kotabe, M., Zhou, J.N., 2005. Strategic alliance-based sourcing and market performance: evidence from foreign firms operating in China. J. Int. Bus. Stud. 36, 187–208. https://doi.org/10.1057/palgrave.jibs.8400120.

Muslimen, R., Yusof, M., Sakura, A., Abidin, Z., 2011. Lean manufacturing implementation in Malaysian automotive components manufacturer : a case study. Proeddings World Congr. Eng. 6–10. https://doi.org/10.1007/978-1-4614-2317-1, 2011 I.

Mwanza, B.G., Mbohwa, C., 2017. Drivers to sustainable plastic solid waste recycling: a review. Procedia Manuf. 8, 649–656. https://doi.org/10.1016/j.promfg.2017.02.083.

Naylor, J.B., Naim, M.M., Berry, D., 1999. Leagility: integrating the lean and agile manufacturing paradigms in the total supply chain. Int. J. Prod. Econ. 62, 107–118. https://doi.org/10.1016/S0925-5273(98)00223-0.

New, C., 1992. World-class manufacturing versus strategic trade-offs. Int. J. Oper. Prod. Manag. 12, 19–31.

Ng, R., Low, J.S.C., Song, B., 2015. Integrating and implementing Lean and Green practices based on proposition of Carbon-Value Efficiency metric. J. Clean. Prod. 95, 242–255. https://doi.org/10.1016/j.jclepro.2015.02.043.

Ngamsirijit, W., 2011. Manufacturing flexibility improvement and resource-based view: cases of automotive firms. Int. J. Agil. Syst. Manag. 4, 319–341. https://doi.org/10.1504/IJASM.2011.043130.

Nidumolu, R., Prahalad, C.K., Rangaswami, M.R., 2009. Why sustainability is now the key driver of innovation. Harv. Bus. Rev. 57–64. https://doi.org/10.1109/EMR.2013.6601104.

Nielsen, K.R., 2020. Policymakers' views on sustainable end-user innovation: implications for sustainable innovation. J. Clean. Prod. 254 https://doi.org/10.1016/j.jclepro.2020.120030.

Nieuwenhuis, P., Katsifou, E., 2015. More sustainable automotive production through understanding decoupling points in leagile manufacturing. J. Clean. Prod. 95, 232–241. https://doi.org/10.1016/j.jclepro.2015.02.084.

Ninlawan, C., Seksan, P., Tossapol, K., Pilada, W., 2010. The implementation of green supply chain management practices in electronics industry. Proc. Int. MultiConference Eng. Comput. Sci. IMECS 2010 III, 1563–1568, 2010.

Nkrumah, S.K., Asamoah, D., Annan, J., Agyei-Owusu, B., 2021. Examining green capabilities as drivers of green supply chain management adoption. Manag. Res. Rev. 44, 94–111. https://doi.org/10.1108/MRR-01-2020-0015.

Nordin, N., Ashari, H., Hassan, M.G., 2014. Drivers and barriers in sustainable manufacturing implementation in Malaysian manufacturing firms. IEEE Int. Conf. Ind. Eng. Eng. Manag. 687–691. https://doi.org/10.1109/IEEM.2014.7058726, 2015–Janua.

Nordin, N., Deros, B.M., Wahab, A.W., 2010. A survey on lean manufacturing implementation in Malaysian automotive industry. Int. J. Automot. Mech. Eng. 1, 374–380. https://doi.org/10.15282/ijame.8.2013.33.0121.

Nunes, B., Bennett, D., 2010. Green operations initiatives in the automotive industry: an environmental reports analysis and benchmarking study. Benchmark 17, 396–420. https://doi.org/10.1108/14635771011049362.

Ocampo, L.A., Clark, E.E., 2015. A sustainable manufacturing strategy framework: the convergence of two fields. Asian Acad. Manag. J. 20, 29–57. https://doi.org/10.1108/SCM-01-2014-0007.

Oliver, R.L., 1996. Satisfaction: A Behavioral Perspective on the Consumer. McGraw-Hill, NY, USA.

Olugu, E.U., Wong, K.Y., Shaharoun, A.M., 2010. A comprehensive approach in assessing the performance of an automobile closed-loop supply chain. Sustainability 2, 871–889. https://doi.org/10.3390/su2040871.

Orji, I.J., Liu, S., 2020. A dynamic perspective on the key drivers of innovation-led lean approaches to achieve sustainability in manufacturing supply chain. Int. J. Prod. Econ. 219 https://doi.org/10.1016/j.ijpe.2018.12.002, 1.

Pampanelli, A.B., Found, P., Bernardes, A.M., 2014. A lean & green model for a production cell. J. Clean. Prod. 85, 19–30. https://doi.org/10.1016/j.jclepro.2013.06.014.

Papke-Shields, K.E., Malhotra, M.K., 2001. Assessing the impact of the manufacturing executive's role on business performance through strategic alignment. J. Oper. Manag. 19, 5–22. https://doi.org/10.1016/S0272-6963(00)00050-4.

Paulraj, A., 2011. Understanding the relationships between internal resources and capabilities, sustainable supply management and organizational sustainability. J. Supply Chain Manag. 47, 19–37. https://doi.org/10.1111/j.1745-493X.2010.03212.x.

Piercy, N., Rich, N., 2015. The relationship between lean operations and sustainable operations. Int. J. Oper. Prod. Manag. https://doi.org/10.1108/IJOPM-03-2014-0143.

Porter, M.E., Linde, C. Van Der, 1995. Green and competitive: ending the stalemate harvard business review. Harv. Bus. Rev. 73, 120–134.

Prince, J., Kay, J., 2003. Combining lean and agile characteristics: creation of virtual groups by enhanced production flow analysis. Int. J. Prod. Econ. 85, 305–318. https://doi.org/10.1016/S0925-5273(03)00118-X.

Pujari, D., Wright, G., Peattie, K., 2003. Green and competitive influences on environmental new product development performance. J. Bus. Res. 56, 657–671. https://doi.org/10.1016/S0148-2963(01)00310-1.

Putnik, G.D., Putnik, Z., 2012. Lean vs agile in the context of complexity management in organizations. Learn. Organ. 19, 248–266. https://doi.org/10.1108/09696471211220046.

Rahimifard, S., Coates, G., Staikos, T., Edwards, C., Abu-Bakar, M., 2009. Barriers, drivers and challenges for sustainable product recovery and recycling. Int. J. Sustain. Eng. 2, 80–90. https://doi.org/10.1080/19397030903019766.

Rahman, S., Laosirihongthong, T., Sohal, A.S., 2010. Impact of lean strategy on operational performance: a study of Thai manufacturing companies. J. Manuf. Technol. Manag. 21, 839–852. https://doi.org/10.1108/17410381011077946.

Raisinghani, M.S., Ette, H., Pierce, R., Cannon, G., Daripaly, P., 2005. Six sigma: concepts, tools, and applications. Ind. Manag. Data Syst. 105, 491–505. https://doi.org/10.1108/02635570510592389.

Rao, P., Holt, D., 2005. Do green supply chains lead to competitiveness and economic performance? Int. J. Oper. Prod. Manag. 25, 898–916. https://doi.org/10.1108/EL-01-2017-0019.

Rehman, M.A.A., Shrivastava, R.L., 2013. Green manufacturing (GM): past, present and future(a state of art review). World Rev. Sci. Technol. Sustain. Dev. 10, 17–55. https://doi.org/10.1504/WRSTSD.2013.050784.

Rehman, M.A.A., Shrivastava, R.L., 2011. An innovative approach to evaluate green supply chain management (GSCM) drivers by using interpretive structural modeling (ISM). Int. J. Innovat. Technol. Manag. 8, 315–336. https://doi.org/10.1142/S0219877011002453.

Rehman, M.A.A., Shrivastava, R.R., Shrivastava, R.L., 2014. Evaluating green manufacturing drivers: an interpretive structural modelling approach. Int. J. Prod. Qual. Manag. 13, 471–494. https://doi.org/10.1504/IJPQM.2014.062223.

Rehman, M.A., Seth, D., Shrivastava, R.L., 2016. Impact of green manufacturing practices on organisational performance in Indian context: an empirical study. J. Clean. Prod. 137, 427–448. https://doi.org/10.1016/j.jclepro.2016.07.106.

Rettab B, B.B.A., 2008. Green Supply Chain in Dubai. Dubai Chamber Centre for Responsible Business, Dubai,UAE.

Reuter, C., Foerstl, K., Hartmann, E., Blome, C., 2010. Sustainable global supplier management : the role of dynamic. J. Supply Chain Manag. 46, 45–63.

Ribeiro, I., Kaufmann, J., Schmidt, A., Peças, P., Henriques, E., Götze, U., 2016. Fostering selection of sustainable manufacturing technologies – a case study involving product design, supply chain and life cycle performance. J. Clean. Prod. 112, 3306–3319. https://doi.org/10.1016/j.jclepro.2015.10.043.

Richey, R.G., Chen, H., Genchev, S.E., Daugherty, P.J., 2005. Developing effective reverse logistics programs. Ind. Market. Manag. 34, 830–840. https://doi.org/10.1016/j.indmarman.2005.01.003.

Robins, N., Kumar, R., 1999. Producing, providing, trading: manufacturing industry and sustainable cities. Environ. Urbanization 11, 75–93. https://doi.org/10.1630/095624799101285101.

Rosen, M.A., Kishawy, H.A., 2012. Sustainable manufacturing and design: concepts, practices and needs. Sustainability 4, 154–174. https://doi.org/10.3390/su4020154.

Rothenberg, S., Pil, F.K., Maxwell, J., 2001. Lean, green, and the quest for superior environmental performance. Prod. Oper. Manag. 10, 228–243. https://doi.org/10.1111/j.1937-5956.2001.tb00372.x.

Rother, M., Shook, J., 1998. Learning to See: Value Stream Mapping to Add Value and Eliminate Muda. The Lean Enterprise Institute, Brookline, MA.

Rusinko, C.A., 2007. Green manufacturing: an evaluation of environmentally sustainable manufacturing practices and their impact on competitive outcomes. IEEE Trans. Eng. Manag. 54, 445–454. https://doi.org/10.1109/TEM.2007.900806.

Russell, R.S., Taylor, B.W., 2000. Operations Management. Prentice Hall, Englewood Cliffs.

Sáez-Martínez, F.J., Lefebvre, G., Hernández, J.J., Clark, J.H., 2016. Drivers of sustainable cleaner production and sustainable energy options. J. Clean. Prod. 138, 1–7. https://doi.org/10.1016/j.jclepro.2016.08.094.

Salonitis, K., Tsinopoulos, C., 2016. Drivers and barriers of lean implementation in the Greek manufacturing sector. Procedia CIRP 57, 189–194. https://doi.org/10.1016/j.procir.2016.11.033.

Sarkis, J., 1998. Evaluating environmentally conscious business practices. Eur. J. Oper. Res. 107, 159–174. https://doi.org/10.1016/S0377-2217(97)00160-4.

Savaskan, R.C., Bhattacharya, S., Van Wassenhove, L.N., 2004. Closed-loop supply chain models with product remanufacturing. Manag. Sci. 50, 239–252. https://doi.org/10.1287/mnsc.1030.0186.

Seth, D., Rehman, M.A.A., Shrivastava, R.L., 2018. Green manufacturing drivers and their relationships for small and medium(SME) and large industries. J. Clean. Prod. 198, 1381–1405. https://doi.org/10.1016/j.jclepro.2018.07.106.

Sezen, B., Çankaya, S.Y., 2013. Effects of green manufacturing and eco-innovation on sustainability performance. Procedia - Soc. Behav. Sci. 99, 154–163. https://doi.org/10.1016/j.sbspro.2013.10.481.

Shah, R., Ward, P.T., 2003a. Lean manufacturing: context, practice bundles, and performance. J. Oper. Manag. 21, 129–149. https://doi.org/10.1016/S0272-6963(02)00108-0.

Shah, R., Ward, P.T., 2003b. Lean manufacturing: context, practice bundles, and performance. J. Oper. Manag. 21, 129–149. https://doi.org/10.1016/S0272-6963(02)00108-0.

Shang, K.C., Lu, C.S., Li, S., 2010. A taxonomy of green supply chain management capability among electronics-related manufacturing firms in Taiwan. J. Environ. Manag. 91, 1218–1226. https://doi.org/10.1016/j.jenvman.2010.01.016.

Shankar, K., Kumar, P., Kannan, D., 2016. Analyzing the drivers of advanced sustainable manufacturing system using AHP approach. Sustainability 8, 824. https://doi.org/10.3390/su8080824.

Sharifi, H., Colquhoun, G., Barclay, I., Dann, Z., 2001. Agile manufacturing: a management and operational framework. Proc. Inst. Mech. Eng. Part B J. Eng. Manuf. 215, 857–869. https://doi.org/10.1243/0954405011518647.

Sharifi, H., Zhang, Z., 2001. Agile manufacturing in practice - Application of a methodology. Int. J. Oper. Prod. Manag. 21, 772–794. https://doi.org/10.1108/01443570110390462.

Sharifi, H., Zhang, Z., 2000. A methodology for achieving agility in manufacturing organisations. Int. J. Oper. Prod. Manag. 20, 496–513. https://doi.org/10.1108/01443570010314818.

Sharma, S., Henriques, I., 2005. Stakeholder influences on sustainability practices in the Canadian forest products industry. Strat. Manag. J. 26, 159–180. https://doi.org/10.1002/smj.439.

Sharp, J.M., Irani, Z., Desai, S., 1999. Working towards agile manufacturing in the UK industry. Int. J. Prod. Econ. 62, 155–169. https://doi.org/10.1016/S0925-5273(98)00228-X.

Sharrard, A.L., Matthews, S., Reis, R., 2008. Estimating construction project environmental effects using an input-output-based hybrid life-cycle assessment model. J. Infrastruct. Syst. 14, 327–336. https://doi.org/10.1061/(ASCE)1076-0342(2008)14:4(327).

Shen, L., Olfat, L., Govindan, K., Khodaverdi, R., Diabat, A., 2013. A fuzzy multi criteria approach for evaluating green supplier's performance in green supply chain with linguistic preferences. Resour. Conserv. Recycl. 74, 170–179. https://doi.org/10.1016/j.resconrec.2012.09.006.

Shibin, K.T., Dubey, R., Gunasekaran, A., Hazen, B., Roubaud, D., Gupta, S., Foropon, C., 2017. Examining sustainable supply chain management of SMEs using resource based view and institutional theory. Ann. Oper. Res. 1–26. https://doi.org/10.1007/s10479-017-2706-x.
Shrivastava, P., 1995. Environmental technologies and competltlve advantage. Strateg. Manag. 16, 183–200.
Siemieniuch, C.E., Sinclair, M.A., Henshaw, M.J. deC., 2015. Global drivers, sustainable manufacturing and systems ergonomics. Appl. Ergon. 51, 104–119. https://doi.org/10.1016/j.apergo.2015.04.018.
Sim, K.L., Rogers, J.W., 2008. Implementing lean production systems: barriers to change. Manag. Res. News 32, 37–49. https://doi.org/10.1108/01409170910922014.
Singh, B., Garg, S.K., Sharma, S.K., Grewal, C., 2010. Lean implementation and its benefits to production industry. Int. J. Lean Six Sigma 1, 157–168. https://doi.org/10.1108/20401461011049520.
Singh Sangwan, K., Bhamu, J., Mehta, D., Sangwan, K.S., Bhamu, J., Mehta, D., Singh Sangwan, K., Bhamu, J., Mehta, D., Sangwan, K.S., Bhamu, J., Mehta, D., Singh Sangwan, K., Bhamu, J., Mehta, D., 2014. Development of lean manufacturing implementation drivers for Indian ceramic industry. Int. J. Prod. Perform. Manag. 63, 569–587. https://doi.org/10.1108/IJPPM-06-2013-0105.
Snee, R.D., 2010. Lean Six Sigma – getting better all the time. Int. J. Lean Six Sigma 1, 9–29. https://doi.org/10.1108/20401461011033130.
Sohal, A.S., Egglestone, A., 1994. Lean production: experience among Australian organizations. Int. J. Oper. Prod. Manag. 14, 35–51. https://doi.org/10.1108/01443579410068639.
Soković, M., Pavletić, D., Krulčić, E., 2006. Six Sigma process improvements in automotive parts production. J. Achiev. Mater. Manuf. Eng. 19, 96–102.
Somsuk, N., Laosirihongthong, T., 2017. Prioritization of applicable drivers for green supply chain management implementation toward sustainability in Thailand. Int. J. Sustain. Dev. World Ecol. 24, 175–191. https://doi.org/10.1080/13504509.2016.1187210.
Song, F., Su, F., Zhu, D., Li, L., Li, H., Sun, D., 2020. Evaluation and driving factors of sustainable development of the wetland ecosystem in Northeast China: an emergy approach. J. Clean. Prod. 248, 119236 https://doi.org/10.1016/j.jclepro.2019.119236.
Spangenberg, J.H., 2013. Design for sustainability (DfS): interface of sustainable production and consumption. Handb. Sustain. Eng. 18, 575–595. https://doi.org/10.1007/978-1-4020-8939-8_63.
Srivastava, S.K., 2007. Green supply-chain management: a state-of-the-art literature review. Int. J. Manag. Rev. 9, 53–80. https://doi.org/10.1111/j.1468-2370.2007.00202.x.
Stratton, R., Warburton, R.D., 2003. The strategic integration of agile and lean supply. Int. J. Prod. Econ. 183–198. https://doi.org/10.13140/RG.2.1.4083.2488.
Stump, B., Badurdeen, F.B., Badurdeen, F.S., 2012. Integrating lean and other strategies for mass customization manufacturing: a case study. J. Intell. Manuf. 23, 109–124. https://doi.org/10.1007/s10845-009-0289-3.
Sun, H., Hong, C., 2002. The alignment between manufacturing and business strategies: its influence on business performance. Technovation 22, 699–705. https://doi.org/10.1016/S0166-4972(01)00066-9.
Suzaki, K., 1987. The New Manufacturing Challenge: Techniques for Continuous Improvement. The Free Press, New York, NY.
Swafford, P.M., Ghosh, S., Murthy, N., 2006. The antecedents of supply chain agility of a firm: scale development and model testing. J. Oper. Manag. 24, 170–188. https://doi.org/10.1016/j.jom.2005.05.002.
Swink, M., Jacobs, B.W., 2012. Six Sigma adoption: operating performance impacts and contextual drivers of success. J. Oper. Manag. 30, 437–453. https://doi.org/10.1016/j.jom.2012.05.001.
Taj, S., Morosan, C., 2011. The impact of lean operations on the Chinese manufacturing performance. J. Manuf. Technol. Manag. 22, 223–240. https://doi.org/10.1108/17410381111102234.
Thanki, S., Govindan, K., Thakkar, J., 2016. An investigation on lean-green implementation practices in Indian SMEs using analytical hierarchy process (AHP) approach. J. Clean. Prod. 135, 284–298. https://doi.org/10.1016/j.jclepro.2016.06.105.
Thun, J.H., 2008. Empirical analysis of manufacturing strategy implementation. Int. J. Prod. Econ. 113, 370–382. https://doi.org/10.1016/j.ijpe.2007.09.005.
Tseng, M.L., Chiu, A.S.F., Tan, R.R., Siriban-Manalang, A.B., 2013. Sustainable consumption and production for Asia: sustainability through green design and practice. J. Clean. Prod. 40, 1–5. https://doi.org/10.1016/j.jclepro.2012.07.015.
Tseng, Y.H., Lin, C.T., 2011. Enhancing enterprise agility by deploying agile drivers, capabilities and providers. Inf. Sci. 181, 3693–3708. https://doi.org/10.1016/j.ins.2011.04.034.
Tudor, T., Adam, E., Bates, M., 2007. Drivers and limitations for the successful development and functioning of EIPs (eco-industrial parks): a literature review. Ecol. Econ. 61, 199–207. https://doi.org/10.1016/j.ecolecon.2006.10.010.
Van Hoek, R.I., 1999. From reversed logistics to green supply chains. Supply Chain Manag. 4, 129–134. https://doi.org/10.1108/13598549910279576.
Vázquez-Bustelo, D., Avella, L., 2006. Agile manufacturing: industrial case studies in Spain. Technovation 26, 1147–1161. https://doi.org/10.1016/j.technovation.2005.11.006.
Vázquez-Bustelo, D., Avella, L., Fernández, E., 2007. Agility drivers, enablers and outcomes: empirical test of an integrated agile manufacturing model. Int. J. Oper. Prod. Manag. 27, 1303–1332. https://doi.org/10.1108/01443570710835633.
Veleva, V., Ellenbecker, M., 2001. Indicators of sustainable production: framework and methodology. J. Clean. Prod. https://doi.org/10.1016/S0959-6526(01)00010-5.
Vickers, I., James, P., Smallbone, D., Baldock, R., 2005. Understanding small firm responses to regulation: the case of workplace health and safety. Pol. Stud. 26, 149–169. https://doi.org/10.1080/01442870500127626.
Vokurka, R., Fliedner, G., 1997. Agility: competitive weapon of the 1990's and beyond. Prod. Inventory Manag. J. 38, 19–24.
Wackernagel, M., Rees, W., 1996. Our Ecological Footprint: Reducing Human Impact on the Earth. New Society Publishers, Gabriola Island.
Walker, H., Di Sisto, L., McBain, D., 2008. Drivers and barriers to environmental supply chain management practices: lessons from the public and private sectors. J. Purch. Supply Manag. 14, 69–85. https://doi.org/10.1016/j.pursup.2008.01.007.
Wang, J., Cao, D.B., 2008. Relationships between two approaches for planning manufacturing strategy: a strategic approach and a paradigmatic approach. Int. J. Prod. Econ. 115, 349–361. https://doi.org/10.1016/j.ijpe.2008.04.014.
Ward, P.T., Duray, R., 2000. Manufacturing strategy in context: environment, competitive strategy and manufacturing strategy. J. Oper. Manag. 18, 123–138. https://doi.org/10.1016/S0272-6963(99)00021-2.
Wells, P., Seitz, M., 2005. Business models and closed-loop supply chains: a typology. Supply Chain Manag. 10, 249–251. https://doi.org/10.1108/13598540510612712.
Westkämper, E., Alting, Arndt, 2000. Life cycle management and assessment: approaches and visions towards sustainable manufacturing. CIRP Ann 49, 501–526. https://doi.org/10.1016/S0007-8506(07)63453-2.
Wiendahl, H.P., ElMaraghy, H.A., Nyhuis, P., Zäh, M.F., Wiendahl, H.H., Duffie, N., Brieke, M., 2007. Changeable manufacturing - classification, design and operation. CIRP Ann. - Manuf. Technol. 56, 783–809. https://doi.org/10.1016/j.cirp.2007.10.003.
Williamson, D., Lynch-Wood, G., Ramsay, J., 2006. Drivers of environmental behaviour in manufacturing SMEs and the implications for CSR. J. Bus. Ethics 67, 317–330. https://doi.org/10.1007/s10551-006-9187-1.
Womack, J.P., Jones, D.T., 1997. Lean thinking—banish waste and create wealth in your corporation. J. Oper. Res. Soc. 48 https://doi.org/10.1057/palgrave.jors.2600967, 1148–1148.
Womack, J.P., Jones, D.T., Roos, D., 1990. The Machine that Changed the World: the Story of Lean Production. HarperCollins, New York.
Worley, J.M., Doolen, T.L., 2006. The role of communication and management support in a lean manufacturing implementation. Manag. Decis. 44, 228–245. https://doi.org/10.1108/00251740610650210.
Wu, L., Subramanian, N., Abdulrahman, M.D., Liu, C., hung, Lai K., Pawar, K.S., 2015. The impact of integrated practices of lean, green, and social management systems on firm sustainability performance-evidence from Chinese fashion auto-parts suppliers. Sustain. Times 7, 3838–3858. https://doi.org/10.3390/su7043838.
Yadav, G., Luthra, S., Huisingh, D., Mangla, S.K., Narkhede, B.E., Liu, Y., 2020. Development of a lean manufacturing framework to enhance its adoption within manufacturing companies in developing economies. J. Clean. Prod. https://doi.org/10.1016/j.jclepro.2019.118726.
Yalabik, B., Fairchild, R.J., 2011. Customer, regulatory, and competitive pressure as drivers of environmental innovation. Int. J. Prod. Econ. 131, 519–527. https://doi.org/10.1016/j.ijpe.2011.01.020.
Yang, M.G., Hong, P., Modi, S.B., 2011. Impact of lean manufacturing and environmental management on business performance: an empirical study of manufacturing firms. Int. J. Prod. Econ. 129, 251–261. https://doi.org/10.1016/j.ijpe.2010.10.017.
Yen, Y.X., Yen, S.Y., 2012. Top-management's role in adopting green purchasing standards in high-tech industrial firms. J. Bus. Res. 65, 951–959. https://doi.org/10.1016/j.jbusres.2011.05.002.
Yusuf, Y., Sarhadi, M., Gunasekaran, A., 1999. Agile manufacturing: the drivers, concepts and attributes. Int. J. Prod. Econ. 62, 33–43. https://doi.org/10.1016/S0925-5273(98)00219-9.
Yusof, S.M., Habidin, N.F., 2012. Relationship between lean six sigma, environmental management systems, and organizational performance in the malaysian automotive industry. Int. J. 13, 293–300. https://doi.org/10.1007/s12239.
Yusuf, Y.Y., Adeleye, E.O., 2002. A comparative study of lean and agile manufacturing with a related survey of current practices in the UK. Int. J. Prod. Res. 40, 4545–4562. https://doi.org/10.1080/00207540210157141.
Yusuf, Y.Y., Adeleye, E.O., Sivayoganathan, K., 2003. Volume flexibility: the agile manufacturing conundrum. Manag. Decis. 41, 613–624. https://doi.org/10.1108/00251740310495540.
Yusuf, Y.Y., Gunasekaran, A., Adeleye, E.O., Sivayoganathan, K., 2004. Agile supply chain capabilities: determinants of competitive objectives. Eur. J. Oper. Res. 159, 379–392. https://doi.org/10.1016/j.ejor.2003.08.022.
Zameer, H., Wang, Y., Yasmeen, H., 2020. Reinforcing green competitive advantage through green production, creativity and green brand image: implications for cleaner production in China. J. Clean. Prod. 247 https://doi.org/10.1016/j.jclepro.2019.119119.
Zarte, M., Pechmann, A., Nunes, I.L., 2019. Decision support systems for sustainable manufacturing surrounding the product and production life cycle – a literature review. J. Clean. Prod. 219, 336–349. https://doi.org/10.1016/j.jclepro.2019.02.092.
Zhang, D.Z., 2011. Towards theory building in agile manufacturing strategies - case studies of an agility taxonomy. Int. J. Prod. Econ. 131, 303–312. https://doi.org/10.1016/j.ijpe.2010.08.010.
Zhang, Z.D., Sharifi, H., 2007. Towards theory building in agile manufacturing strategy - a taxonomical approach. IEEE Trans. Eng. Manag. 54, 351–370. https://doi.org/10.1109/TEM.2007.893989.
Zhou, B., 2016. Lean principles, practices, and impacts: a study on small and medium-sized enterprises (SMEs). Ann. Oper. Res. 241, 457–474. https://doi.org/10.1007/s10479-012-1177-3.

Zhu, Q., Geng, Y., 2013. Drivers and barriers of extended supply chain practices for energy saving and emission reduction among Chinese manufacturers. J. Clean. Prod. 40, 6–12. https://doi.org/10.1016/j.jclepro.2010.09.017.

Zhu, Q., Geng, Y., Fujita, T., Hashimoto, S., 2010. Green supply chain management in leading manufacturers: case studies in Japanese large companies. Manag. Res. Rev. 33, 380–392. https://doi.org/10.1108/01409171011030471.

Zhu, Q., Geng, Y., Sarkis, J., Lai, K. hung, 2011. Evaluating green supply chain management among Chinese manufacturers from the ecological modernization perspective. Transp. Res. Part E Logist. Transp. Rev. 47, 808–821. https://doi.org/10.1016/j.tre.2010.09.013.

Zhu, Q., Sarkis, J., 2006. An inter-sectoral comparison of green supply chain management in China: drivers and practices. J. Clean. Prod. 14, 472–486. https://doi.org/10.1016/j.jclepro.2005.01.003.

Zhu, Q., Sarkis, J., 2004. Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises. J. Oper. Manag. 22, 265–289. https://doi.org/10.1016/j.jom.2004.01.005.

Zhu, Q., Sarkis, J., Geng, Y., 2005. Green supply chain management in China: pressures, practices and performance. Int. J. Oper. Prod. Manag. 25, 449–468. https://doi.org/10.1108/01443570510593148.

Zhu, Q., Sarkis, J., Lai, K. hung, 2007. Green supply chain management: pressures, practices and performance within the Chinese automobile industry. J. Clean. Prod. 15, 1041–1052. https://doi.org/10.1016/j.jclepro.2006.05.021.

Zsidisin, G.A., Siferd, S.P., 2001. Environmental purchasing: a framework for theory development. Eur. J. Purch. Supply Manag. 7, 61–73. https://doi.org/10.1016/S0969-7012(00)00007-1.

Zu, X., Fredendall, L.D., Douglas, T.J., 2008. The evolving theory of quality management: the role of Six Sigma. J. Oper. Manag. 26, 630–650. https://doi.org/10.1016/j.jom.2008.02.001.