

Integrating Sustainability in Project Management: Implications in Manufacturing Industry

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From project management perspective, the purport of the study is to examine how sustainability can be integrated into different areas including project management and manufacturing industry. By referring to knowledge and concepts established by previous academic contributions, how interdependencies between three above-mentioned realms can therefore be identified. The PRISMA methodology is used in this study to filter appropriate papers, which are found by the pre-determined combinations of keywords – the pertinent wordings relevant to this study (e.g. sustainable, triple bottom line, etc.) – for systematic literature review. The result of the study shows the correlation between three types of isomorphism pressure by which the social constructionism is shaped. Beside this, the normative pressure is the prevalent mean (i.e. standards, indices, indicators, etc.) to advance sustainability ideology nowadays. The statistics derived from selected papers accord with the noted context, showing that ISO standard is the widely accepted method for sustainable development. This reveals that either practitioners or organisations can effectively adopt sustainable practices by referring to such standardised norms with other measures mentioned in this study, such as lean thinking, methodologies for green supplier selection, project governance etc. Finally, it is concluded that as the component operated within organisations, the achievement of projects is directly affected by the environment in which it is managed – in brief the more substantial conducting environment where a project is undertaken, the more sustainably attainable outcomes can be derived from a project.

Keywords: Environmental sustainability, Social sustainability, Sustainability in Project Management, ISO, Sustainable development.

1. Introduction

There are natural resources which are limited and irreversible, most of which will be thoroughly depleted sooner or later. Resources used through human activities, such as manufacturing, further cause environmentally negative repercussions. Sih *et al.* (2011) argue that human activities can change most organisms in environments. The planet provides the habitat in which people can implement activities. Therefore, how to make use of overarching resources without causing environmental degradation (e.g. minimised damage to surroundings) has become the prominent subject and responsibility with which every person should be concerned. Elkington (1997) defines the widespread phrase, triple bottom line (TBL), including three pillars regarding sustainability (i.e. environment, economic, social); they also are called Triple-P (People, Planet, Profit). With regard to the social dimension, there are many aspects that need to be considered in different circumstances. According to McKenzie (2004, p.23), social sustainability is defined as "a positive condition within communities, and a process within communities that can achieve that condition". Besides this, the study also indicates several useful implications of social sustainability, including the equity in different aspects (e.g. education), or diversity, etc. The position of being a project manager at which the different extent of time, cost and human resource are determined based on the needs of every project.

Hence, it is imperative to embed the concept of sustainability into this realm to cover all three elements of the triple-bottom-line through different knowledge and measures. Moreover, when a project is proceeded in the manufacturing industry – the field that consumes a huge amount of resources for manufacturing products, which in turn can generate a lot of pollutants – which policies or practices (e.g. procurement) – and how – should be incorporated and adopted are indispensable nowadays to meet sustainable goals. Misopoulos *et al.* (2018) contend that the research is primarily focused on social and environmental facets of sustainability these days. Therefore, this study is aimed at examining the current research toward sustainability particularly in regard to these two noted dimensions in project management. According to Misopoulos *et al.* (2018), the study encapsulates elements overlapping between project management and manufacturing, such as project, and lean thinking. How those elements can lead to the notion of sustainability will be discussed in this study. Walker *et al.* (2012) affirm that there is growing attention paid to sustainable procurement. As a component of procurement management, the supplier selection process has become crucial as a result of several factors such as doing business in several countries, globalisation and farming-out (Bai and Sarkis, 2010). As noted, how to select suppliers sustainably will be discussed. From a governance perspective, Müller and Blomquist (2006) point out that programme and portfolio management is deemed as a partial governance structure within an organisation. Müller (2009, p.2) suggests that "governance provides a framework for ethical decision making and managerial action within an organisation that is based on transparency, accountability and defined roles". The measures and practices to achieve an organisations' aims can be monitored to ensure their consistency, which also facilitates efficiency (Müller, 2009).

2. Theoretical Background

2.1 The rationale of sustainability

Sustainability (i.e. sustainable development), is a subject to which increasing attention has been paid (Lélé, 1991) because of several underlying reasons; scarce and valuable natural resources are gradually being depleted; the ever-growing population imposes immoderate needs upon limited resources. Besides this, human behaviour is causing negative and irreversible repercussions – environmental pollution, over-utilization of resources, greenhouse gas emission, etc. – which in turn engenders more serious problems. As in the context noted above, for the sake of not just the contemporary, but also the hereafter, the responsibility of implementing sustainable development should be undertaken by every person. Likewise, WCED (1987, p.41) defines sustainability as "meeting the needs of the present without compromising the ability of future generations to meet theirs".

However, it is believed that there is no absolute definition given to sustainable development, indicating that individuals or organisations are likely to interpret the term – sustainable development – either based on their own interests or when they are operating under different circumstances (Kates *et al.*, 2005). The equivocal definition of the term (i.e. sustainable development) does not cause confusion or negative consequences. This characteristic of openness concerning adapting its definition in different situations, however, has exerted positive influences as both the words sustain and develop are embedded with inspirational implications (Kates *et al.*, 2005). In addition to this, Elkington (1997) coined the well-known phrase, triple bottom line (TBL), identifying the three dimensions (i.e. environment, economic, social), which are also known as Triple-P or 3PL (People, Planet, Profit). This triple-bottom-line concept has become the prototype for sustainable development by showing the intersections in the above Venn diagram, which are bearable, equitable, sustainable, and viable. Those overlaps are the domains with which organisations tend to comply not just to meet the

requirements of either customers or stakeholders, but also for themselves from a long-term perspective with respect to accountability (Eccles, 2011; Rogers, 2011).

As noted, business groups need to take into account more facets related to sustainability since standards of conforming to such concepts increases. That being said, corporations employing sustainable practices into their operational strategy can obtain more benefits and position themselves conspicuously in markets (Whittaker, 1999). Based on this, Savitz and Weber (2014) claim that the influences imposed by positive TBL lead to the enhancement of corporate value. Henriques and Richardson (2004, p.3) declare that "TBL agenda focuses corporations not just on the economic value that they add, but also on the environmental and social value that they add – or destroy"; they also contend that – rather than governments or non-governmental organisations (NGOs) – businesses will play an important role in promoting sustainable development. Based on the above mentioned rationale, business organisations can be classified into four sorts: locusts; companies that spoil the value of society and the environment, caterpillars; companies which have similar features as locusts, but which are distinguished by less widespread influence, butterflies; companies genuinely devoted to sustainable development with more or less connection to unsustainable actions, and honeybees; companies fully committed to sustainability ideology, also being paragons to their counterparts (Henriques and Richardson, 2004). To aid in transforming corporations from locusts to caterpillars, butterflies or even honeybees, the government's impetus or initiatives are imperative to materialising the desired outcomes (Brandoni and Polonara, 2012; Henriques and Richardson, 2004).

McGregor's (1960) theory X contends that people inherently dislike working. This can be referred to the Taylor's (2011) scientific management, claiming that workers' performance and duties needs to be explicitly defined (Drummond, 2000). Given this, it is assumed that there is a need to have a front-runner that is able to establish either guidelines or standards upon which organisations or individuals can act concerning sustainable development. Governments or international organisations can effectively promote specific movements by enacting acts or accords, such as the Kyoto protocol, Paris agreement, and United Nations Sustainable Development Goals. It is said that once a leading company starts applying specific practices in a specific market, their counterparts would tend to follow suit.

2.2 The indicator and assessment of sustainability

It is straightforward that the economic aspect of TBL, can be quantified by currency units. However, there is no generic metric for the other two –environmental and social – to be measured against (Slaper and Hall, 2011). Singh *et al.* (2009) suggest that useful tools such as sustainable development indicators or indexes are developed to improve the performance of firms or countries concerning the environment, society, economy, etc. The Dow Jones Sustainability Groups index (DJSGI) reviews sustainable development based on the information of Dow Jones Global Index (DJGI) is a prime example by which sustainability performance can be assessed. There are generic criteria compatible to evaluate all industries such as standards and practices which are extensively consented to; conversely, experts from specific industry sectors provide information to form criteria (e.g. the impetus based on the three pillars of the triple bottom line or political driving force) that galvanise achievements of sustainability in certain industry realms (Knoepfel, 2001). Besides this, SAM – the label registered by RobecoSAM – also provides assessment methodology to help and diagnose corporations' sustainability performance. Moreover, management certifications, such as ISO 9001, ISO 14001, etc., can be regarded as the way by which project managers consider sustainable development factors to reach project success (Martínez-Perales *et al.*, 2018).

2.3 Sustainability in project management

PMBOK® Guide (2017, p.4) defines the project as a "temporary endeavour undertaken to create unique product, service, or result". As the noted characteristic, a project itself is transient, suggesting that the conventional concept – including cost, time and quality – is primarily considered (Silvius and Schipper, 2015). While, when considering sustainability in project management, traditional short-term concerns are not applicable. Instead, the pillars of the triple bottom line should also be pondered (Silvius *et al.*, 2017). The APM (2006 cited in Salama 2018) affirms that sustainable management practices implemented throughout levels of projects by project and programme managers enable them to make contributions. Nonetheless, sustainable project management is still regarded as being in its germination stage (Silvius, 2017).

There are numerous valuable implications delivered from Sabini *et al.* (2019) upon implementing sustainable project management (SPM): first, the implementation of SPM is enacted through phases – initiation, planning, execution and closure – within a project; secondly, SPM influences imposed are collective and hierarchical, from individuals to the whole project environment; the incentive of carrying out SPM is based on the orientation of an organisations' benefits. Deland (2009) in response to the question of what SPM is, determines that it regards minimising the resources which are used throughout a project from initiation to closure by project managers and their teams. As an important step in determining what, when, how, and who will carry out essential actions in advance, the planning stage in a project is the domain in which it is determined whether sustainability can be integrated (Martin and Miller 1982).

2.4 Sustainable procurement

Lysons and Farrington (2012) interpret purchasing as the acquisition of suitable requirements is accomplished timely through the procurement process from trustworthy resources for the likely cheapest cost. As noted, it can be said that procurement is important leverage that can be used to create advantages for organisations. Project procurement management is clarified by PMBOK® Guide (2017, p.459) as "the process necessary to purchase or acquire products, services, or results needed from outside the project team"; there are also three primary activities, which are to plan procurement management, implement procurement and control procurement, executed in the procurement process. Based on Kerzner's study (2017), the strategy used in corporate procurement is distinguished from project procurement due to constraints, the explicit customers' demands, and the attainability of crucial resources. Besides this, tactics used at the project level are more likely to apply single source procurement rather than procuring resources in a small amount from multiple entitled suppliers, which is favoured by corporates. Sanghera (2010) outlines what parts are needed in finishing procurement management, such as the make-or-buy decisions, and the selection of qualified suppliers in conducting of procurement process.

The emerging trend of the outsourcing strategy engenders confusion as to whether organisations should make or buy specific products, services, or results (Cáñez *et al.*, 2000; Leiblein *et al.*, 2002). Through encapsulating the noted context above discussing make-or-buy decision, the final and pivotal aspect; supplier selection in procurement management is manifested. Outsourcing, enabling organisations to maintain and develop their core competitive edge, has become a trend through which suppliers performing operations or services previously managed in-house has increased (Cheraghi *et al.*, 2004). Thus, suppliers play a significant role either in the performance of a firm or project (Carr and Pearson, 1999;

Liu *et al.*, 2015). There are assorted types of projects created and implemented for different purposes and objectives, suggesting that the priorities and criteria in terms of selecting appropriate suppliers are miscellaneous and that organisations should take their needs and interests into account (De Araújo *et al.*, 2017). As per the definition given by Walker and Brammer (2009, p.128) with respect to sustainable procurement; "consistent with the principles of sustainable development, such as ensuring a strong, healthy and just society, living within environmental limits, and promoting good governance". From the triple-bottom-line perspective, Hollos *et al.* (2012) reveal the importance and benefits of co-operating with sustainable suppliers, and in doing so, the positive influence upon green and social practices can be observed. Govindan *et al.* (2015), considering the environmental aspect, compile and rank criteria used to select suppliers; there are numerous tools and standards, such as environmental management systems, and ISO 14001 mentioned for supplier selection processes. With respect to the social aspect in procurement, the pressure exerted by stakeholders (e.g. customers, government, press, etc.) is the source of momentum that social sustainability is incorporated in the process of supplier selection (Anisul Huq *et al.*, 2014; Ehr Gott *et al.*, 2011). Carter (2005) manifests that despite the fact that corporations with high extent of PSR (i.e. purchasing social responsibility) have no direct influence upon supplier performance, PSR has a positive effect on organisational learning, which acts as an intermediary between PSR and supplier performance. In short, considering social sustainability in procurement can create advantages such as enhancing the reputation of organisations (Ehr Gott *et al.*, 2011).

2.5 Sustainability in manufacturing: project management and procurement perspective

Manufacturing is also one of the primary causes, leading to the depletion of natural resources through either direct or indirect manners; this induces negative consequences on the environment, endangers the well-being of human beings and wildlife, and imperils the ecosystem; social conflicts, therefore, are eventually caused (Stark *et al.*, 2017). Thus, research toward sustainability from a manufacturing perspective has been increased (Stark *et al.*, 2017).

MacAdam (2009) claims that lean concepts can be employed in project management despite the fact that such concepts are always connected to manufacturing field. The lean project delivery system (LPDS) first introduced by Ballard (2000) embodies the application of lean practices in project management. Ballard and Howell (2003) contend that projects are transient production systems which are developed to deliver product in maximised value with minimised waste; such projects are called lean projects.

2.6 Lean procurement

Lean management, stemming from the system of Japanese automobile company, is the prime paradigm in the manufacturing sector. There are notions and practices related to lean procurement, which are mentioned by a few studies (Bhasin and Burcher, 2006; Kaynak, 2005). Based on this, the implication regarding lean procurement is given by Wilson and Roy (2009) as buying things in small numbers from a few suppliers in a recurrent frequency. As opposed to conventional procurement only focusing on the availability and price in terms of supplier selection (Lysons and Farrington, 2012), Ellram (1995) contends that there are many elements that need to be considered to establish alliance between buyers and suppliers. The lean concept is well-adopted by manufacturing industry (Pepper and Spedding, 2010), and Karlsson and Ahlstrom (1997) suppose that the premise of lean procurement is lean manufacturing, manifesting that they are highly correlated with each other. Finally, according to Martínez-Jurado and Moyano-Fuentes (2014), lean principles can be linked to sustainability aspects, such as minimising waste. In short, the extent to which lean thinking is applied has a direct influence

upon the development of sustainability.

3. Methodology

3.1 Overview

This study discusses sustainability in different sectors, the aim of which is to develop and understand the correlation among sustainability, project management, project procurement management, and manufacturing industry; and what interdependencies can be identified and explored from those subjects noted above. The purpose of the study is two-fold; first, to investigate how well sustainability is – environmental and social – implemented in the manufacturing industry and the implications or roles of project management in this industry and second, how the concept of sustainability can be integrated with portfolio, programme and project (PPP) and the process of project planning.

3.2 Data-Collection Method

Different search scenarios with various combinations of keywords were carried out on three database platforms - Scopus, Web of Science and a University's Library system powered by EBSCO (table 1).

Database	Syntax
EBSCO	TITLE("green" OR "environm*" OR "soci* sust*" OR "sust* practice*" OR "Sustainab*" OR "triple bottom line" OR "TBL" OR "Sustainable development" OR "social" OR "societ*" OR "3BL") AND ("project management")

Table 1. Search criteria

The extracted articles were de-duplicated and then further refined according to specific inclusion/exclusion criteria (table 2).

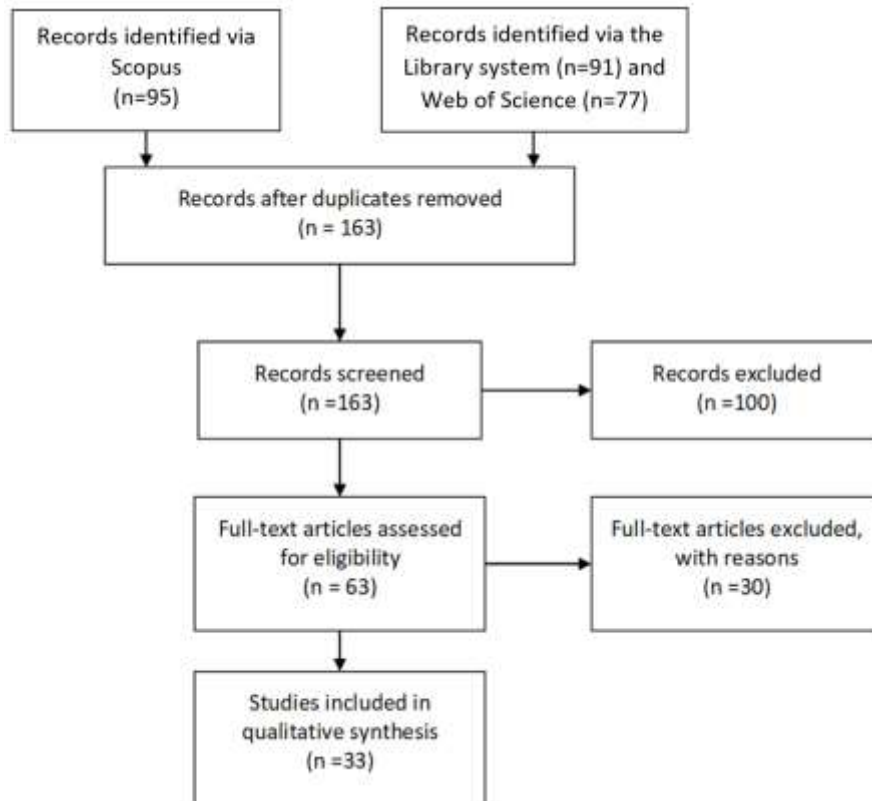
Criterion	Included	Excluded
Timeframe	2009-2019	Prior to 2009
Language	English	Non-English
Domain	Manufacturing (e.g. construction, infrastructure)	Non-manufacturing, (e.g. IT, energy, education, food industry, etc.) Non-Project management area
Triple-bottom line/Sustainability	Social and Environmental	Economic
The type of source	Peer-reviewed journal article	Non-journal article

Table 2. Inclusion and exclusion criteria

Moher *et al.* (2015, p.3) suggest that "a systematic review attempts to collate all relevant evidence that fits pre-specified eligibility criteria to answer a specific research question". Given this, the author is able to use a systematic literature review to not only investigate the research progress made in a specific domain, but also address research questions posed in the study.

PRISMA is a methodology – providing filtering tools – utilised to finalise a determined number of articles in terms of being analysed in a systematic literature review (figure 1). After assessing the title and abstract of 163 articles, the overall number of articles can be reduced to 63 pieces relative to the criteria mentioned above. Moreover, in order to know the status quo and extent to which sustainability is integrated within the project management field, articles mentioning manufacturing or manufacturing-related sectors were incorporated for systematic literature review.

Figure 1. The PRISMA methodology

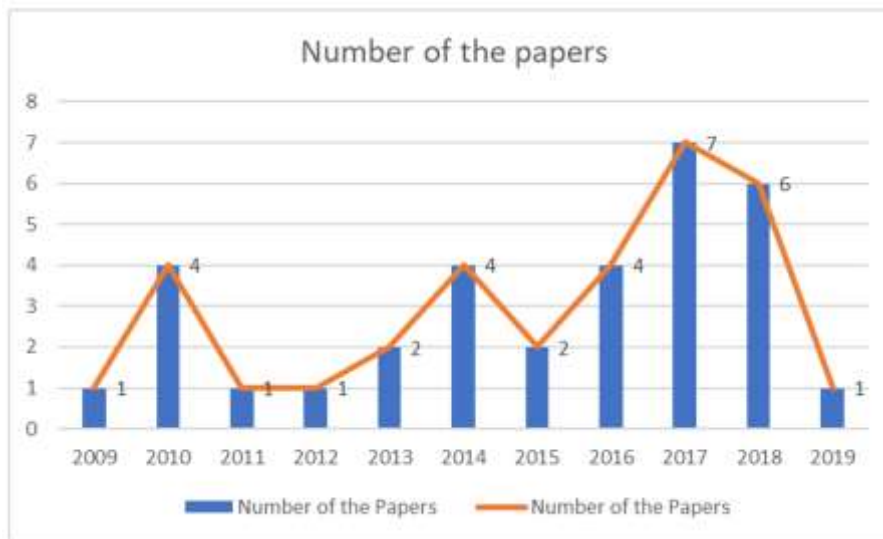


4. Findings

According to the information derived from 33 papers and presented in taxonomy tables, it is feasible to analyse and compile those materials. There are three patterns shown below through which the findings are demonstrated.

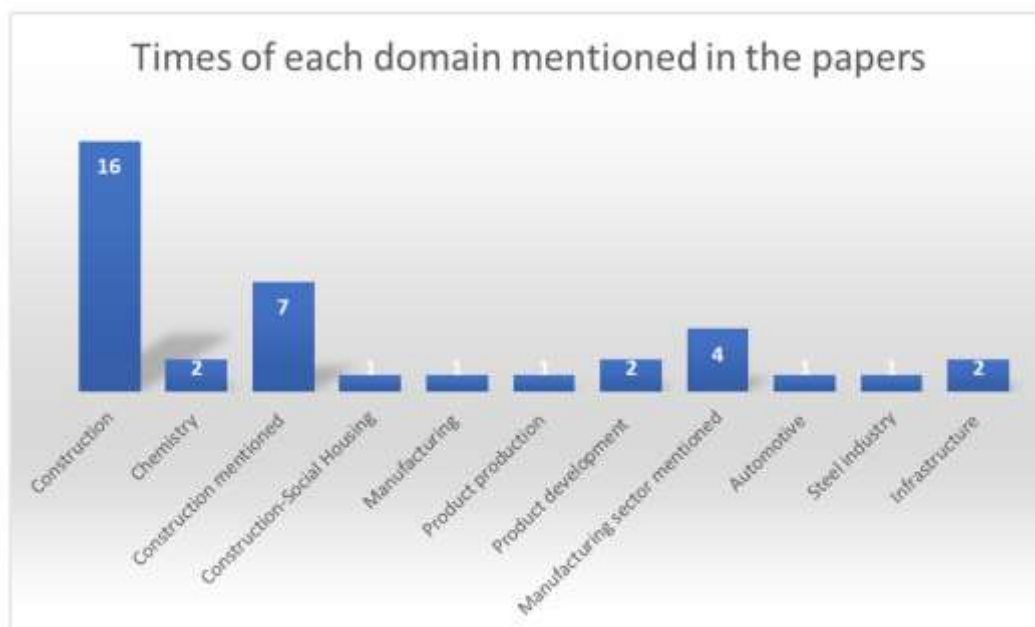
According to figure 2 and the curve showing the quantity of individual papers adopted for systematic literature review from each year, there is no noticeable trend (i.e. it is fluctuating); while there were seven papers suitable to be employed from 2017 followed by six pieces in 2018. The total number of articles issued in both years – 2017 and 2018 — are equal to the totality of the articles from 2012 to 2016. Given this, it can be said that the concern toward sustainability is gradually mounting. Nonetheless, the number of appropriate papers being referred to dramatically decreased to 1 piece in 2019. This is might be a result that the time at which the articles were collected was in June (i.e. there are still six months remaining and unaccounted for in the 2019 total).

Figure 2. Number of articles adopted each year



With regard to sustainability in different sectors, there are papers focusing on the construction aspect with 16 times mentioned; this number is significantly higher than that of other sectors in papers, such as chemistry, manufacturing, etc. Figure 3 also shows that when discussing industry is not the main theme in specific papers, the number of times the construction realm (e.g. green construction, etc.) is mentioned more in the context than other aspects. In summary, construction is the domain within which research is currently most focused within.

Figure 3. Fields incorporated in manufacturing industry

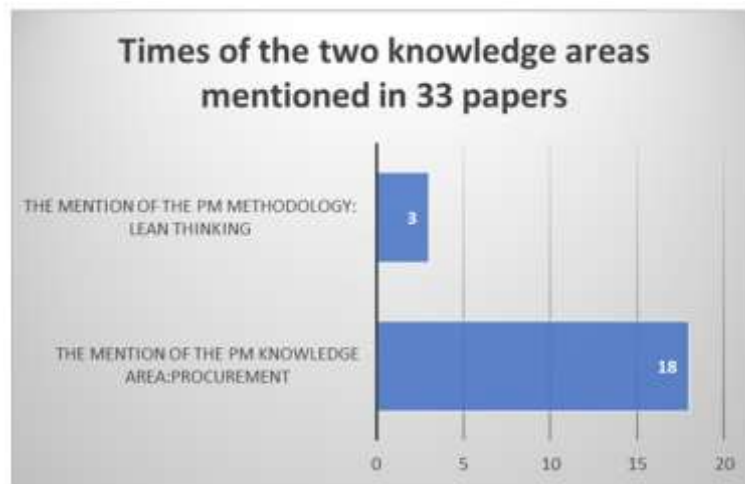


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green construction, etc.) is mentioned more in the context than other aspects. In summary, construction is the domain within which research is currently most focused within.

When considering project management methodology in lean thinking and knowledge areas related to procurement, figure 4 illustrates how many instances each element is mentioned within the 33 papers assessed. It is straight-forward to ascertain that procurement in the PM knowledge area are mentioned six times as often as lean thinking in the PM methodology. In Klotz and Homan's study (2009), lean is noted as an element in the framework that can contribute to the development of specific measures to map delivery processes. Likewise, the lean concept is hardly mentioned – that is regarded as one of the components required to

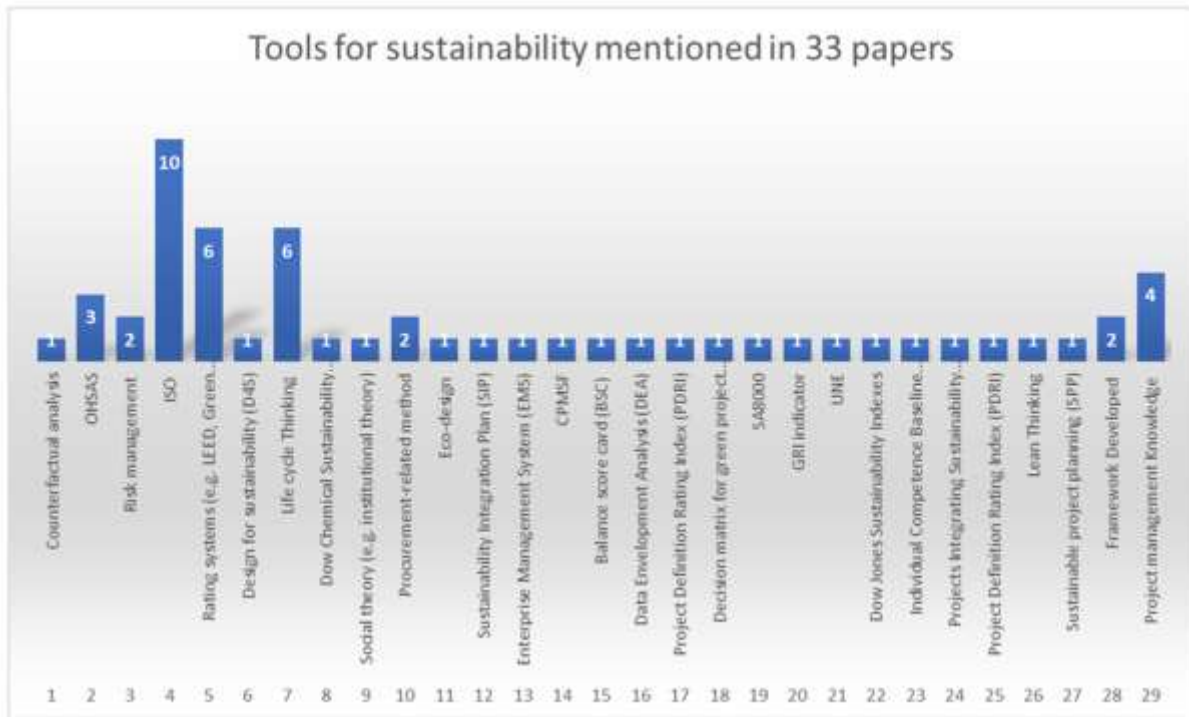
Figure 4. Occurrences of the PM-related methodology and knowledge areas



accomplish green construction management and coordination (GCMC) processes (Al-Tekreeti and Beheiry, 2016). It is thus that lean manufacturing, as a project management methodology, has been discussed comparatively in-depth in the research, which is issued by Misopoulos *et al.* (2018). In spite of that there are far more papers mentioning procurement, most of them only scratch the surface or exclude it from the context rather than having exhaustively discussed it. There are solely 3 out of 18 papers in which the procurement is mentioned specifically – that is either to depict the weightiness of the alliance contract in sustainable project management or in regard to procurement as a crucial element which would exert influence on sustainable projects or combine whole life project management measures with private finance initiative (PFI) projects to facilitate a higher extent of sustainability (Kivilä *et al.*, 2017; Klotz and Horman, 2009; Wang *et al.*, 2014).

Based on figure 5, there are 29 measures identified from the 33 papers, adopted and discussed for sustainability in different sectors of project management. It is evident that the International Standardisation Organisation (ISO) is the leverage mentioned and incorporated the most by which sustainability can be effectively promoted. The second most adopted mechanisms are life cycle assessment (LCA), and numerous rating systems (e.g. LEED, Green Mark, etc.), which have been widely introduced within the construction field. They both appear six times in the papers. The following two measures are OHSAS and management knowledge mentioned three and four times respectively. The former is the standard or deemed as safety management system (SMS), used to ensure the safety of working environment, while the latter comprises the skills such as programmes and portfolios; (Pillay, 2018).

Figure 5. Types of tools employed for sustainability



Aside from those devised frameworks or mechanisms for reviewing or assessing the extent of sustainability in the remaining tools listed in figure 5, it is also worth noting that there are a few established metrics that organisations can work against, including SA 8000, GRI indicator, and the Dow Jones sustainability indexes. Based on the noted findings above, it is concluded that such above-mentioned standards, indicators, and indexes are the major leverage utilised to thrust the movement of sustainability these days. It can also be said that the normative pressure is the principal source of impetus to advance sustainability. Furthermore, it is surprising that as an emerging aspect in which researchers are interested (Misopoulos *et al.*, 2018), there are as few as three selected references that bring up the lean concept. To summarise, the research questions aforementioned in the methodology section can be addressed after rationalising the referred findings above; this suggests that several dimensions will be discussed, encompassing institutional theory, overarching standards, lean thinking, and sustainable supplier selection.

5. Discussion

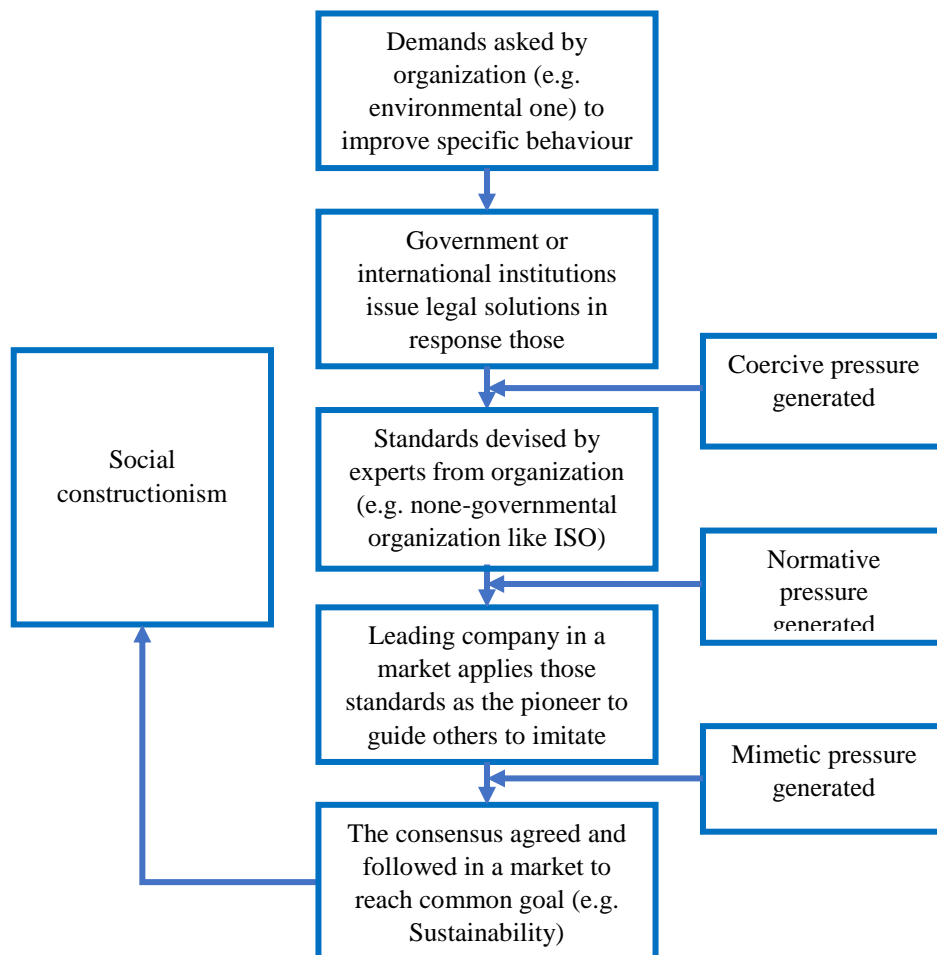
5.1 Institutional theory

To comment with regard to the requirements of sustainability, the institutional theory consisting of three isomorphic pressures – normative, mimetic and coercive – is the essentiality that organisations can act upon (Esfahbodi *et al.*, 2017). According to Hanim Mohamad Zailani *et al.* (2012), regulatory authorities and government institutions, in order to respond to the demands made by environmental organisations, would enact laws, and legal standards/rules; such deeds are particularly effective toward manufacturers, similarly, Othman *et al.* (2011) claim the positive outcomes that corporate social responsibility (CSR) reputation is enhanced by regulations. However, Jennings and Zandbergen (1995) contend that from an ecological perspective that the higher the extent to which coercive pressure is imposed, then the original purpose of implementing practices and activities would more likely be diverted at the organisational level. Given this, the prevalence and dissemination of practices should rely upon

the potency of normative and mimetic isomorphism. Haveman (1993) declares that a successful or a more profitable firm in a market would become an iconic figure and that its actions would be emulated by other corporations within the same market, as profitability is easily and equivalently regarded as success in profit-oriented environments. In light of the above-mentioned context, the relational graph among three types of isomorphism and their implications to organisations can be developed and illustrated below (figure 6).

In conclusion, the three types of pressure comprising institutional theory are the factors that embody the theory called social constructionism. Burr (2015, p.4-5) maintains that "knowledge is sustained by social processes", and knowledge binding with social action can contribute to constructions of the world. By reflecting upon this point of view, institutional theory enables organisations or individuals within organisations to follow codes of conduct either by legal demands from official authorities, or by the standards determined by groups of specialists from

Figure 6. The interrelation between the three types of isomorphism



different fields, or by being subjected to the peers' influence within a market. For instance, when considering sustainability issues in a project, such as selecting sustainable suppliers and

which criteria should be incorporated in order to meet sustainability goals, the pre-established norms and knowledge can aid an entire sector in reaching common values.

5.2 Implementation of sustainability in manufacturing and project management

5.2.1 Standards

According to the noted findings, there are standards and mechanisms – ISO, OHSAS, SAI, UNE, GRI indicators, and the Dow Jones Sustainability Indexes – employed for advancing sustainability. These items are adapted to different industries rather than the measures of rating systems, including the Green Mark and LEED, which are primarily applied to the construction industry. Therefore, how these standards promote sustainability particularly in environmental and social aspects will be discussed except those which are construction-orientated. The table below presents every standard discovered from the selected papers for systematic literature review.

Sustainability Scope	ISO	OHS	SAI	UNE
Social	ISO 26000; ISO 9001	OHSAS 18000; OHSAS 18001	SA 8000	UNE 166002
Environmental	ISO 21929; ISO 14040; ISO 14044; ISO 14062; ISO 14000; ISO 14001; ISO 50001; ISO 14006; ISO 26000	*	*	*
Other	ISO 21500; ISO 21505	*	*	*

Table 3. Standards and sustainability dimension covered based on Martinez-Perales *et al.* (2018)

Considering the social aspect, there are six social-related standards found within table 3. The WBCSD (1999, p.3) has defined social responsibility (SR) as "the continuing commitment by business to behave ethically and contribute to economic development while improving the quality of life of the workforce and their families as well as that of the local community and society at large". Through using this definition as a starting point, the core value of each standard will be simply depicted as follows: ISO (2018) issues the guidance describing what ISO 26000 is. It is the standard aimed at achieving sustainable development through looking at seven kernel dimensions (i.e. "human rights, labour practices, the environment, fair operating practices, consumer issues, community involvement and development") (ISO, 2018 p.9). It also stresses the importance concerning relationships with stakeholders; ISO 9001 is a quality management system composed of seven principles (i.e. "customer focus, leadership, engagement of people, process approach, improvement, evidence-based decision making, relationship management") to make organisations outstanding and improve their performance (ISO, 2015 p.2-14). The OHSAS 18000 series focuses on assisting organisations to amend the safety of working environments, which prevents employees from befalling hazards (BSI, n.d.); by referring to the International Labour Organisation (ILO), and other international labour laws, SA 8000 is the standard applicable to protect work forces within organisations (SAI, 2014); UNE 166002 is the innovation (R&D&I) management system used to aid any activities which are related to the R&D&I aspects, such as resource conservation through the supervising of R&D&I sectors (Mir and Casadesús, 2011). There are benefits of being certificated with these management system standards (MSSs). According to (BSI, n.d.), business performance is reformed by adopting OHSAS 18001 such as the higher extent of engagement of personnel because plain processes are offered to employees to act upon, which in turn create a much safer

working environment. The creation of the SA 8000 is based on the convention of human rights of the UN and other international organisations' norms, thus making inclusivity materialise (Mueller *et al.*, 2009). Orzes *et al.* (2017) further indicate the benefits for which organisations might implement SA 8000; firms can positively enhance their outputs produced by labour due to the employees' satisfaction and devotedness; sales performance is also positively affected since the companies with such certification display an image of dedication to corporate social responsibility (CSR) to customers. With respect to the ISO 9001, Tari *et al.* (2012) declared its benefits by conducting a literature review; the advantages which can be acquired through being certificated with ISO 9001 are a well perceived image from customer's viewpoints, the enhancement of efficiency by clarifying duties, etc. The principal purpose of obtaining UNE 166002 is to facilitate R&D&I activities and projects (Mir and Casadesús, 2011) and to develop firms' abilities to innovate (Garechana *et al.*, 2017); the manner through which resources can be optimised by improved measures of documentation is mentioned in the former study; the latter, conversely, implies that the CSR can be attributed to resource efficiency – that is the more innovative firms are, the more positively they are viewed by society. Through this, a better relationship with society is attainable; from a stakeholder perspective, whether firms employ ISO 26000 or not is affected by the stress imposed by stakeholders such as, wider industry, government and customers; for instance, the high transparency required in a specific sector may make the application of ISO 26000 compulsory to uphold the reputation as a whole (Castka and Balzarova, 2008). In short, in order to manage a good relationship with stakeholders, certain certification is necessary for organisations to possess.

According to the definition of the ISO 14000 family administered by the International Organisation for Standardisation, it is a standard which "provides practical tools for companies and organisations of all kinds looking to manage their environmental responsibilities" (ISO, n.d.). Based on this foothold, the other standards affiliated to the ISO 14000 family for specific needs are created as follows. ISO (2015) describes ISO 14001 as the framework which enables organisations to "protect the environment and respond to changing environmental conditions in balance with socio-economic needs". To boost sustainable development, ISO 14001 has become the prevalent measure by which firms seek to accomplish so (MacDonald, 2005). Link and Naveh (2006) claim that there is positive correlation between adopting ISO 14001 and environmental performance by which the personnel discretion is influenced via such standardisation. Raines (2002) reveals that the reduction of waste, the optimisation of energy, and resource savings by implementing ISO 14001. From the manufacturing point of view, the manufacturing firms based in Malaysia contend that improving a firm's image contributes the most in terms of results from implementing ISO 14001 (Abdullah and Fuong, 2010). However, there are the results of studies showing that the benefits ISO 14001 can engender are limited (Jiang and Bansal, 2003; Zobel, 2013). In light of this, Morrow and Rondinelli (2002) affirm that such environmental management systems are used as the instrument, whereas it has its influence; for example, facilitating the integration with other management systems, such as OHSAS, and ISO 9001. To derive greater benefits, Bernardo *et al.* (2015) argue that management systems should be integrated rather than administering them respectively. Hence, it is believed that companies keen to be perceived as green/sustainable organisations need to acquire the overarching MSSs. McKane *et al.* (2009) reflect the noted context that the specific MSS can be a catalyst for introducing other standards – that is ISO 50001; aimed at aiding organisations in establishing "the systems and processes necessary to continually improve energy performance, including energy efficiency, energy use and energy consumption" (ISO, 2018). McKane *et al.* (2009) indicate that there are approximately two thirds of businesses holding certification for ISO 90001/14001 which also already have energy policies. The scarcity of energy sources and their ever-mounting prices arouse the awareness of energy

management (Chiu *et al.*, 2012). This concern is particularly valued in manufacturing industry in which different methodologies and concepts are developed to boost the usage of energy in studies (Chiu *et al.*, 2012; Gopalakrishnan *et al.*, 2014; Thiede *et al.*, 2013). Although the primary incentive for which organisations may conduct energy management systems (EMS) is cost saving, there are other benefits attributed to doing so. For instance, with climate change causing numerous natural calamities – floods, droughts, etc. – which can be prevented by using EMS effectively (Fiedler and Mircea, 2012). The other standards mentioned, such as ISO 21929 discussing sustainability in building construction will be excluded from the discussion. Aside from this, ISO 14040 and 14044 for life cycle assessment, ISO 14062 for product design and development, ISO 14006 for eco-design, and ISO 21500 and 21505 regarding project, programme and portfolio management are feasible for utilisation as a starting point for exploring how sustainability can be achieved.

5.2.2 GRI indicator and Dow Jones sustainability indices

GRI has been an advocate in sustainability reporting since 1997, providing 70 indicators that businesses can inform the influence related to sustainability dimensions, including climate change, human rights, etc. The GRI indicator is an enabler with which decisions made at multiple levels of hierarchies within organisations can be assessed and traced (Joung *et al.*, 2012). The Dow Jones Sustainability indexes review top 10 percent of firms in the Dow Jones Global Total Stock Market Index in terms of their sustainability behaviour by assessing against 12 criteria that involve the three pillars of sustainability (Dow Jones cited in Feng *et al.*, 2010). Apart from these two above-mentioned indicator and index, there are numerous similar measures existing for sustainability. The Economist (2002) indicates that for sustainability in manufacturing, the criticalities are setting the scope of sustainability and the systematic definition of plain boundaries, with which in turn metrics can be established. By classifying a different set of indicators into five suitable brackets (i.e. environmental stewardship, economic growth, etc.) and sub-brackets, the development of a categorisation of sustainability indicators is conducted by the National Institute of Standards and Technology (NIST). Joung *et al.* (2012) further develop the process for assessing sustainability; manufacturers, therefore, are able to assess sustainability by the evaluation framework along with 212 indicators (SMIR, 2011).

From the project management point of view, Martínez-Perales *et al.* (2018) maintain that the outcome of projects depends upon environments in which they are conducted. The standards mentioned in this section are managed at an organisation level. This suggests that the more certification acquired by organisations, the greater the extent to which the conducting environment becomes more robust and facilitates the implementation of sustainable projects. In other words, the more projects which are satisfactorily completed, the more organisations become remarkable. To summarise, there is an evident interrelationship between organisational performance and project management.

5.3 Supplier assessment

5.3.1 Supplier selection: Standard and Lean thinking

ISO (2017, p.2) launched the standard ISO 20400 regarding sustainable procurement, which is defined as "the process of making purchasing decisions that meet an organisation's needs for goods and services in a way that benefits not only the organisation but society as a whole, while minimising its impact on the environment". This standard also facilitates the suppliers and stakeholders to act sustainably. Moreover, the standard also mentions that ISO 26000 accounts for the social responsibility component in ISO 20400 in terms of human rights and labour

aspects. This once more reflects the context mentioned early that organisations need to be certificated with one more standard to become comprehensively sustainable. The supplier selection is a vital process within the manufacturing industry (González and Quesada, 2004). Given this, how can this process be implemented sustainably at the project management level? Curkovic and Sroufe (2011) discuss how environmental management system (EMS) can promote sustainability within a supply chain, supposing that the standard registration can be used as leverage to influence suppliers in the supply chain; for instance, demanding suppliers be certified with specific standards; or otherwise resulting in the termination of contracts. There are studies mentioning the feasibility of integrating ISO with the supplier selection process (Chen, 2005; Motwani *et al.*, 1999; Zhu and Geng, 2001). At the project level, it is a mechanism providing temporary endeavours (PMBOK® Guide, 2017), based on this feature, it can be assumed that the contribution of each project generated to organisations will be limited; a projects' goal is essentially aligned with an organisational orientation strategically; the project is highly likely to be conducted under the same environment with a certain extent of constraints such as the budget and time. According to the noted content, it is believed that it would be effective to implement specific tasks to complete projects by following an organisation's predetermined or planned guidelines. As a constituent subordinate to procurement, the process of supplier selection can be operated within the organisational framework. The obtainment of standard certification is at an organisational level, and the result of projects hinges on the environment in which they are undertaken (Martínez-Perales *et al.*, 2018). Likewise, Gray (2001) argues that a successful project can result from the specific organisational environment – in brief, MSS is applicable to supplier selection.

From the project management perspective, the two inputs – enterprise environmental factors, and organisational process assets – are two factors that might influence supplier selection by using MSS. According to the definition of two factors referring from PMBOK® Guide (2017), the definition of enterprise environment factors (EEFs) is the input majorly used in the project planning phase; the situations that affect, restrict or lead the project either internally or externally. Both internal and external elements that might influence supplier selection are provided in the PMBOK® Guide (2017).

Conversely, organisational process assets (OPAs) are factors that can also sway the management of a project comprising purchasing policies/standards, organisational principles and criteria for projects, pre-qualified suppliers list, etc. (PMBOK® Guide, 2017).

Cagliano *et al.* (2004) allude that there is significant influence that leanness imposes upon manufacturing performance. Moreover, to successfully conduct lean production as manufacturers, the aid given from suppliers is an imperative component (Keller *et al.*, 1991). In order to realise lean supply, Birgün Barla (2003) contends a few points that need to be attained, including establishing long-term relationships with suppliers, early supplier involvement for the development of new products, the reformation of the information exchange with suppliers, utilising suppliers' specialised knowledge to lower product cost and to amend manufacturability, and the establishment of the long-term customer-buyer devotedness. By examining practices from four categories (i.e. production, distribution, transportation, customer relationship), suppliers regarded as lean have better performance than those deemed as non-lean (Wu, 2003). In short, this study suggests that the integration of JIT know-how with other practices is required, which are likely to be used as the criteria for selecting potential suppliers. Ho *et al.* (2010) list the most three common measures for selecting suppliers, including quality, delivery, and price/cost. Based on their work, Abdollah *et al.* (2015) create the framework pertaining lean aspects (i.e. cost, quality, delivery) for supplier selection.

In short, lean measures in manufacturing is the technique that organisations seek to employ to maintain their competitiveness (Abdulmalek and Rajgopal, 2007). The above context presents the correlation between supplier selection and lean concepts.

5.3.2 *The approach for green supplier selection*

Multi-criteria decision making approaches are the means with which supplier selection can be affected. Ho *et al.* (2010) compiled the most common measures employed to assess and choose suppliers. The result shows that the DEA is the most popular of the individual approaches; there are others, such as mathematical programming, AHP, CBR, ANP, etc. However, the AHP method is comparatively prevalent in terms of an integrated approach. When it comes to green supplier evaluation and selection, Govindan *et al.* (2015) conclude that AHP – encompassing fuzzy AHP, FEHP – is the individual methodology approach widely adopted, which is followed by ANP and mathematical programming; there are only eight papers, on the other hand, utilising integrated measures. Considering both studies together, it is believed that AHP is relatively well-accepted in supplier evaluation and selection. AHP having been developed by Saaty (1980), and Ho (2008) points out that the analytic hierarchy process (AHP) is broadly adopted because it is easy and flexible to use. To conclude, this section provides some methods which enable capitalisation upon supplier selection from a multi-criteria decision making approach perspective.

5.4 Project Management: ISO 21500 and Portfolios, Programme and Projects

ISO (2012) issues the standards (i.e. ISO 21500) concerning the principle in terms of variables, such as the processes of project management, which can impose influence upon the result of projects. However, Silvius (2015) affirms that sustainability is not persuasively taken into account in this standard. Based on 21500, Carboni *et al.* (2013) combine sustainability into the process of project management. Thereafter, the other standard (i.e. ISO 21505) issued by ISO regarding project, programme and portfolio management in which sustainability is specifically involved (Silvius, 2017) – that is the "sustainable results, benefits and enhanced opportunities" are more likely to be attained (ISO, 2017). In this section, the discussion will focus on ISO 21500 and its related study (e.g. PRiSM) and ISO 21505 with respect to the project planning. Sanghera (2010) suggests that a series approach – ISO, Six Sigma, etc. – pertaining to quality can be harmoniously integrated with quality management; planning quality generating components (e.g. quality management plans, quality metrics, quality checklists) is the pivotal process which can further generate the processes including quality assurance and quality control. Given this, the standards intrinsically characteristic of quality, involving ISO 14001, 9001, 50001, and 26000, are the important inputs for planning quality. This ensures the deliverables of projects meet quality requirements, which in turn can avoid dispensable cost incurred for reworking (Carboni *et al.*, 2013).

ISO (2017) depicts that projects, programmes and portfolios can be governed by principles and contexts which are provided by the ISO 21505 document. Serrano *et al.* (2017) argue that there are six underlying guidelines in ISO 21505 by which the governance structure for PPP can be created. One of the guidelines is ensuring ethics and sustainability. Project governance is "the use of systems, structures of authority, and processes to allocate resources and coordinate or control activity in a project" (Pinto, 2014 p. 383). Müller *et al.* (2015) put forward the types of project governance including the governance of separate projects and the governance of a program or portfolio of projects. The Project Management Institute (PMI) (2016) has published a practice guide discussing the governance of portfolios, programmes and projects; the following discussion will be based on this publication and focusing on the governance of projects.

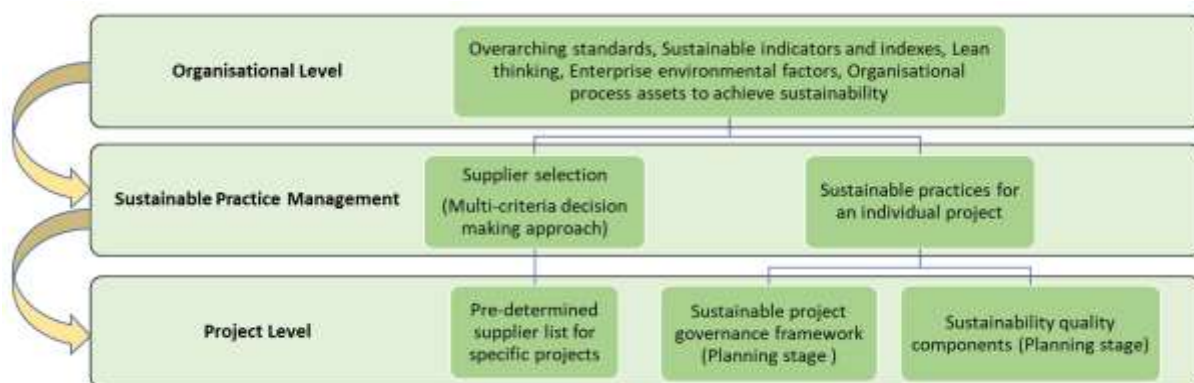
At the project level, the governance implemented is for deliverables such as either a product, service or result to align with organisational strategies and management targets. There are six factors – "project sponsor, governing bodies, current governance policies and structures, governance business needs and goals and project management methodology" – working as the inputs to finish the four steps (i.e. assess, plan, implement, improve) project governance framework within a specific project life cycle (PMI, 2016 p.76).

Joslin and Müller (2015), based on Turner’s study (2006), point out that the individuals’ appreciation towards project management is affected by project governance due to the framework given by which projects are established, managed, and reported. Müller *et al.* (2014) indicate that there are numerous approaches for project governance, the guide for project governance delivered by PMI (2016) introduces some general components in this aspect. As mentioned, the compatibility of quality management enables standards, norms or other means pertaining to sustainability to be combined with it (Sanghera, 2010). Likewise, the policies and criteria regarding sustainability must also be implanted at the planning step, facilitating the generation of the project management governance plan, this ensures the following practices are conducted against instituted metrics for project governance.

5.5 Framework for sustainable project in manufacturing industry

By synthesising assorted studies mentioned above for facilitating sustainability, the framework regarding how project can be undertaken sustainably in manufacturing field is shown in figure 7 below. There are several essentials – assorted standards (e.g. ISO), sustainable indicators and indexes, lean thinking, enterprise environmental factors, and organisational process assets – necessarily incorporated at the organisational level by which the sustainable supplier selection process and sustainable practices are established within conducting environment of projects. At the decision making stage, the supplier selection implemented by multi-criteria decision making approach and sustainable practices for different projects are therefore organised to provide details, which are operated at the project level. As a result of the pre-existing practices set, the pre-determined supplier list, and the constituents for accomplishing sustainable project governance framework and planning quality enable a specific project to be conducted in sustainable way.

Figure 7. Integrating sustainability within a project in manufacturing industry



6. Conclusion

The result of this study implies that organisations, in order to be deemed sustainable, need to

obtain and adopt as many instruments (e.g. ISO, GRI) as they possibly can, resulting in obtaining benefits, such as the enhancement of an image and so forth. Moreover, by combining the 212 indicators specialised for manufacturing (SMIR, 2011) and the framework for assessing sustainability developed by Joung *et al.* (2012), the practitioners in manufacturing industry can comprehend what the factors requiring consideration are.

Based upon ISO 21500, Carboni *et al.* (2013) embed sustainability into the project planning phase, in which the quality-related standards (e.g. ISO 14001, 9001, etc.) can be adopted to meet either organisational goals or stakeholders' needs. With regard to project governance at the project level, it is suggested that such quality consciousness assimilating from such standards (e.g. ISO 14001, 9001, etc.) should also be considered in the planning phase in which project governance structure is developed.

In a nutshell, instead of devising a new theory, this study tends to provide some basic knowledge concerning sustainability from the project management point of view. Although the study has successfully demonstrated some noted fundamental points, it has certain limitations. The discussion regarding practices in this study are rather general by merely reviewing academic references. The scope of industry and research results could be more specific by conducting a field survey or interviews with professionals in specific fields. In addition, without incorporating quantitative method in the study, a problem that incurs is that some results might not be convincing because they are chosen and delivered based on the authors' subconscious preferences.

7. References

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