

Synergizing Lean and Green Management for Sustainable Performance of Higher Education Institutions in Malaysia

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Abstract— Despite the undeniable importance role of public universities in educating the Malaysian citizens, the universities these days are struggling to generate wealth for their own development. Generating wealth is becoming one of the important strategy for public universities as the allocation from the federal government for their operating expenditures has been drastically reduced. In fact, this strategy has been clearly outlined in the Malaysia Education Blueprint 2015-2025. Despite this significant reduction of source of income, the universities have to find a way to overcome this challenge by becoming more efficient and effective in their services to the stakeholders by becoming leaner. Lean universities will remove the existing waste or non-value added activities in many aspects in the universities' operations, which would yield higher returns and savings. In addition to lean, universities have also the responsibility to protect the environment. As a matter of fact, lean and green practices, share the same objective - that is to reduce waste. However, studies on lean and green universities is rather scarce. Even though there are evidences that these two concepts can be integrated, the synergy between the two concepts has yet to be discovered. This paper will elaborate on how lean and green can be integrated and the potential benefits towards sustainable higher education institutions performances.

Keywords — *Lean, green, sustainable performance, higher education institutions, Malaysia*

1. Introduction

The Higher Education Institutions (HEIs) in Malaysia are now struggling to be more entrepreneurial to utilize its assets due to budget cut by the government [1]. In other words, budget cut has forced HEIs to rethink and review their current state of operations and even to certain extent, the organizational culture, to become more efficient

with their ever increasing limited resources. The dependency on the government grants is starting to gradually diminish. This policy, in fact, is in line with the Malaysia Education Blueprint 2015-2025 where financial sustainability (shift #5) is laid out as one of the key objectives. The university transformation program (UniTP) or purple book has outlined three streams of incomes, mainly from sources such as the development, block grants, tuition fees, Waqf, endowment, and commercial activities and grants. However, none of these sources, highlights the importance of savings from the income generated from those activities.

Therefore, in addition to the guidelines, it is also suggested that these public universities, which the main income source comes from the government fund, to generate their wealth through savings by becoming more lean organizations, or better known as Lean Higher Education (LHE). LHE is expected to enable universities to improve productivity and competitiveness, and ultimately delivers greater value to the stakeholders [2].

Furthermore, the Industrial Revolution 4.0 is becoming a greater challenge for today's organization. The rapid change of technology and the new digitization culture have forced organizations to rethink their current strategies. In this context, the "University of the Future" will undergo tremendous changes in the operations, particularly in teaching and learning and even their organizational structure. Hence, universities need to be more adaptable and flexible in order to be competitive. In other words, the university has to be agile. Lean is the foundation of an agile organization [3]. Therefore, lean is highly important for universities to respond to IR 4.0 challenges. Despite the widespread studies and the application of lean practices in manufacturing and private sector, there are still limited studies on lean practices carried out in the public sector particularly in the university settings. A work by

[4] is one of the few studies that focuses on universities and may not be applicable to the Malaysian public universities. Due to limited resources and global competition, a model or framework for public universities to become lean is timely and necessary.

Meanwhile, in addition to being lean, protection of the environment should not be taken into granted. The savings realized from being lean at the expense of the environment will certainly not be sustainable in the long run. Moreover, lean and green have similar aim which is to reduce waste from the non-value added activities. The term "waste", however, is perceived differently, which means both concepts are mutually exclusive. In lean management the waste include defect, inventory, over processing, waiting, motion, transportation and overproduction, while in green management, waste is defined as unnecessary use of resources or, the release of substances that can have an environmental impact [5]. In line with this synergistic view, researchers have proposed the integration of lean and green management in organizations [6]. However, their meta-analysis work has yet to be tested in the real organization, therefore urges further studies in this area. Hence, this paper aims to propose the Lean Green Higher Education (LGHE) framework for Malaysia. The LGHE framework is hoped to help the public higher education institutions to achieve not only economic benefits, but also social and environmental gains as well.

2. Will Lean Practices Lead to Improved Higher Education Institutions Performances?

Even though the role of Higher Education Institutions (HEI) in providing educational services for Malaysia is undeniable, their performances in term of generating sustainable income is still questionable [7]. HEIs generally depend on the funds provided by the government to support their daily operations. The continuous funds from the government, however, are decreasing each year due to the country's economic situation. As a result of the policy of budget cutting, the management of HEI has no other option but to utilize a very tight operational budget for implementing institutional activities. The HEI management can no longer depend solely on the government supports, instead they should start emphasizing on the improvement efforts to achieve the overall mission and vision. In other words, cost management in the universities is essential in order to generate good quality of graduates each year. Hence, the top management of HEI may opt for lean management on their operational activities to keep the cost down at

manageable level without sacrificing the quality of the students' education.

During the last two decades, lean management has received the reputation to be the "leading approach" for achieving dramatic performance improvements by delivering higher quality at lower costs [8], [9]. From its origins in manufacturing, lean has spread first to the service sector and is now successfully adopted by an increasing number of public sector organizations [10] [11]. Paradoxically, the enthusiasm for Lean in Higher Education has so far been limited [12]. Hence, a study on its application is deemed worthwhile.

Lean Higher Education (LHE) refers to the adaptation of lean thinking to higher education, typically with the goal of improving the efficiency and effectiveness of operations [2]. Lean, originally developed at the Toyota Motor Corporation, is a management philosophy that emphasizes "respect for people" and "continuous improvement" as core tenets [13]. Lean practices encourage people at all organizational levels to re-imagine services from a customer's point of view, removing process steps that do not add value and emphasizing steps that add the most value. While the concept of "customers" and "products" is controversial in higher education settings, there are certainly diverse stakeholders who are interested in the success of colleges and universities, the most common of which are students, faculty, administrators, potential employers and various levels of government.

Lean in Higher Education (LHE) has been applied both to administrative and academic services. A researcher described such initiatives within university settings, including the critical factors for success and ways to measure progress [14]. He noted that LHE can be effective to respond to higher education's heightened expectations, reducing expenses in an era of rising costs, meeting demands of public accountability, and leveraging institutional resources to fulfill the educational, scholarship, and outreach missions of higher education. Through a comprehensive literature review examining lean's impact on higher education, indicated that lean has a significant and measurable impact when used to improve academic and administrative operations. Such improvements are effective at the department/unit level or throughout and entire institution. However, the authors also noted that implementing Lean is a serious undertaking that is most impactful if it involves long-term strategic planning. Although the application of lean management in higher education is more prevalent in administrative processes (e.g., admissions, registration, HR, and procurement) it also has been applied to academic processes (e.g.,

course design and teaching, improving degree programs, student feedback, and handling of assignments) in an increasing number of cases.

A number of higher education institutions (HEIs) have embarked on the Lean initiatives for improving the efficiency of business processes by systematically eliminating waste (i.e. non-value added activities or steps or procedures) as shown in Table 1. Examples of such HEIs are St Andrews University (Scotland), Cardiff University (Wales), Coventry University, University of Portsmouth (England), Central Connecticut State University, Bowling Green State University, MIT, Oklahoma State University (USA), etc., to name a few here. Although Lean has been widely accepted by a number of HEIs, our research has shown that very few universities are integrating Lean with green for improving the efficiency and effectiveness of university processes for sustainable growth.

Lean tools that are appropriate for higher education are the tools that help make previously invisible activities visible, (value stream maps, process maps, and metrics; that help identify root causes (5 why's); that aid in explaining how the customer defines value (focus groups); that provide a collaborative problem solving environment (Kaizen events); and that organize the improvement process (A3 problem solving).

Lean tools that may not be as valuable in higher education settings are probably ones that may interfere with academic freedom and student learning and that places emphasis on heavily used manufacturing terminology such as takt time, leveling, and even the phrase, "serving one's customers," which is not common language at an intuition of higher education.

Based on the discussion above, we defines lean operations as an operational strategy that integrate social (human) and technical (technology) practices with the primary goal of enhancing business performance through increasing operational performance by continually reducing and eventually eliminating all forms of waste in the processes. This can be realized through the involvement of all people or entire workforce in the organization [15]–[19].

3. Will Green practices lead to improved Higher Education Institutions Performances?

Green practices have been associated with better performance [20] [21]. Similar to lean, green practices aim to achieve reduction in wastes. Hence, they are deemed as a compatible approach

[22]. Unlike in lean practices, waste from the view of green is directly associated with the environmental waste in the form of water, energy, air, solid waste and hazardous waste [5]. EPA has also outlined the relationship between waste in lean and environmental impacts of the waste as shown in Table 2.

4. Synergizing Lean and Green Practices – Will it Works?

Lean practices was initially developed in Japan by Taiichi Ohno and Shigeo Shingo, where it was known as Toyota Production System [23]. After the Second World War, Toyota could not compete with the mass production system used in the USA, especially when considering quality and cost [24]. For this reason, instead of focusing on mass production, Toyota created a new management system focused on the reduction of waste in all aspects of it is operations [23]. Waste is defined as all those process activities which do not contribute with, or add value to, the transformation of a product into its final form as sold to the customer [17]. These include unnecessary motion, excess inventory, waiting, quality defects, over-processing, unnecessary transport and overproduction. To eliminate or reduce these wastes, various tools that include kaizen, cellular manufacturing, Just-in-Time (JIT), poka-yoke, pull systems, standardized work, 5S or housekeeping, among others, were developed as part of the lean approach [23]. Nowadays, lean practices is considered the most influential new paradigm in manufacturing, as empirical evidence suggests it improves the competitiveness of organizations [25] by reducing inventories and lead-times, and improving productivity and quality [24]. These days, the application of lean practices has moved beyond manufacturing sector to any organizations including the higher institutions.

On the other hand, environmental concerns have led organizations to take a proactive role in developing cleaner processes and services as well as designing recyclable products. Thus, the green paradigm has emerged as a philosophy and operational approach to improve the environmental efficiency of organizations and reduce the ecological impact of their products and services while still achieving their financial objectives. In general terms, the green management can be considered an initiative [26] that encompasses methods that include environmental operations management, also known as green operations, [27], [28], green supply chains [29], [30] reverse logistics [31], design for environment or eco-design [32], green building [33], and green manufacturing [34]. Green can, therefore, be defined as an

initiative that intends to reduce the negative environmental impact of the production and consumption of products and services through the utilization of these methods, thus improving the environmental footprint of organizations [35].

The move towards green operations has forced organizations to seek alternatives to combine the “traditional” measures of performance of profitability, efficiency, customer satisfaction, quality and responsiveness with green objectives and initiatives. Lean Green or also known as Green Lean is the result of this combination. Thinking about the meaning of lean and green, their synchronism seems to be around their focus on waste reduction; however, this goes further beyond. Mollenkopf et al. [22] suggest that green lean searches for a more efficient system to reduce the production of undesired products, and the environmental impact of their conception along the supply chain and internal operations of an organization. Also, the practice that supports lean and green are similar, generating a system that is efficient and well-organized devoted to continuous improvement [36]. Lean Green works to improve processes at an operational level, reducing operational cost [37]. So it is possible to conclude that green lean is an effective tool to improve processes and reduce costs, by not only reducing non-value-added activities but also physical waste created by systems.

In addition, lean companies, which deploy continuous improvement techniques, seem to be more likely to accept environmental innovations [22]. As lean tends to emphasize waste reduction, it provides a better atmosphere to deploy green philosophies, methods and tools. In this scenario, the similarity between the two seems logical, waste reduction. However, green goes beyond waste reduction as it is also concerned with process efficiency, reduction of material consumption and recycling, and similarly as all the quality improvement approaches, one of its ultimate objectives is to improve customers’ satisfaction. From this view, it is possible to identify several synergies between the lean and green concepts, these being: waste reduction, lead-time reduction and use of different approaches and techniques to manage people, organizations and supply chain relations [38].

However, as discussed in the previous section, waste has different meanings in lean and green. For lean, waste refers to any activity that does not add value to the product, while for the green concept, waste is related to the wasteful consumption of water, energy or any natural resource [37]. Despite their difference, non-value-added activities can also be considered part of wasting energy and natural

resources. For example, unnecessary or excessive transportation of products and/or raw materials is not only one of the seven wastes defined by lean but also a waste of non-renewable natural resources. Thus, both practices aim for less transportation to save cost (lean) and reduce the consumption of natural resources and CO₂ output (green) [39]. Another example is excessive inventory, which according to lean is considered waste because it increases lead time, prevents the rapid identification of problems and discourages communication [25]. Excessive inventory also requires storage space and needs to be lighted, and sometimes heated or chilled, which from the environmental point of view may be considered a waste of energy if the lighting, heating and/or chilling is not done efficiently [40]. In this way, it is possible to relate all the seven lean wastes to those considered and defined by green initiatives. This indicates that lean can serve as a catalyst for green, facilitating companies the deployment of environmental policies and practices. However, there are still some areas in which lean and green cannot be combined as well as there are still some limitations when considering green lean as an integrated approach.

Some objectives of both approaches that may not be possible to combine, for example: their focus, what are considered wastes, the customer, manufacturing strategies and some practices adopted by organizations [22], [38]. For this reason, despite the several synergies already identified, lean and green cannot perfectly be combined, they are concurrent and, thus, can effectively work together, but there are still some points that deserve attention when deploying both initiatives simultaneously. The main difference between lean and green lies in the definition of waste by the organizations. Despite both meanings take the approach of working to improve processes at an operational level, lean focuses on workforce reduction, space reduction, increase capacity utilization, higher system flexibility and the use of standard components [37], [41]. On the other hand, green ranges from practices like reduce, reuse and recycle (3Rs), rework, return and remanufacture [37]. Another clear difference between lean and green is the type of customer [38]. Lean focuses on cost and lead-time reduction to satisfy customers [39], while in green, customers are more concerned as to whether the product that they are purchasing is helping them being more environmentally friendly [22], [38]. More importantly, the green customer would not mind paying more for an environmental-friendly product, which would not occur with lean customers.

So it is clear that lean and green are not completely compatible, there are still some areas in which they

cannot be combined particularly in the context of higher education institutions. However, those incompatible areas do not undermine or block the utilization of lean and green simultaneously as an integrated management approach; contrary to this, it gives the opportunity to improve both methods in

a way that they can perfectly match. Nevertheless, even as an integrated approach, the green lean concept may still find some limitations that require attention.

Table 1. Wastes in Higher Education Institutions

Type of Wastes	Waste in higher education institutions	Examples
Excess Motion	The unnecessary movement of staff and students. Departments scattered across various sites/campuses	Moving staff and students between classrooms or from one campus site to another
Excess Transportation	The movement of materials such as paper, multiple approvals, multiple handovers. Excessive e-mail attachments	Multiple approvals for conference attendance, moving paper, parts and materials around buildings and between different campuses
Underutilized People	Not using people's full abilities. Not giving people the right work	Staff not teaching their specialist subject area, not teaching post graduate courses, no research or scholarly activity time
Inventory	More supplies or items than required. Records and documents held longer than usefully required	Too many marketing brochures, too much stationery and other documents. Too many photocopies of class notes, storage for all the above in offices or stockrooms
Defects	Errors in inputting data, underutilized classrooms	Wrong grades input into system, correcting and checking data. Timetabling errors
Over Production	Producing more than what is needed for immediate use. Unbalanced workload across semesters and uneven scheduling	Too many teaching handouts made in advance and then stored. Staff workload is uneven across semesters and timetabling of students is not level across days or weeks
Waiting	Queuing for anything, waiting for documents to be approved, IT systems downtime, looking for files, books and documents. Time taken to respond to student queries	Waiting for multimedia systems to start up or classrooms to empty of previous occupants, waiting for maintenance engineers, waiting for permission or approval, searching for books, papers, handouts etc.
Over Processing	Overdesigning a product or a service for a customer. Multiple approvals or handovers. Multiple checks. New course or program launch without having the processes ready to deliver	Too much information via e-mail, too many signatures required, and too many people involved. Too many student surveys and too many meetings

Table 2. Environmental Impacts of the Deadly Wastes

Waste Type	Environmental Impacts
Transportation and Motion	<ul style="list-style-type: none"> • More energy use for transport • Emissions for transport • More space required for WIP movement, increasing lighting, heating, and cooling demand and energy consumption • More packaging required to protect components during movement • Damage and spills during transportation • Transportation of hazardous materials requires special shipping and packaging to prevent risk during accident
Inventory	<ul style="list-style-type: none"> • More packaging to store work-in-progress (WIP) • Waste from deterioration or damage to stored WIP • More materials needed to replace damaged WIP • More energy used to heat, cool, and light inventory space
Defects	<ul style="list-style-type: none"> • Raw materials and energy consumed in making defective products • Defective components require recycling or disposal • More space required for rework and repair, increasing energy use for heating, cooling, and lighting
Over Production	<ul style="list-style-type: none"> • More raw materials and energy consumed in making the unnecessary products • Extra products may spoil or become obsolete requiring disposal • Extra hazardous materials used result in extra emissions, waste disposal, worker exposure, etc.
Waiting	<ul style="list-style-type: none"> • Potential material spoilage or component damage causing waste • Wasted energy from heating, cooling, and lighting during idle stage
Over Processing	<ul style="list-style-type: none"> • More parts and raw materials consumed per unit of operation • Unnecessary processing increases wastes, energy use, and emissions

Source: EPA, 2007

5. Conclusion

To be sustainable in the long term, the HEIs need to find ways to reduce their dependency on the government funds and become more independent in their operations. Lean Green practices can be a solution to generate wealth for the HEIs. From our viewpoint, HEIs can make use of both methodologies simultaneously for tackling efficiency and effectiveness of educational processes. Lean can be a good starting point in establishing business processes and identifying and reducing or even eliminating different forms of waste that exist in delivering services to the

stakeholders. Green can also reduce waste, but it is environmental waste. Green practices will result in HEIs and its community to take care of their environment for more sustainable outcome in the long run.

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