Lean Management

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Lean management has generated new approaches to reduce non-value-adding activities in different sectors of the economy, including in higher education systems. Lean principles in higher education institutions (HEIs) contribute positively to sustainability performance.

Keywords: lean principles ; HEIs ; waste management

1. Introduction

Toyota first introduced lean principles as an alternative process management system. To produce process efficiency by focusing on customer and effective operations management, Toyota invented the 'Toyota Production System (TPS)', later known as lean philosophy [1]. Lean philosophy focuses on stabilizing and standardizing work processes so that critical problems become apparent, and the workforce develops the ability to think critically to solve problems and improve workflow [2]. It seeks optimal production of goods or services by eliminating waste and increasing the flow of activity throughout the entire value stream [3].

Lean principles were born in the manufacturing industry and then—due to the opportunities and benefits it creates [4]—have been adopted as an improvement program in various organizations such as service organizations [5] in both public [6] and private sectors [7]. Nowadays, the implementation of lean principles has increased in HEIs [8]. Lean higher education is the application of lean principles to higher education administration (admissions, add/drop credit, purchasing, facilities, hiring, and budgeting) as well as academic activities (course design and teaching, improving degree programs, student feedback, handling of assignments) [9]. Although many service sectors still perceive lean practices are only applicable to the manufacturing sector [10], more HEIs in developed countries such as the United Kingdom and the United States are now using lean principles to improve their operations. According to Thomas et al. [11], compared to the amount of knowledge on lean in the manufacturing sector, the literature on applying lean principles in HEIs is still in its infancy, but this research's extent is growing.

Currently, many businesses are concerned with sustainability. Sustainability, as defined, is a property of a process or state that can be maintained at a certain level indefinitely [12]. Namely, the Triple Bottom Line strategy necessitates a comprehensive performance based on three pillars of sustainability, including social, economic, and environmental [13][14].

Focusing on a single in-depth case study will provide a clearer picture of an established method (lean) applied to a new subject (HEI). Nicholson and Pakgohar [15] used lean principles to solve some of the pressure points for academic workloads in a university law clinic. The studies have applied lean principles in HEI to evaluate and design the processes more effectively.

HEIs are now operating in an increasingly complex and challenging situation [16] as they have to meet growing student demand and the continuous organizational improvement it entails [17]. Educational institutions are now facing unprecedented competition for students, research funds, prestige, quality ratings, incubated companies, fundraising, academicians, skilled workers, and so on [9]. There are specific conflicting goals for service providers with customers inside and outside HEIs [15]. Globalization has also encouraged HEIs to constantly develop robust quality-assurance systems for faculty improvement, research funding, and academic and technological programs. These have motivated HEIs to redesign their business processes to reduce administration overheads and improve services for stakeholders [17].

Similar to the application in other industries, the goal of lean practices in HEIs is to add value without wasting resources [18]. If it is applied correctly, lean practices will eliminate waste—making processes more efficient and delivering better values to customers of HEIs—with core processes covering teaching-learning, research, and dissemination of new knowledge and information [15]. However, It is necessary to define waste and how they are interconnected to identify and eliminate the root causes [10].

2. Sustainability in HEIs

Nawanir et al. [13] divided lean practices in HEIs into seven categories: waste identification, work standardization, level and balance workloads, built-in quality, pull system, multifunctional employees, and continuous improvement. Lean practices in HEIs as a systemic approach play an important role in sustainability because of their potential effect on sustainability performance. The primary purpose of lean principles is to maximize stakeholder value and eliminate all waste to optimize the entire process [19][20]. Applying lean principles in HEI can improve student satisfaction.

HEIs are a good candidate for lean and sustainable practices [19]. In the last few years, there have been many studies on successful sustainable development in HEIs, e.g., [13][21][22][23][24]. Aleixo et al. [21] pointed out five sustainable development activities in HEIs—education, research, campus operations, community outreach, and raising awareness in the community—that need communication and coordination with the different stakeholders. These circumstances triggered waste in day-to-day activities related to many cross-functional or departmental processes, so it requires more time or steps.

3. Application of Lean Management

In the manufacturing sector, lean implementation has proved quite successful as it reduces waste and increases efficiency. This success encourages another sector to implement lean principles to improve the quality of its services. In the recent decade, lean principles have become a methodology for development in various sectors, including higher education [25]. HEIs are seeking new methods to stay competitive in an ever-changing world. This means going above and beyond the competitors in terms of education and service and keeping expenses reasonable. In higher education, sustainable development is a critical concern. As a systematic approach, lean principles in HEIs play a significant role in sustainability.

Lean principles are relevant to be applied to HEIs, taking into consideration of their application, especially regarding the distinctive attributes of service operations. Hess and Benjamin [26] used lean principles in the university to improve processes in curriculum delivery, business and auxiliary services, admissions and enrollment management, and research. They found that the key to successful implementation in a university setting is to avoid a top-down approach instead of focusing on faculty involvement in the design and implementation of the lean methodology. Cudney et al. [27] found that in lean implementation, engaging internal and external customers and emphasizing the value of direct involvement, stakeholders' commitment, and participation can improve quality and decrease waste in learning, teaching, and administration.

In lean principles, the different categories of waste are overproduction, over-processing, waiting or delay, motion waste, excess inventory, waste talent, transportation, and defect or reworking [28]. In the manufacturing sector, each waste form is defined as follows: overproduction refers to products for which there is no demand; over-processing refers to unnecessary production line processes; waiting may occur as products, waiting in queues or delays that keep employees waiting; motion waste refers to unnecessary movements of workers; transportation waste means unnecessary traffic in the manufacturing area; inventory waste may be a shortage and excessive stocking of raw materials or finished goods; defects refer to avoidable production of defective products, and talent waste refers to the non-use of workers' abilities or skills [10]. Because the eight categories of waste refer to the manufacturing sector, they must be adapted to the context of HEIs [10][26][27][28][29][30][31][32]. Kazancoglu dan Ozkan-Ozen [10] investigated eight wastes in HEIs by proposing a multi-stage model. They are classified into overproduction, over-processing, waiting, motion, transportation, inventory, defects, and talent. Douglas et al. [30] classified wastes as overproduction, over-processing, waiting, motion, transportation, inventory, defect, and underutilized people. The examples of waste modes in HEI are briefly described as follows:

- A defect is defined as an error in the process or service support requirements. Such wastes are the lecturer having trouble finding a file, typographical mistakes, and making mistakes in learning materials and preparation.
- Overproduction occurs when doing services that do not need or earlier than scheduled. Such as wastes are lecturers printing too many copies of materials, the teaching load is too much to handle, and the lecture adds extra hours to accomplish their work.
- Waiting is defined as delays in a process. For example, the lecturer takes a long time to respond to messages and questions from students, waits in a meeting, the lecturer misses a deadline for submitting reports.
- Non-utilized talent represents inappropriate work allocation or non-use of lecturer/staff abilities or skills. The lecturer exemplifies non-utilized talent is given a task that is outside of their area of competence, and the lecturer does not do

research or community services every semester

- Extra transportation is defined as unnecessary traffic in HEIs areas. For example, when distributing documents/files across work units, the lecturer makes mistakes.
- Excess inventory represents goods or services that are no longer required to meet current needs. Examples of excess inventory in HEIs are the lecturer storing too many documents and the lecturer hoarding office stationery.
- Extra motion or unnecessary movement: This waste occurs when lecturers or staff have to spend more time/energy to provide a service. Consider the examples such as the distance between classrooms and office/workspace is far, and the lecturer's workplace is always disorganized.
- Over-processing or doing more work than required. Such as waste are the lecturer spends a significant amount of time locating documents, files, and journals, information is received through various channels (WhatsApp, email, hard copy, etc.), repeatedly posting the same information or announcement. Underutilization of a highly talented and educated lecturer/staff is common in education; furthermore, the disconnection between stakeholders in education prevents real learning for change [28].

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