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Lean Operations in Tertiary Institutions: A Tool for Elimination of Waste in Technical Universities, Ghana

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ABSTRACT

The application of lean operation systems in tertiary institutions has a potential benefits to many universities in Ghana. The focus of this study was to systematical evaluate the basic principles of lean management and its application to tertiary institutions by streamlining structures and models that will provide satisfactory services for customers by eliminating administrative wastes. The survey design was used with questionnaire as the instrument for data gathering. A random sampling strategy was applied in obtaining the sample size for the study. The findings of the study revealed seven different types of administrative waste where each of these wastes were ranked in terms of their magnitude within the university. Also, the indication of the result is that, over staffing the number of academic or administrative units and underutilization of talent of employees' were the most essential component of waste identified. Therefore, the techniques and tools to guide the implementation of lean model in the university as proposed by the study is to establish norms and standards; focus on the value of the customer; use punitive measures as deterrents; adhere strictly to budget lines; establish workflow sequence; ensure effective communication and information; zero inventory as well as follow laid down administrative procedures. The novelty of this study is that, it provides concrete direction in implementing lean frameworks in all universities and helps streamline activities that will create value by mapping the streams to satisfy the needs of the university community.

Key words: Lean Operations, Quality Standards, Waste management, Tertiary Education.

INTRODUCTION

The responsibility of any organization is to provide quality management service to the satisfaction of customers with minimal resources as much as possible. The ability of management to recognize and act decisively in respect of quality connected to organization's variables that contribute so much to the attainment of the desired targets is a necessary prerequisite for the management system to function effectively. In terms of desired outcomes,

the quality of products and services as a strategic goal is dependent on the organizational processes and the given environments (16). Prakash (33) reiterated that in tertiary institutions, apart from comprehensive quality management and assurance, the most needed attention or priority is given to teaching and learning activities, quality provision of facilities and the overall satisfaction of the academic community. Salam and Al-Salim (38) found that complete quality management has a significant impact on the overall performance of higher education institutions since it helps cut down waste. Globally, reduction of waste is a strategic direction and drive of every contemporary organization. Waste has become a bane in every sector of the economy including the public tertiary institutions in Ghana. The excessive waste in the public sector has reached a level where there seems to be no regard for the customer needs and satisfaction as well as the value for goods and services provided (42).

The mandate of all tertiary institutions is to effectively manage its resources by downsizing excess cost and unnecessary waste in the management service delivery. Thus, there is the need for tertiary institutions in Ghana to engage in lean operation system in order to eliminate waste and other excess expenditure. Lean operation system is a tool of managing an organization with the aim of given the customer the needed satisfaction yet utilizing a minimal resources as much as possible (10). The focus of lean management is to provide satisfactory services for customers and removing waste as much as possible. For public tertiary institutions, lean operation system offers a fresh perspective and instills both discipline and optimism (30). Lean operation system is an approach for reducing non-value-added tasks that is both effective and comprehensive (43, 32). One of the primary ideas of Lean is to define value, map, and redesign processes in order to deliver continuous improvement, remove waste, and focus on customer expectations (46, 15). Lean necessitates the use of specific tools and approaches in tertiary institutions such as value chain analysis, relationship between variables and quality management training programmes (4).

STATEMENT OF THE PROBLEM

In the contemporary educational environment, there is a keen competition among tertiary institutions globally. Tertiary institutions in Ghana compete with both global and local universities in terms of students' enrolment, the value of services they bring to learners and for the tuition fees that students are expected to pay. The facilities and services in relation to quality of education, learning experience, infrastructure (lecture halls, labs, library, etc.) and the services offered to help sustain students life and experience are represented by the total quality of services provided. In recent years, students have become conscious for other quality indicators, such as basic educational infrastructure, comfortable and quality living hostels; state-of-the-art facilities and of late, digital innovations. In an attempt to offer students the best of these facilities and services, high tuition fees are charged and students also expects high returns in terms of quality service delivery, thereby putting pressure on tertiary institutions. Therefore, in order to improve facilities and services leading to customer satisfaction, tertiary institutions need to apply the lean operation system by cutting down cost and removing waste with a few resources available. Thus, to be successful in these competitive environments resources must be judiciously used and waste eliminated from various operations in order to reduce operational costs and improve service quality (47, 37, 35).

In tertiary institutions however, there is significantly less research or not much literature on lean operation system implementation in creating value for customers. This is mostly due to

the challenge of interpreting lean systems in higher education institutions (7, 3) as well as a lack of knowledge on the elimination of waste (21). One of the most important setbacks is lack of awareness of the possible benefits of lean in higher education institutions since the concept of lean management is not well understood by university management (25). Other concerns are as a result of lack of organizational innovation and transformation leadership on the part of university management (10) and with an erroneous impression that lean operation system is based on only elimination of waste (32). Some tertiary institutions and other public sector organizations attempt to eliminate waste without efforts to lean the system due to lack of resources for lean operation, particularly budget and time (7, 11).

The goal of this research is to develop and asses a lean management framework for waste management in tertiary institutions based on these observations. It is envisaged that by such proposal, it will contribute to closing the research gap, reducing a number of wastes, and increasing the adoption of lean in tertiary institutions. Effective lean operations (5) are vital for a waste management system (13). Since there has been limited evidence of structured frameworks on lean in tertiary institutions (45), in terms of waste, the study expands and focuses on the corpus of research on lean and wastes (27). Literature suggests that lean initiatives have had great impact on tertiary institutions that have successfully implemented it (24, 10). However, what is most important in lean operation implementation is to create the awareness of the need to transform and change practices that have not been utilized and the need for employees to accept the principles of its implementation (47, 37). Therefore, the aim of this study is to outline and identify the various opportunities of lean management practices in ascertaining the sources of misplacements and misappropriations emanating in the tertiary institutions operations from the viewpoint of stakeholder consultations. Subsequently, this would facilitate the creation and implementation of lean operation initiatives by encouraging stakeholders' involvement and consultations in tertiary institutions in Ghana.

OBJECTIVES OF THE STUDY

The focus of the study is to illustrate the conceptual view of waste in tertiary institutions using lean operation system. Specifically the study seeks to;

a. Evaluate the basic principles of lean implementation in the Tamale Technical University.
b. Assess element of wastes in the Tamale Technical University
c. Identify benefits of lean operation implementation in the Tamale Technical University
d. Ascertain the possible ways of eliminating waste through the lean operation system in the Tamale Technical University.

LITERATURE REVIEW

Lean operation is an organizational philosophy rather than a collection of techniques. Along each organizational level, lean is seen as the desire to challenge one's behavior, learn from failures, and create innovative solutions to resourceful processes on a constant basis. Lean is a way of thinking and operation that is always focused on the customer and delivering value (46). Manufacturing has been the primary focus of lean development and application. Various activities, however, have demonstrated that the lean concept may also be utilized in the public service sector (20). Lean operation system is a concept that aims to increase an organization's efficiency by decreasing waste in its various operations. Waste is defined as any action that does not contribute value to the creation of goods or services, and its reduction can be used to enhance a variety of business resources. Stocks of raw materials, supplies, and unfinished

production, as well as production and distribution facilities, must be reduced in order to meet production process requirements and decrease the release of defective products, which is of particular relevance for organizations. Increased employee productivity and improved document circulation can be critical issues for service organizations. However, applying lean operation system concepts enables for the creation of competitive advantages (22). By reducing waste and improving waste management, businesses can produce more high quality products at lower costs.

Implementing lean operation system in industries is already familiar practice, and its characteristics have been extensively addressed in previous studies (4, 2, 3) Lean management was later used in the service sector, but a sense of their applicability and utility had already developed in both commercial and public organizations. Lean operation is a method of thinking and doing for a complete organization, not a strategy or a cost-cutting program. Lean operations are being used by businesses across all industries and services, including healthcare and government. Lean operations have shown enormous benefits in terms of labour and productivity improvement (45-75%), cost savings (25-55 %), space reduction (35-50 %), inventory reduction (60-90 %), rework (50-90%), and delivery improvements (60-90%), among other things (9, 47) Indeed, past research has demonstrated that in order to compete in today's tertiary environment, services must go much beyond the basics of education, such as providing lectures, grading papers and publishing results.

Due to the pressure of decreased funding from governments, there is a pressure to expand services that can benefit university community such as enhance student learning, accomplish knowledge creation and sharing, retain enrolment of qualified students and ensuring that good working standards are adhered. When waste is eliminated across whole value streams rather than at isolated points, processes are created that require significantly less human labor, space, money, and time to produce products and services at far lower costs and with far fewer flaws than traditional business systems. Institutions can respond to changing customer demands with a wide range of products, high quality, low cost, and quick turnaround times. Also, data management is considerably easier and more precise (22). Strategies that have a financial benefit on organizations (6, 41) might be employed by establishments to enhance and improve its operations. The important gains of applying lean is the reduced operational expenses, enhanced procedures and product quality, increased efficiency, which leads to increased productivity and the organizations adaptability and resourcefulness (8, 36, 40).

METHODOLOGY

The study adopted a survey design with questionnaire as the instrument for data gathering. Data was obtained through a self-administered structured questionnaire. A Likert scale type of questions was used to elicit response from the staff of Tamale Technical University on issues pertaining to the elimination of waste at the various units of the university. The study population included the administrative staff, deans of schools, heads of departments, unit heads, procurement and the library staff. A random sampling technique was adopted to randomly select participants from this departments based on a laid down checklist which made it possible for appropriate classification. A sample size of 42 participants was obtained from a study population of 109 using a confidence level of 90% and a margin of error of 10%.

Respondents were selected based on the conditions that each person has an equal chance of being selected for the study. Data was collected based on the responses of the university staff to score and rank these wastes. As a result, the originality of this study is demonstrating a clear, complete and comprehensive lean waste framework based on current lean philosophy in tertiary institutions.

Analytical framework

The study used descriptive statistics such as frequency tables and percentages to present the socio-demography characteristics of the staffs. Mean was use as a measure of central tendency whiles the Standard Deviation as a measure of dispersion. The high mean value corresponds to "agree" in their responses while a low standard deviation explains the degree of consensus to the factors outlined. Inferential statistics for comparing means in the type of One Sample t-Test was used. The test statistic for a One Sample *(t)* analysis was used on the respondents view on elimination of waste in tertiary institutions.

RESULTS AND DISCUSSIONS

Demographic Characteristics of Respondents

In terms of demographic characteristics, the study sought to obtain data from respondents on areas which include working period and the qualification of staff considered for the study.

Table 1: Sex of Respondents

Sex	Frequency	Percent	Valid Percent	Cumulative Percent
Male	29	69.0	69.0	69.0
Female	13	31.0	31.0	100.0
Total	42	100.0	100.0	

Source: field data

Findings from Table 1 revealed that amongst respondents who participated in the study, males make up the majority representing 69% of the total respondents. Such results have implications especially in the achievement of gender balance amongst the University staff. It also has implications on how staff related policies are formulated and implemented with reference to the adoption of lean operation to reduce the waste of university resources and to ensure efficiency.

Table 2: Employment Status of Staff

Mode of Employment	Frequency	Percent	Valid Percent	Cumulative Percent
Full Time	38	90.5	90.5	90.5
Part Time	2	4.8	4.8	95.2
Other	2	4.8	4.8	100.0
Total	42	100.0	100.0	

Source: field data

Table 2 shows that majority of the participants representing 90.5% are employed on a full-time basis. It is important to note that the mode of employment plays a major role in determining the nature of task that can be assigned and the extent of commitment to executing task and achieving set objectives. In this case since majority of respondents are employed on a full-time basis there is the likelihood of they being committed to the adoption of lean operations by the university.

Table 3: Working Period of University staff

Working Period	Frequency	Percent	Valid Percent	Cumulative %
Under 5	27	64.3	64.3	64.3
Above 10 years but less than 15 years	13	31.0	31.0	95.2
Above 20 years but less than 30 years	2	4.8	4.8	100.0
Total	42	100.0	100.0	

Source: field data

Table 3 shows that majority of the respondents representing 64.3% have worked for the Tamale Technical University for more than 5years. Such observation has implications especially on performance level of staff. In lean operation implementation in the university, the work experience of staff must be taken into consideration because; knowledge of the managerial systems is key to successful implementation of the lean operations.

Table 4: Highest Qualification of Staff

Qualification	Frequency	Percent	Valid Percent	Cumulative Percent
Masters	20	47.6	47.6	47.6
First Degree	17	40.5	40.5	88.1
HND	4	9.5	9.5	97.6
Others	1	2.4	2.4	100.0
Total	42	100.0	100.0	

Source: field data

From Table 4, the study revealed that majority of respondents representing 47.6% have Masters as their highest academic qualification. It is important to note that amongst respondents who participated in the study there was no one with a PhD qualification. The academic qualification of staff is an important factor as considered in the provision of training on lean operations. In this case with most staff having master's qualification, it should be taken into account in determining what form of training should be provided and furthermore how lean operations would be operationalized by staff of the university.

Table 5: One sample Test for Demographic Characteristics

	Test Value = 0					
	T	DF	Sig.(2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Sex	18.138	41	.000	1.30952	1.1637	1.4553
Employment	11.493	41	.000	1.19048	.9813	1.3997
Years of work at the University	15.514	41	.000	1.40476	1.2219	1.5876
Highest Qualification	22.909	41	.000	2.66667	2.4316	2.9018

Source: field data

The analysis in table 5, states that the null hypothesis (Ho) =there is no difference between the sex, employment status, working time and highest qualification. Given that the P value < 0.05, we reject the null hypothesis and fail to reject the null hypothesis if otherwise. Since the P value of .000 < 0.05, we reject the null hypothesis as it indicates that there is a significant difference between the sex, employment status, working time and highest qualification of respondents.

The Basic Principles of Lean Implementation

The study sought to assess the basic principles of lean implementation in Tamale Technical University in relations to its quality assurance guidelines. The respondents were made to share their opinion in relation to various philosophies of lean implementation at the university. This is shown in Table 6.

Table 6: Basic Principles of Lean Implementation

Statistics	Identify users and value	Mapping value stream	Uninterrupted flow	Responding to customer needs	Pursuing excellence
Valid	42	42	42	42	42
Missing	0	0	0	0	0
Mean	2.9286	3.6905	3.7381	2.7619	3.8095
Mode	2.00	4.00	4.00	2.00	4.00
Std. Deviation	1.21761	.99971	1.01356	1.28423	1.08736
Minimum	1.00	1.00	1.00	1.00	1.00
Maximum	5.00	5.00	5.00	5.00	5.00

Source: field data

Table 6 shows that there is high consensus among the participants in all the principles of lean implementation ascribed in the study (identify value, mapping the value stream, creating smooth flow, responding to customer needs, and pursuing excellence). Taking the high mean and low standard deviation into consideration, respondents have strongly come to an agreement that all identified lean principles are in relation to the university managerial operations. However, it could be seen from Table 6 that, majority of the participants rated pursuing excellence, uninterrupted flow and mapping value stream as the most significant building blocks for the lean implementation at the university with a mean value of (3.8095, 3.7381 and 3.6905) respectively.

This result suggests that all the stakeholders of the University align themselves to the various building blocks of lean implementation, since the key emphasis on eliminating waste is through a strategic approach to implementing an enhancement driven towards the satisfaction of the customer as they desire for perfection. Lean ideas, procedures, and techniques were first used in the manufacturing sector, but they are slowly gaining traction and being applied in service industries such as administration, academia, security and health care (39, 26, 1). The overall aim of eliminating waste is to enhance quality, achieve competitive advantage, lower operation cost and create a dynamic system that respond to customer demands. The application of lean operational principles guarantees that the entire organizational approach is supported by a constant evaluation of the operations to ensure that they are steadily generating value to its customers.

This will enable tertiary institutions to retain a high quality of service while still being able to develop and adapt with an evolving situations through adopting long-term transformation. This finding confirms the study of Kang and Manyonge (22) on the exploration of lean principals in higher educational institutes based on degree of implementation and indigence. The authors indicated that the crucial stage in lean philosophy is identification of the value from the customer point of view, mapping all the activities within the organization to provide value for the customer through products or service delivery, creating smooth flow of products or services to the customer without interruption, recognize the needs of the customers by developing processes to meet them and finally the need to pursue excellence since there no end to the strategy of minimizing waiting period, reserve capacity, expenses and mistakes.

Elements of Waste in Tertiary Institutions

The study sought to assess the basic elements of waste in Tamale Technical University in relations to its operation system. The respondents were made to share their opinion in line with various components of perceived waste identified at the university. This is shown in Table 7.

Table 7: Waste in Tertiary Institutions

Statistics	Over production	Underutilization of talents	Delays	Abuse of Assets	Defects	Over processing	Excess inventory
N+Valid	42	42	42	42	42	42	42
Missing	0	0	0	0	0	0	0
Mean	3.9286	4.0714	3.8095	3.4524	3.8333	3.7381	3.6429
Mode	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Std. Deviation	1.06823	1.04153	.89423	.94230	.88115	.93859	.85029
Minimum	1.00	2.00	1.00	1.00	2.00	1.00	2.00
Maximum	5.00	5.00	5.00	5.00	5.00	5.00	5.00

Source: field data

Table 7 indicates the various components of educational waste identified by the participants at the Tamale Technical University. Considering the value of the mean, mode and standard deviation as illustrated from the analysis, it is clear that majority of the participants have unanimously identified their institutional waste to include; over production; delays of all kind; over processing , abuse of assets, defects, underutilization of talents and excess inventory.

Table 7 revealed that participants rated over production ("over staffing the number of academic or administrative units than expected") and underutilization of talent ("employees' abilities and talent are underused, excessive bureaucracy and employees not receiving work according to their skills") as the most essential component of waste in the university with a mean value (3.9286 and 4.0714) respectively. The other most significant component of waste identified by the participants were defects, delays and over processing with a mean value of (3.8333, 3.8095 and 3.7381) respectively.

With this, it can be deduced that waste is any form of activity or process that increases cost, time value, reduces quality of services and add no value to goods and services as perceived by the customer (47). This result confirms the findings of Hicks (18), Klein, Tonetto, Avila, and Moreira (24) as well as Michael and Elser (27). Their findings presented a waste control framework with models to assist academics and university management to understand wastes. Another peculiar area of their research was to address underutilization of talents and over-processing of wastes. Waste identification helps tertiary institutions to organize activities that will create more value to satisfy their customers.

Lean is a valuable practice that allows academic institutions to discover and eliminate waste in order to simplify and improve procedures. However, this must first be understood by the university personnel (10). There are eight different form of waste interpreted to universities by Douglas et al. (10) as well as Kazancoglu and Ozkan-Ozen (23), though there are considerable variations in their grouping. Also, in order to establish the hierarchy of importance in the identified waste Kazancoglu and Ozkan-Ozen (23) explore the causal relationship between the detected wastes in order to build an order of relevance which is a complex policy outcome. Nonetheless, the outcomes will be exceptional to each institution, based on their constraints. The authors suggest a roadmap for guiding lean transformation in tertiary institutions and identify opportunities for expansion. Muñoz-Guijosa, Bautista, Verdu-Rios, Diaz-Lantada, Lafont, Echavarri, Muñoz, Lorenzo and Muñoz (28) listed some problems which are peculiar to tertiary institutions and the possible solutions using a lean-based operation to enhance their routine management system. Likewise, Sunder (44) enumerated peculiar waste problems facing tertiary institutions that must be made clear to all staff and the need to pursue excellence to achieve quality education for all. Though, Muñoz -Guijosa et al. (28) and Sunder (44) did not classify the problems of universities into eight identifiable wastes, they affirm the waste categorized by Kazancoglu and Ozkan-Ozen (23) and Douglas et al (10).

Benefits of Lean Operations in Tertiary Institutions

The study sought to assess the possible benefits of lean system in the Tamale Technical University in relations to its implementation. The respondents were made to share their opinion in line with various areas of perceived benefits at the university. This is shown in Table 8.

Table 8: Benefits in lean operation system

	Enhances communication	Information flows and delivery	Minimizes data and inventory	Quality of service to university community	Efficiency and flexibility in management process	Productivity and job satisfaction
N Valid	42	42	42	42	42	42
Missing	0	0	0	0	0	0
Mean	2.8095	4.2619	3.0238	4.2857	3.2857	2.7857
Mode	4.00	5.00	2.00	5.00	4.00	4.00
Std. Deviation	1.41831	.93859	1.31572	.94445	1.23537	1.24029
Minimum	1.00	1.00	1.00	1.00	1.00	1.00
Maximum	5.00	5.00	5.00	5.00	5.00	5.00

Source: field data

The study as revealed in table 8 indicate a significant level of consensus around the benefits that could be derived from lean operation system in the Tamale Technical University. The participants identified potential benefits of lean implementation to include but not limited to: enhance communication; information flows and delivery; minimizes data and inventory; quality of service to the university community; efficiency and flexibility in management process; productivity and job satisfaction. However, Table 8 revealed that the participants rated quality of service to the university community and ensuring Information flows and delivery as the most important value and benefits that could be derived from lean initiative in the university with a mean value of (4.2857 and 4.2619) respectively.

These findings indicate a wide variety of areas in the university management processes and systems. Generally, lean operation have been adopted in the management operations at the various universities in the past few years, mostly to reduce costs and enhance quality, enhance competitiveness in the market, improves performance and efficiency as well as stakeholder satisfaction. These findings therefore affirm the study of Kang and Manyonge (22) on the exploration of lean principals in higher educational institutes based on degree of implementation and indigence. The authors cite the quality and timing of information as well as improved communication, standardization of operating procedures, flow visualization, innovative problem-solving strategies, job motivation, and satisfaction as benefits. All of these potentials for development are linked to how well the lean thinking methodology is implemented.

Similar study by Grudowski, and Wiśniewska (16); Spiridonova, Ruzaeva and Bosak (42); Gomez-Molina and Moyano-Fuentes (14) on lean management in universities supports this study. The authors postulated a number of justifications that lean operation approach can be used to solving waste problems in tertiary institutions. The authors justify this hypothesis by various case statement analyses of lean operation solutions in tertiary institutions to include but not limited to: developing quality improvement strategies in line with institutional vision and goals, improving communication and information flow, reduction in cost and improving quality of services to satisfaction of customers.

Strategy of Waste Elimination in Tamale Technical University

Eliminating waste and providing services to satisfy the needs of the university community is the main target of the university management. Therefore, the participants were asked to indicate the possible ways to reduce waste in the university. This is analyzed in Table 9.

Table 9: Possible Ways to Eliminate Waste

Variables	Valid	Missing	Mean	Mode	Std. Deviation	Minimum	Maximum
Establish norms and standards	42	0	2.2857	1.00	1.23537	1.00	5.00
Reduce cost of holding stock	42	0	3.1667	4.00	1.28626	1.00	5.00
Punitive measures as deterrents	42	0	3.0476	3.00	1.20876	1.00	5.00
Strict adherence to budget	42	0	3.2619	3.00	1.21092	1.00	5.00
Establish workflow sequence	42	0	3.0714	2.00	1.36851	1.00	5.00
Effective communication and information	42	0	3.2143	3.00	1.25980	1.00	5.00
Zero inventory	42	0	3.1429	3.00	1.09481	1.00	5.00
Laid down administrative procedures	42	0	3.2381	4.00	1.33999	1.00	5.00

Source: Field Data

The position of the mean value and the standard deviation in Table 9 indicates that the participants highly consented to all the identified possible ways of eliminating waste through lean operation at the university. Participants were of the view that waste reduction significantly decreases resources use as well as boosting productivity. Consequently, the participants indicated the possible ways of eliminating waste in the value chain of the university system to include but not limited to the following: establishing norms and standards; focusing on the value of the customer; punitive measures as deterrents; strict adherence to budget; establishing workflow sequence; effective communication and information; zero inventory as well as laid down administrative procedures. By enhancing operations and ensuring procedural consistency, reducing waste helps to improve organizational efficiency (2). These findings affirm the study of Radnor and Walley (34) on "Learning to walk before we try to run: adapting lean for the public sector" and Hines, Martins, and Beale (19) on "Testing the boundaries of lean thinking: Observations from the legal public sector". The authors' indicated that "long waiting lists, rescheduling, and creating unneeded reports are all examples of waste in services" in tertiary institutions.

Several other authors place emphasis as to how lean could be used to better or address a particular issue (29, 17). Nikolaeva et al. (29), attempted to look at the concept of building "smart universities" by incorporating lean principles. According to Petrusch and Vaccaro (31) the eight quality criteria define by students as they expects from their university included but not limited dependability, compassion, accessibility, effective response, ease of "self-service", skills, effective communication, personalization and interpretability. Nonetheless, depending

on the type of services and each strategic implementation, universities ought to prioritize and allocate resources to various levels of units to enhance quality. Similarly, Gupta et al. (17) explored the potential reasons of students' inability to complete their university education and assessed the possibility of using lean techniques to minimize the rate at which they drop from school. Their findings revealed that tertiary institutions must retain and sustain an effective record keeping to tract down students' dropout rate and create management awareness on the effects and the justification for students' decision to drop out from school. The study therefore is inspired by the present necessity to design a model lean system that is administered and accessible from anywhere and in which the quality of higher education is guaranteed, the efficiency of value generation processes is boosted and a culture of continuous improvement is fostered in tertiary institutions in Ghana.

CONCLUSION OF THE STUDY

This study gives an insight into the practical construct of lean implementation framework in the academic environment and added a new taxonomy into what has previously been written in the area of lean and total quality services management. Precisely, four main constructs were identified and analyzed as the cardinal points that underpin this study on the utilization of lean operation for enhancing the management of tertiary education. This include; the basic principles of lean implementation, components of waste, benefits of lean operations and the strategy of waste elimination in tertiary institutions.

This study shows a significant level of consented opinion on the possible lean principles and how it affects management processes in the university. It is evident from the study that, the building blocks of lean application ensures that the general managerial policy and systems are aligned to the mission and vision of the universities. This is possible through consistent analysis of the processes that lead to the provision of quality services to the customer. Tertiary institutions are made up of array of systems, units and divisions with various forms of processes and bureaucratic tenacities that lead to waste which is a bigger challenge to all universities. Several challenges have bedeviled many universities and Tamale Technical University is not an exception. These setbacks could be grouped into collection of wastes that can be minimized through lean operation.

The study brings to bear the fact that, any form of human activity at the tertiary institutions that consume resources without producing any value to satisfy the needs of the university community should be first recognized and understood before it can be eliminated. For a university, there are several challenges across functional and departmental units that lead to all forms of bureaucracy and longer processes, and the more all these processes are engaged the likelihood of more mistakes and subsequent waste being created. Consequently, lean operation is needed, initially to identify waste in its present's processes and then eliminate these wastes by reducing cost, ensuring quality, enhance productivity and improve customer satisfaction. The moment waste is recognized and understood, the needed lean methods must be applied to salvage the situation.

Therefore, the study proposed certain lean techniques and tools to guide its implementation at the university. This included but not limited to establish norms and standards; focusing on the value of the customer; using punitive measures as deterrents; adhering strictly to budget lines; establishing workflow sequence; effective communication and information; zero inventory as

well as laid down administrative procedures. These would enable universities to retain a high quality of service while allowing them to develop and adapt within its present circumstances, which is possible through adopting long-term transformation drive. Based on the identified waste at the various universities, several other lean principles could be added to improve on waste elimination. Improved communication and information at the various units and departments could prevent many avoidable mistakes and errors. An effective communication and information flow between various units and departments allow smooth flow of processes and coordination of linkages from top management to the down management and auxiliary units of the university.

The "novelty" of this study is that, it gives a transparent, universal and coordinated lean structure framework on the various types of waste in the tertiary institutions. The findings provide a key instrument for waste identification, evaluation and highlighting the fundamentals that allow lean application analysis in the university. Perhaps, this study has the potential of contributing to bridge the research gap and possibly help to eliminate all forms of institutional waste by improving the processes of lean integration and implementation in tertiary institutions. This study expands the body of knowledge on lean operation and waste in tertiary institutions, because very little literature is known on administrative waste and lean management in the various universities in Ghana. The highlight of this study is that lean operation is a significant feature of multidisciplinary standpoint that is adopted to enhance the sustainability of tertiary education in Ghana. However, the managerial implications on this study is that, it will update the university management on the main principles of lean application that should be adopted to avoid waste and improve quality of services to the university community. Though, the implementation of lean will definitely come with resistance from sections of the university, this study would enable university management to confront those challenges tactically. Generally this study brings in a novel framework that can be applied by university management in recognition and prioritization of various kinds of waste as a principle of lean implementation in the university.

The outcome of this study is inspiring, but is fashioned with certain limitations that cannot be ignored. First and foremost, the prejudice inherent in the data collected and the subsequent evaluation of the individual perspectives. Other shortcoming of the study is the arithmetic mean of the participants' perceptions and viewpoints from different units and departments of the university.

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