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The Effect of Lean on Improving the Quality of Higher Education in Indonesia

[1)]Andri Oktarian,[2)]DadangSurjasa
[1,2)]UniversitasTrisakti
andrio.oktarian@gmail.com

ABSTRACT

Higher education essentially needs to pay attention to the quality of its graduates, whether it is by the current market demand for the world of work. To provide a quality education service, it is not enough to make improvements within the tertiary institution. In general, Lean management in tertiary institutions has 3 fields, namely the field of education, the field of research, and the field of service. The principles and practices of Lean management applied in universities are the same as those applied to the service, manufacturing, or government sectors. To eliminate wasted time, it is necessary to eliminate complexity, cost, or activities that do not add value.Lean principles such as just-in-time can be applied to a better quality of learning and research. This paper examines how Lean principles can be applied to education and research in universities - Lean Higher Learning and Lean Research with a focus on value flow analysis for better quality improvement of learning and research.

Keywords: *Lean HigherEducation, Lean Management, Research*

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**Corresponding author*

INTRODUCTION

Educational Institution is an institution that is given the task and authority to carry out activities in creating the continuity of the quality of human knowledge so that it has the quality and can achieve a goal in life in the future. Education is a conscious and planned effort to create an atmosphere of learning and the learning process so that students actively develop their potential to have religious-spiritual strength, self-control, personality, intelligence, noble character, and skills needed by themselves, society, the nation, and the State.(Law 20 of 2003, nd)Education has a very important role for mankind because education can form humans with quality integrity and away from ignorance. Even the state regulates the rights of every Indonesian citizen to get an education (Sujatmoko, 2010).

Currently, education can be achieved both formally and non-formally. For formal education, the highest level of education is found in tertiary institutions. At present, almost all people are competing to be able to continue their education to higher education, with the hope that besides gaining knowledge it is also easy to find work because the demands of companies as users of education graduates require a college diploma to be able to contribute to work (Simangunsong, 2019).

Higher education in essence needs to pay attention to the quality of its graduates, whether it is by the market demand for the world of work. Therefore, universities need to continue to improve the quality of graduates produced because competition in the world of work is already very tight from day to day as evidenced by the large number of productive age population who do not work as can be seen in Table 1.

Table 1: Unemployment Rate in Indonesia

Age group	**Open Unemployment Rate by Age Group**		
	2019	**2018**	**2017**
20-24	15.62	16.73	16.62
25-29	7.18	6.99	6.76
30-34	3.55	3.47	3.40
35-39	2.26	2.49	2.45
40-44	2.08	1.81	1.86
45-49	1.82	1.58	1.51
50-54	1.66	1.40	1.54

Source: BPS.go.id

Competition in the education industry is a challenge for higher education institutions in carrying out educational service activities. Higher education institutions are required to think hard in implementing competitive strategies by producing educational services that can form personalities and broad insights for students. To provide a quality education service, it is not enough to make improvements within the tertiary institution. External factors also have a considerable influence on the quality of higher education, external factors influence are the participation of stakeholders, starting from suppliers (student suppliers, namely secondary schools), companies (universities), and customers (graduate users, namely companies).

Therefore, universities need to carry out management engineering by applying the concept of lean management. The application of lean management aims to regulate and control supply activities within the company to entities that do not have beneficial values. In simple terms, lean management is the control link in the chain from suppliers or suppliers to customers. With the implementation of lean management, it is expected that the chain can be controlled which simply consists of one supplier and one producer. However, it can also be a complex chain, consisting of many suppliers, many

manufacturers, many agents or wholesalers, which in universities have their language for all of them.

In general, higher education supply chain management has 3 fields, namely the field of education, the field of research, and the field of service. Where there are suppliers in the education sector are secondary schools, and consumers or those who absorb processed products from higher education are industry/companies. In lean management that focuses on education, it is important to understand the area of higher education supply chain, where if a gap is formed between the number of college graduates and graduates who are absorbed by the industrial world, it is necessary to do a process flow analysis. Either as a whole supply chain or partially. Where there are several types of supply chain measurement/analysis.

With this analysis, it can be concluded that the performance of each supply chain, as well as the entire supply chain, needs to be streamlined from activities that do not have added value in carrying out higher education programs and goals. From the analysis process in this paper, the author has a goal that the application of lean can provide the right solution to improve supply chain performance in universities. So that a university not only creates a lot of graduates but can also create a harmonious relationship between graduates and the level of intelligence of graduates so that all graduates can feel the benefits after completing their studies at a university.

LITERATUREREVIEW

The Lean movement originating from Toyota Production Systems has inspired a wide variety of businesses and organizations including service and public organizations such as healthcare. If Lean principles apply in general, then they should also apply to university education. So far, there seem to be very few examples of how lean is being applied by universities. Daniel T. Jones co-author of "The Machine That Changed the World" said in connection with the conference keynote address in September 2012 that most of the examples with Lean at university so far had to do with administration.(Bozkus, 2011) uses “Lean Higher Education” primarily to explain how administrative processes can be improved. (Doman, 2011) also saw opportunities to improve administrative processes. (Antony, et.al., 2012)writes that: "Although LSS (Lean Six Sigma) as a strong business process improvement strategy has been around for more than ten years, its application in the context of lean is still in its infancy". Leaning education and research may have to be seen from a national perspective and not from a university perspective because it could be that the main waste created is in the system as a whole.

The very basis for the application of Lean in all organizations is the awareness and commitment of each member of the organization in applying Lean practices in everyday organizational life. It aims to make continuous improvements and increase the respect of each member of the organization. As an example of implementing Lean in an organization starting from the highest level, namely the manager. A manager will provide insight and understanding to employees, and guide the process of solving a problem.Employees need to learn how to ask questions that allow them to solve problems on their own in the field, of equal or better quality than a manager's expectations. Usually, problems occur when a manager cannot delegate repair tasks to subordinates so that problems cannot be unraveled and resolved which makes problems at work prolonged, this can affect work productivity to below.

Lean Management

The theoretical basis for Lean is based on (Liker, 2004). We focus on part II which is called: The right process will produce the right results.

Table 2: Different types of waste according to (Liker, 2004)with interpretation for university processes. The type of waste selected for further analysis is indicated in bold.

Waste	UniversityInterpretation	Comment
Transportation	Transport of students from home to university and within the university	Could be relevant when comparing distance and campus education not only from a time perspective but also from a sustainability perspective
Inventory	Frontloading (storing) of knowledge which is supposed to be used much later	The problem with attending theoretical courses like mathematics that are supposed to be used much later is that much of the acquired learning is not retained in memory and therefore waste
Motion	Not analyzed	There is no obvious relevance for this in education
Waiting	Waiting for entry, for courses, for exams, for teacher feedback, for paper review, acceptance, publication etc.	This could be the most important waste in education and research
Over-processing	In the research process the peer review system could lead to over-processing	With different reviewers having aspirations to keep high standards on all levels this could lead to lengthy non-value-adding waiting
Over-production	An example is a university education without employment opportunities. Research papers mainly for the purpose of merits	One interpretation could be that doing things not asked for by the customer are seen as over-production
Defects	Course throughput and failed articles	Under-production or not doing things needed could be interpreted as defects
Unused creativity	Could be a problem	Varies depending on leadership

Here, we look at the principles: Create a continuous process flow and use a pull system. This was chosen because here the impact on customers is believed to be significant. Other principles such as lightening the workload (heijunka) focus more on productivity. We are particularly focused on the principle of continuous process flow and value-added time analysis. Each process can be classified as added value, not value-added and waste. Processes that do not add value are necessary and can be like control, but do not add value. Waste must be removed.(Liker, 2004) discussing eight types of waste, see Table 2. Of these, we have selected the waste that we think is most relevant for university education and research processes.

Basic Principlesof Lean

Based on the Lean principle, visionary benchmarks are created for the education and research process. Trisakti is used as an example in the educational process. Without conducting a detailed examination, we assume that Trisakti can become a typical example of higher education in Indonesia. For the educational process, we use the example of a basic course in Quality Management, which is implemented both on campus and remotely. The education chosen is based on ease and access to information. The courses chosen have been taught for years at Trisakti University, Jakarta, where one of the authors studied. For the research process, we use the process of publishing fiction in scientific journals. An example of fiction is for a journal without open access. We use Table 2 as the basis for value flow analysis and identify waste in terms of time. We then discuss processes from the perspective of inventory, overproduction, and defects. Finally, we see how the principle of attraction can be applied.

The Difference Between Lean in College and Lean in Other Sectors

Lean applied at the college level follows more principles and practices lean managementthe same as that applied to the service, manufacturing, or government sectors.Lean management easily takes into account the unique governance structure of an educational institution in higher education. Lean management is more responsive to the needs of various stakeholders on a non-zero-sum basis and is therefore very well suited for the ongoing governance and quality improvement of higher education.

The teaching business of higher education learning or administration can be likened to Lean management practiced in other service sectors because teaching and administration consist of repetitive transactional processes, in whole or in part.Guidance for the implementation of Lean in tertiary administration and at a lower level in teaching is presented in the book Lean Higher Education, Improving the Value and Performance of University Processes. (Bozkus, 2011).

Impact of Lean in Higher Education

The impact of Lean on higher education (i.e. in academic activities), has been studied and has the potential to have benefits. Benefits include reduced waiting time, increased number of graduates, lower operating costs, increased student satisfaction scores, etc. A report analyzing Lean in higher education shows that the Lean principle has been successfully applied in several universities in Indonesia.(Langer, 2011) Various stakeholders in higher education are likely to perceive their organization as very different or have unique characteristics compared to other organizations or service businesses that use lean management.

Principles of Lean Application in Higher Education

Lean principles applied in supply chain management include the following five aspects:

1. Determine the linkages between each flow in the supplier network,
   Higher education institutions should pay extra attention to the development of the educational culture to improve the quality and ability of students as a whole to help students to overcome academic, personal problems and also to increase their optimism and self-confidence by contributing to providing good quality teaching by providing a learning experience that is quality. Educational aspects such as basic education, objectives, curriculum, methods, and approaches used,

available facilities and infrastructure, environment, evaluation, and so on need to be reviewed.(Mirfani, et.al. 2012). Given that the teacher is at the forefront of educational activities, the teacher must have awareness and responsibility for the duties and professions they carry.

Learning experiences are obtained supported by the creation of a clean school environment, good security services such as providing lost and found services, creating a good atmosphere around the school through music, and an overall comfortable environment to support learning motivation. Campus Physical Facilities are also one of the supporting aspects, namely several adequate parking lots, secure security, a clean food court with a variety of food choices, and a bookstore must be provided by the college.(Radnor & Bucci, 2011)

2. Eliminate or reduce time

   The big challenge in education is that there is not enough time to make more work activity simulations with on-the-job training (practical work). Time wastage needs to be eliminated by reviewing competencies in the curriculum that do not contribute to simulated work activities in making decisions and taking action. To eliminate wasted time, it is necessary to eliminate complexity, cost, or activities that do not add value. The final benefit of simulated work activities is that students' abilities are easily measured.(Wibowo, 2015)

3. Use visual communication

   Teachers also need to have attitudes as humans who think rationally (multi-dimensional), be dynamic, creative, innovative, productivity-oriented, professional, broad-minded, think ahead, respect time and always try to improve knowledge and skills in utilization. learning media based on technology and information (IT).

   There are many teaching methods underway, but not much learning. So we need a teaching staff who reflects as the best instructor in his industrial career. The best lessons are experiences directly experienced by the teacher to get the principles of learning through activity. by applying direct, active student simulations in courses to reinforce Lean principles. The ideal learning outcome is that a student has not only some skills to apply Lean principles, but especially the confidence to do so in the workplace.(Ismagilova, 2014)

4. Apply standard working methods

   In equating working methods, a national curriculum is used which is the task of the Ministry of National Education and locally the task of the District Education Office. In preparing the planning of learning programs, it must refer to the Content Standards (SI) and Graduate Competency Standards (SKL) as well as the KTSP preparation guidelines that have been compiled by BSNP. The implementation of KTSP-based learning includes three things: pre-test, competency formation, and post-test.

   After the competency is implemented, an evaluation is carried out which is divided into two, namely evaluation by the internal parties (teachers and school administrators), hereinafter referred to as self-evaluation and evaluation by external parties (independent bodies or school accreditation bodies). Evaluation targets broadly include input (including programs), processes, and results. Assessment of learning outcomes in KTSP can be done with class assessments, basic ability tests, the final assessment of education units and certification, benchmarking, and program assessment.(Wibowo, 2016)

5. Reduce or reduce procurement lead time and inventory waiting times.
   Students as knowledge users need to be given quality education that can compete and have a competitive advantage over other universities to complete their studies before the study period expires. To support this, higher education needs to position itself as the "procurement" of higher education.(Wibowo, 2015).

DISCUSSION

Process Analysis of Education and Research

Processes need to be explained with a purpose and with clear inputs and outputs. Value flow analysis is performed using ordinary tables for different sub-processes. For each step, current performance is compared against visionary best practices. These differences are described as the potential for improvement and are discussed further. Value flow analysis is mainly used to identify waste in the form of waiting. These steps are also viewed from a needs perspective. Where a process starts and where it stops can be discussed and can be the subject of managerial decisions. The question of where education and research start and end can have many answers.(Vukadinovic, et.al., 2017)defines a process as: "a process is a network of activities that are repeated in time, the purpose of which is to create value for external or internal customers". This definition is similar to other definitions found in the literature and serves our purposes. A process of creating value for customers. This requires us to define who the customers are.(Anvari, et.al., 2011)define customers as those we want to create value for. They note that sometimes defining who a customer is can be difficult. Their view of creating value is very broad, for example, future generations are also seen as customers. Applying this perspective to the educational and research process means that we may have to identify customers in several stages. The value created in the educational process is for students who need to increase their level of knowledge. In most cases, this knowledge, which is validated by the university, is then used to obtain employment. An employer is a person who pays for competency hours and who has special needs that must be met.(LeMahieu, et.al., 2017)states about education that: "So the end-user customers, from a practical point of view, our students and their employers". Communities, in the form of local and national authorities, are also employers, but also have an interest in public works to obtain tax revenue. The output of the educational process can be considered the stage when students have worked and have started working. Input can be interpreted as a decision by prospective students who need more competence. Research objectives can be discussed without ever reaching a universal consensus. Basic research has a possible future interest as a customer where applied research helps solve some known problems. Research performance in tertiary institutions is often measured by the number of publications and citations, but this is far from being the end consumer. Viewed fundamentally, it can be said that the purpose of research is to serve the public and business. Therefore, the research output can be seen as the value provided to an identified end-user. Input to the research process can be seen as identified knowledge needs. In Table 3 the proposed general steps of the education and research process are presented.

Table 3. Generic processes proposed in tabular form for education and research

Step	***University education***	***Output***	***University research***	***Output***
Enter	Competency needs	The decision to look for options	Need better knowledge	The decision to start research
Sub-process 1	Look for options	The decision to apply	Formulate a research plan	First plan
Sub-process 2	Prepare application	Applications sent	Applying for funding (optional)	Application
Sub-process 3	Wait	Decision on application	Wait	Decisions about application
Sub-process 4	Wait education to start with	Starting education	Waiting for fundingto start	Funding released
Sub-process 5	Doing education	End of education	Conduct research	Research result
Sub-process 6	Apply for job	Application	Research writingarticle	Sent Manuscripts
Sub-process 7	Wait decision	Decisions about profession	Wait	Review the decision
Sub-process 8	Waiting for it to startwork	Start working	Address reviewers comments	Resend
Sub-process 9	Work first probational period	Decision on continuation	Wait	New reviewers decision
Sub-process 10			Finalizing paper	Sent for publication
Sub-process 11			Waiting for the paperto be published	Publication
Sub-process 12			Use of paper for practical applications or as input for other research	Effects on society
Output		Employer and employee satisfaction levelseducation competence, employability as a retained percentage compared to the finished one education		Verified contribution compared to the time and money it was used for research process

Educational Process

The visionary Lean education process can be derived from the selected Lean principles. In Table 4 the proposed benchmark process for the Quality Management course is presented in parallel with the campus and distance courses.

Table 4. Indonesia's quality management education processes were reviewed and compared against proposed benchmarks.

Step	Quality Management Coursescampus	Quality Management Coursesdistance	Quality Management course benchmarks	Comment
Competence need identified	Look for options via the university's website or SIS USAKTI which lists all available education	As for the campus	Can be SIS USAKTI but, other than thatcourse contentand pedagogy are designed based onstudent needs.How to learn based on learningpreference; Speedtailored to student availability	Website SIS USAKTI provides a good rundown ofTrisakti University education
Submit application	Apply in a suitable Trisakti university - geographically restricted selection; application twice per year Create an account and send it via Studera.nu	For campus, not limited to location. Currently a limited number of places	It could be www.studera.nu but with a continuous review of the application	Applications can be sent twice a year, most recently 3-4 months before startingeducation. Most of thetime wasted with a fraction of not adding value time.
Waiting for an application answer	About 2-8 months	As for the campus	No waiting	Most of the time is wasted
Waiting for education to begin	2-4 months	As for the campus	No waiting	Wasting time
Doing education	At least 10 weeks	As for the campus	Flexible speed based on need	Offeringsalways learnedsupplied at 50% speed
Applying for a job (using it's knowledge)	Not analyzed. In most cases of course part of the program.	For adult students working in an organization	Direct use	Need to be based knowledge According to the pull system as a

Step	Quality Management Coursescampus	Quality Management Coursesdistance	Quality Management course benchmarks	Comment
		biased knowledge is usedsoon		rule

"Creating a continuous process flow" means that education is tailored to the needs of students. This means that the process must be started as soon as there is a need for competence. There should not be a break like the current long summer vacation, which is customary in Trisakti education. A student who has completed a certain part of the course must be able to continue directly. In the visionary standard, education is individual and based on a "one-part flow".

"Using a pull system" means education must be driven by need. That is, the need for competence in society will guide the educational process in such a way that it can be adjusted to produce relevant competencies in the numbers needed. The challenge may seem impossible, but it can be compared to a car development and manufacturing process where the waiting time for a new model has been drastically reduced and where cars can be produced per order. Perhaps the modular thinking of car manufacturing can be applied to education. A five-year engineering program in its newest "model" may have a fixed number of general education modules, as is often the case with topics such as mathematics and certain science courses.

Table 5 Flow analysis of time-critical sub-process scores of quality management education against benchmarks with comments.

Step	Quality Management course campus	Quality Management course distance	Quality Management course benchmarks	Improvement potential and comments
Waiting for answer to application	Some 2-8 months	2-8 months	0	Wasted time in average about 5 months. The time checking the applications are non-value adding time. This is most likely very short and counted in minutes.
Waiting for education to start	2-4 months	2-4 months (but could be years due to low availability)	0	Wasted time
Doing education	Minimum 10 Weeks	Minimum 10 weeks	Could be anything above 2 weeks	The value-adding time reference is 200 hours or slightly more than a week. The best performing a student might be able to manage with 100 hours and to do it in two weeks
Time until using knowledge	Not analyzed. In most cases the course would be part of a program and used later. Time in years	From 0 months up	0	For distance courses with mature students using knowledge could easily be immediate. For campus students the ideal case would be to be able to use the knowledge in other courses and in practical work.

Step	Quality Management course campus	Quality Management course distance	Quality Management course benchmarks	Improvement potential and comments
Total time	> 25 weeks but mostly several years	> 25 weeks with an average best performance at about 36 weeks	Minimum 2 weeks	The wasted time in the current educational processes are > 90% compared to the proposed benchmark process.

The challenge for individual courses is easier. For life-long learning, Trisakti university offers a variety of free courses for those who have the necessary university entry requirements. This means that when the need for additional competence in work-life arises, this pull should trigger the start of an educational process. The benchmarking process must be able to assemble an educational offer that is appropriate in content and quantity to the needs of the students. Here, access to knowledge can in most cases be made ten times faster. The potential for improvement in the form of waiting can be seen from various perspectives. Based on the principles of quality and lean, the customer must be the focus. We can consider that eliminating waste in the form of waiting in distance education, which in the current situation could reduce knowledge transfer for 100,000 people from a minimum of 25 weeks to just 2 weeks. By applying the philosophy of distance education, universities in Indonesia will be economically and technically feasible. At first, this could be a distance lecture strategy - Great Online Courses.

This shows that there is still waste in the form of less production. Using automated or semi-automated courses has low variable costs, which means that more potential value in the form of knowledge transfer can be achieved at a low cost. There is one unit of waste that is essential in doing the wrong thing or in other words not educating what is needed. This waste can be seen as "defects" (lack of required knowledge) and as "overproduction" (irrelevant knowledge). The long waiting time of the need to use knowledge increases this risk.

For campus lectures, an important issue is an inventory or initial load of knowledge. Students learn things that should be used years later when much of what is learned risks being forgotten. It seems that the coping strategy might be overkill. The level of knowledge is taken far beyond what is required in most practices to ensure that at least the most important are retained. An alternative explanation is that university education aims at producing researchers, who would also in many cases qualify as overproduction. Yet another example of overproduction is mostly standard credit courses regardless of need. In Indonesia, most universities provide redundant courses. Suppose that often the need for course credit that materializes may not be for 200 hours of education but maybe less, indicating excessive production. Another important waste in the educational process is a form of disability that manifests itself in low throughput. Many students do not complete their education.

The main reason for waste in the form of waiting is the lack of drivers for change combined with old practices, perhaps stemming from the agrarian times when students were needed in the industrialized world as customers. Just-in-time can be improved significantly by focusing more on what the customer needs. The education market in Indonesia is a planned economy in which the state determines its market share in terms of the maximum number of student enrollments. This provides little incentive for universities to change. Establishing admission to a large number of students will reduce the number of students for other courses or result in no remuneration for the number of students who exceed the quota. In the university student allocation system it is distributed between different faculties and departments.

The principle of avoiding an inventory of knowledge is much easier to solve with mature students. In most cases, they have the organization to apply the knowledge to and they are in a good position to determine what their needs are. To achieve the same for young college students without work experience is an even bigger challenge. This means having an education, which is much more integrated into work life. An example is the internship system that is transferred to the university level. The approach is to learn through real-life examples. For example, students who have completed Secondary School in science can apply for a four-month paid training period with a reputable company in Indonesia. It aims to encourage students to initiate technical education but will also serve as potential recruiting for companies that have been nurturing trainees. This will make it possible for university programs with

those who have completed a trainee period to put theory into practice in an organization. This will make the educational process leaner by reducing frontloading and by seeing that theory and practice are combined to a level that guarantees better retention of what has been learned.

Research Process

The general research process has a lot of waste in the form of waiting times. Table 5 presents a superficial review of the research process as one that leads to journal publication. A research project from idea to sharing information with those who are interested should not take much longer than the research itself. For studies published in journal articles, the benchmark time can be 1-3 months. Based on the estimates in Table 6, the time from idea to publication will be around 10-40 months when submitting a funding application. This represents a waste of waiting for around 90% which is similar to the educational process.

Tabel. 6Value flow analysis of time-critical sub-processes of a research process based on Swedish experiences compared to benchmark with comments.

Step	Typical research process	Proposed Benchmark research process	Improvement potential and comments
Formulating research plan	Varying	Varying	Generally, the benchmark research processwith a focus on supporting society might haveto more clearly combine customer needswith researcher interest – both are needed
Applying for funding and waiting for decision	3-12 months	3-12 months	Mostly waste with a small portion of non-value adding time in writing the applicationand when the application is reviewed. The the process has a lot of waste in the form offailed applications (defects)
Waiting for funding to start	3-6 months	0	Waste. Funding often starts with a newcalendar year. This adds no value to theresearch.
Doing research	Varies	Varies	Important to have a continuous process,with little inventory, avoiding over-production, and doing the right thing (lowlevel of defects)
Writing research article	Varies	Varies	Should be part of the continuous process
Submission todecision	Varies but couldbe 1-6 months	<1month	Mostly waste in the form of waiting with asmall part as both non-value adding andvalue-adding in the form of feedback
Addressing reviewer comments and	Varies but couldbe 1 month	<1month	Value-adding combined with waste in theform of waiting (author improvementpotential)

Step	Typical research process	Proposed Benchmark research process	Improvement potential and comments
resubmitting Waiting for reply	Varies	<1 week	Waste in the form of waiting
Waiting for the paper to be	Varies but couldbe 3-12 months	0	Waste in the form of waiting. Many publications provide a digitalversion at this openaccess. Restricting the access of research work, especially when done with publicfunds, behind expensive subscriptions couldbe seen as a defect in the research process. Often publication is taken as the mainresult, possibly with the addition ofcitations.
Use of paper forpractical applications oras input forother research	Varies	Not analyzed	The final effects of the work on otherarticles and in the end on society are seldommeasured.

CONCLUSION

Lean management easily takes into account the unique governance structure of the higher education institution. The teaching business of higher education learning or administration can be likened to Lean management practiced in other service sectors because teaching and administration consist of repetitive transactional processes, in whole or in part. To eliminate wasted time, it is necessary to eliminate complexity, cost, or activities that do not add value. So we need a college that can deliver each of its graduates to the desired career gate as quickly as possible. Students as knowledge users need to be given quality education that can compete and have a competitive advantage over graduates from other universities to complete their studies before the study period expires. To support this, universities need to position themselves as the 'procurement' of universities.

The waste level assessed is around 90% of the time for both the education and research processes. This is what Liker (2004) suggests as an example of a typical level of time waste. The potential increase in distance learning processes with a focus on adult students may be realized without too much trouble. Here, the focus could be on shortening the delivery time from the need for knowledge to the knowledge used. The potential for upgrade reduces this time to as low as 10% of current deliveries. By assessing knowledge faster, the teaching and learning process will be faster. This has several advantages, such as providing newer knowledge and being able to use it more quickly. Another area allows for a flexible pace of study. These two areas of adjustment will make it easier for adult students to pursue university studies. Adhering to Lean principles and being able to make course content more relevant, adjust learning speeds, and faster educational delivery can provide a large increase in knowledge intake for adult students. This could be a sizeable national advantage.

The research process to produce a new journal paper is studied briefly. The indications are that there is considerable potential in making research available to the public faster than the typical research process. Issuance time can be reduced to 10%.

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