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LEAN THINKING PRACTICES AND FUTURE POTENTIAL IN THE EDUCATION SECTOR IN INDIA

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ABSTRACT

This research investigated the challenges and barriers for lean thinking implementation in the higher education sector in India. Also, it focuses on identifying the role of lean thinking in eliminating the wastes of the higher education sector in India. The study's most important contribution is to offer insights to education institutions that eliminate wastes in the higher education sector. Thus, the research is motivated to address the research purpose through an independent sample t-test. The education sector faces constraints like the absence of commitment from top management, lack of clarity and openness in communication, insufficient planning, coordination, and coherence of the actions and the changes brought to processes, no precise definition to resolve the problem, and inadequate justification which is high in a private institution than a public institution. After implementing lean thinking practices, the role of eliminating wastes may vary between public and private institutions. Four wastes (people, process, information, and assets) wastes have been taken into account. Public institutions have adopted the practices to reduce wastes in people, processes, and information waste. However, private institution lean thinking principles reduced assets wastes. Thus, it is clear from the outcome that public institutions have reduced waste more than private institutions.

Keywords: Education sector, lean thinking principle, public institution, and private institution

INTRODUCTION

Lean is a set of principles and practices developed over several decades to have operational excellence. In the last decades, lean concepts have been effectively utilized in public and private sector organizations (Alsmadi *et al.* 2012). The concept focuses on having continuous improvement, and at the same time, it respects the employees as a key to enhance product or service quality. Implementing the concept in the respective organization gives aids like the high engagement of employees, recognize the benefits of product quality, and increment customer satisfaction and profits. Recently, service industries have given tremendous importance to lean concepts to boost the performance in the delivery of top-quality service. It identifies how to reduce waste through the implementation of lean concepts (Schiele, McCue 2011).

Service companies have to follow the concept to reap a competitive advantage. Hence, the competition influences many education institutions to seek improvement in response to higher education market demand. The institution is under severe pressure to meet the expectation of students, faculty, and other members. They have to reduce the expenses in an age of rising costs, declining financial resources and meeting the public's needs effectively. Besides, education institutions have to fulfill the educational, scholarship, and outreach mission of higher education. However, education in India faces difficulties due to globalization. Also, administration issues, assets market have ruined the industry to a great extent. Hence, the education institution needs to balance quality education, good infrastructure, and cost. An efficient management leader, thinker, and strategist is a complex task for the institution. Therefore, many educational institutions try their best to balance the aspects and profit based on existing resources. But the utilization of existing resources can't make any differentiation with other institutions. It is changing rapidly. Thus, it is essential to adopt new teaching and learning approaches to distinguish them from others, give the students a higher value-adding proposition, and focus more on the customer. To achieve the above-stated objectives, it is essential to use the lean concept effectively. It helps the institution to achieve an economically sound and more efficient institution.

Implementing strategies like lean, six sigma in business organizations poses them to face their challenges. Similarly, the implementation of lean six sigma implementation leads to many fundamental problems (Antony *et al.* 2012). Some of the problems associated with lean higher education are lack of awareness of lean concept in the education sector, absence of engagement, and team members' encouragement. Altogether, reap to face challenges and barriers in implementing it in an educational institution. Thus, the study paves the way to recognize the challenges the education institution faces while implementing India's lean concept.

Lean concepts improve areas like inducing students to develop efficient solutions, encourage them to make key decisions, change processes, allow institutions to deal with quick gains, and deliver immediate repercussions that allow the faculty to look at students' enhancement (Radnor, Bucci 2011). Thus the aspects induce the researcher that how lean concepts eliminating the wastes in the education sector in India

Lean in higher education uses to design, deliver the courses and programs to improve the grading system and improve learning assessment practices (Emiliani 2015). Lean concepts and their consistent application of principles and practices diminish the teaching errors and ensure a steady student workload and free curricular resources flow. Some of the tools, like value stream mapping, cause and effect diagram, and Pareto charts, improve teaching materials. By doing so reduces wastes, increases the flow, eliminates content errors. The major limitation of using the concept is that it will create more faculty workloads (Alagaraja 2010). The aspects assist the researcher in finding out the impact of lean concepts on India's education sector.

The objective of the study is to identify how lean thinking eliminating wastes in the education sector in India and to find out the challenges and barriers for lean thinking implementation in the education sector in India and also

Evidence from the studies indicated lean thinking helps determine the wastes and provide a solution to eradicate higher education waste (Antony *et al.* 2015; Klein *et al.* 2015).

- How does lean thinking eliminate wastes in the education sector in India?

Many studies focus on identifying the challenges and how it influences the adoption of lean thinking in higher education in India (Comm, Mathaisel 2005; Coowar *et al.* 2016; Radnor, Bucci 2011; Waterbury 2015; Francis 2014; Kruger 2015;).

- What are the challenges do the education institutes face for implementing lean thinking in higher education in India?

The hypothesis of the study includes

There is a significant difference in lean thinking barriers between the public and private institution

There is a significant difference in people wastes between the public and private institution

There is a significant difference in-process waste, which varies between public and private institutions.

There is a significant difference in asset waste varies between public and private institutions.

There is a significant difference in information waste between public and private institutions.

The significance of the study is paramount as it contributes valuable insight into how education wastes are controlled by implementing the lean thinking principle in the respective institution. Assessing the wastes and find out the barriers faced in implementation provides complete knowledge to the researcher regarding the importance of lean thinking in the education sector. The results of this study may be utilized to intimate other institutions regarding the benefits of lean thinking principles and how lean thinking eliminates wastes in the education sector.

The researcher had an interest in the lean thinking principle theoretically. Subsequently, the researcher is quite interested in studying how the lean thinking principle is following in the education sector in India. The idea induced the researcher to concentrate on the "role of lean thinking on the education sector in India.". In this study, the researcher measures the lean thinking principle based on two aspects. One aspect is to measure the challenges faced by education institutions in adopting the lean thinking principle. The second aspect is to study how lean thinking eliminates wastes in the education sector in India.

Chapter scheme

Chapter1: Theoretical background of the study

Chapter 2: Research methodology

Chapter 3: Analysis, summary findings, implications, and discussion

Conclusion

1. THEORETICAL BACKGROUND OF THE STUDY

1.1. Higher education

Higher education refers to having education over secondary level. Generally, higher education courses are studied at universities, university colleges, and higher education institutions. It also contains certain college-level institutions, including vocational schools, career colleges that award academic degrees and professional certifications. Higher education is a process of drawing out and nurturing the values latent in individuals. It also includes the additional responsibility for institutions in preparing students from a holistic view. It directs the students for the betterment of society (Bebedelis 2008). In the present competitive education system, engineering colleges, arts and science institutions, and B-schools dominate the higher education system. It is more complex and diverse, integrating the dominant public sector of state universities and community colleges that offer most students education. Also, it offers aids like advanced peer learning, enrich disciplined knowledge, and field placements (Bynner *et al.* 2003)

1.2. Higher education in India

In India, various kinds of universities and colleges existed makes the education system to be complex. The India survey of higher education reported more than 45000 institutions that include 903 universities, 10011 stand-alone institutions, and more than 35000 colleges in India (AISHE. 2018). Nearly 36.6 million students had enrolled in higher education, which indicates 25.8% of the gross enrollment ratio. Out of 36.6 million students, 36.4% of involved in the UG program, 17.1% in the science program, and 14.1% in engineering and commerce. Subsequently, GER of higher secondary schools is 62.5% which is 13.5 million students enrolled per year. Though students are highly enrolled in higher education, students still had difficulty accessing higher education quality (Sharma 2018). The most important challenges in higher education are shortage of faculty, lower teaching methods, traditional teaching methods, limited funding, and raised issues over higher education quality for the respective students (Sheikh 2017; Chahal 2015). To eradicate the challenges, the education

sector keen on applying lean thinking principles, which have led to significant improvements in the respective sector (Sunder 2016)

1.3. Lean thinking

Lean thinking refers to "the endless transformation of wastes into value from a customer point of view." The other definition of lean thinking is that it is a" way to specify a value, line up value-creating actions in the best sequence, conduct these activities without interruption whenever someone requests them, and perform them more and more effectively" (Womack, Jones 1997). Lean is a management philosophy and methodology. It uses various tools and techniques to improve quality and diminish wastes (Waterman, McCue 2012). To avail such benefits, the management needs to take a system approach to view how it offers benefits to the organization. The system consists of processes that deliver output in products or services to internal or external customers. Examining the process helps identify the areas where exactly improves requires; this is possible by applying lean tools (Radnor, Boaden 2008). It is based on five principles that directly address the challenges within and between the business units. The basic principle of lean thinking is that it defines value from the customer's point of view, finds out the value stream, makes the value flow, implements pull-based products, and continuously strives hard for perfection.

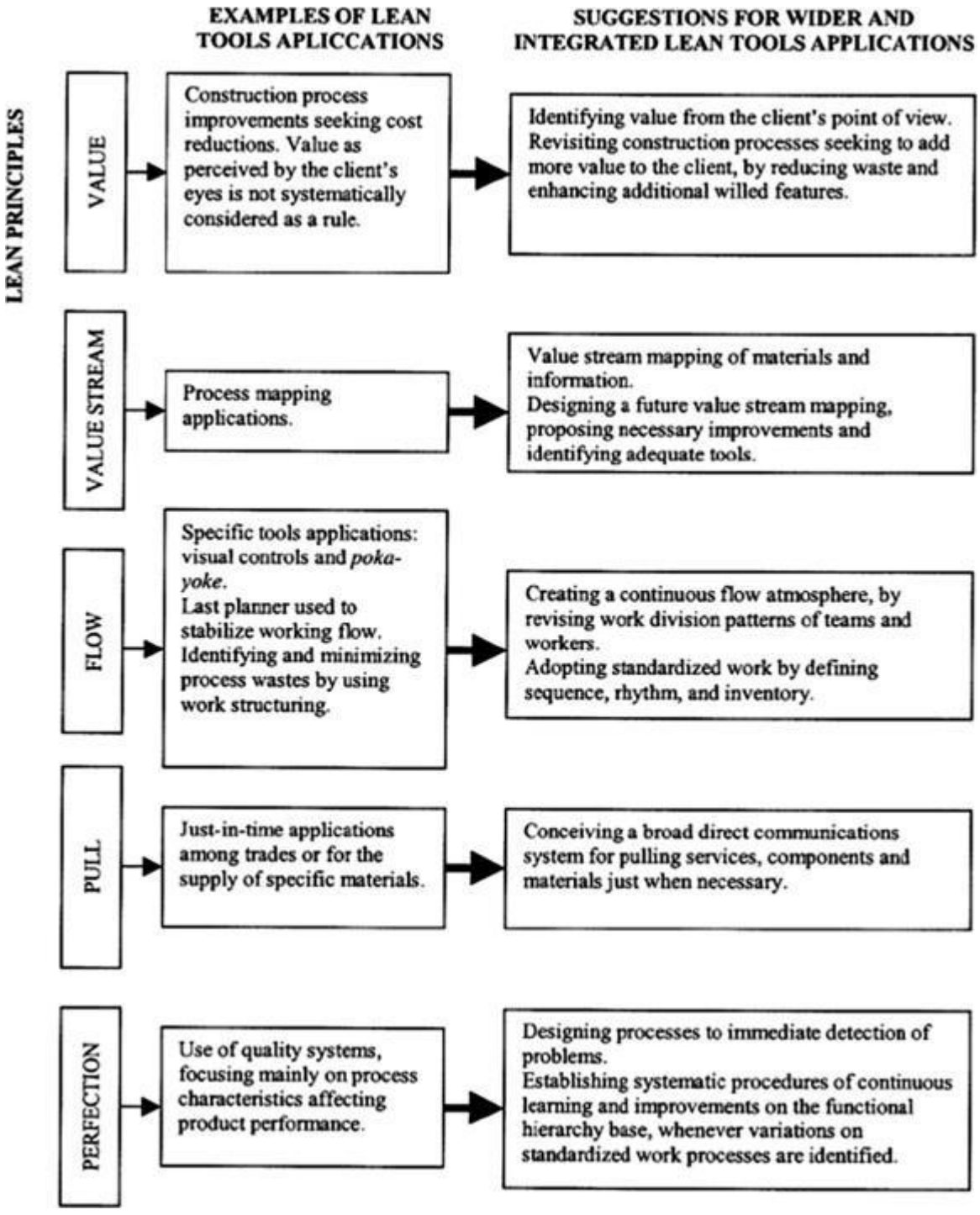

Figure 1 Lean thinking
Source: Radnor, Boaden (2008)

However, the other author pointed out that there are eleven thinking principles (Aziz, Hafez 2013). It includes reducing the share of non-value-added activities, accelerate output value, reduce variability, diminish cycle times, simplify the steps in minimizing the number of steps or parts and linkages, accelerate output flexibility, increase process transparency, concentrate

on control, i.e., the entire process, setup continuous improvement into the process, balance flow improvement with conversion improvement and benchmark.

1.4. Lean thinking in the education sector

In the twenty-first century, the education sector has to face challenges from quality, effectiveness, efficiency, flexibility, transparency, and accountability. It is crucial for education institutions to adopt lean thinking principles to improve the efficiency of the education sector (Maciąg 2019). Higher education institutions have lean practices that improve processes' efficiency, eradicate wastes and non-value-added activities. Cardiff University had first lean thinking in Universities event in 2008. The University of St Andrews hosted the second in the series in 2010. Some of the universities like Coventry University, central Connecticut state university, MIT, Oklahoma state university have adopted lean (Antony 2014)

1.5. Wastes in the education sector

Wastes are any step in education processes that consume resources but no value, as seen from the beneficiary's perspective. Estimates of waste in the education sector are high (Balzer 2020).

Some of the education sector wastes are in admission, teaching and learning, research and development, strategic planning, and administrative procedures emerged while processing the information. Lean thinking uses to reduce the wastes that emerge in the education sector. Lean thinking's main objective is to remove all waste types and accelerate the flow (Chiarini 2011). There are ten attributes in implementing lean to identify the waste (Sfakianaki, Kakouris 2019). There are four concepts of waste, the concept of seven waste, the concept of waste as non-value added activity, the concept of obvious waste, and the concept of waste buffers (Thürer *et al.* 2017). The concept of seven wastes is used widely in the manufacturing sector, and these wastes were not directly associated with higher education institutions. Studies highlighted twelve wastes like over-production, over-processing, waiting, motion, transportation, inventory, defect, talent, underutilized people, information,

asset, and rework (Antony *et al.* 2018; Sunder 2016; Kazancoglu, Ozkan-Ozen 2019; Narayanamurthy *et al.* 2017*;* Balzer 2010).

There are four types of higher education waste: people, process, information, and asset waste (Balzer 2010). People waste refers to waste when institutions fail to acknowledge and utilize employers and work groups' potential and capabilities.

Process waste indicates as it emerges when there are deficiencies in the design or implementation of higher education processes. Information waste exists when there is no sufficient information available to direct the process. Asset waste exhibits as not utilizing human resources effectively (Sunder 2016). Consequently, Antony *et al.* (2018) discuss eight categories of waste: excess motion, transportation, inventory, people, defects, overproduction, over-processing, and waiting. All seven types of waste exist in higher education institutions which have been proved (Narayanamurthy *et al.* 2017). A detailed description of wastes in the education sector is provided below

The first waste is **overproduction waste**. People in the process do not have the legal power to assess the tasks. Also, there are not sure about the desired capacity and required one. It can also be redundant information, and hence manipulations and modifications are not required. The best example of over-production waste is offering uneven tasks to academic staff.

The second waste is **talent**. It represents that not utilizing the capabilities and core potentials of students and employees. Also, engage both person capabilities in non-productive tasks. The best instance of talent waste is teachers don't work by their expertise.

The third waste in **motion**. It exhibits no organized structure for the teachers, which leads to unavoidable searching efforts and movement. The movement of teachers from one campus location to another location is the instance for motion

The fourth waste is **time**. It represents the waiting time to acquire a particular service. Wastes emerge when the information is either not available or not available in a proper context. It can lead to delay. The best instance for time is waiting for approval to do renovation or repairs.

Fifth, waste is **processed**. It refers to doing extra or unnecessary steps or reviews, approvals, and requirements, leading to information overloading. Instance for process waste is irrelevant or inaccurate information.

Sixth waste is **assets**. It indicates the extra physical resources or information overload.

The seventh waste is **knowledge**. Poor knowledge management leads to the recreation of all existing knowledge which exists. People do not disclose information and think it to be their prized possession.

Eight waste is a **defect**. It emerges because of imperfections or poor efficiency. It is vital to work upon the aspects and improve again.

All kind of the above-stated wastes is an obstacle to the education sector. Hence, it is crucial to eliminate the wastes, give aspects like the human workforce, and continuously improve efforts, which are crucial aspects of lean. Lean in the education sector practiced by redefining the systems so that there is no need for rework and make the information available. Training the workforce both in academic and non-academic practices through lean thinking and imbibe through methods and procedures. Also, integrate with peers in developing iterative procedures for making continuous improvement in the education system and procedures. Lastly, providing consistent training to the students in lean principles and practices improves the education sector's continuous improvement.

1.6. Barriers

The primary aid of implementing a lean strategy is that it eliminates everything which did not add value to the services. Every lean improvement could not improve the service sector because it is vital to make a considerable investment (Yusof, Aspinwall 2000). Some of the other obstacles are lack of technical and managerial expertise and HR deficiencies which affect the adoption of lean practices in the service sector (Achanga *et al.* 2006). The absence of staff commitment and training is the major hindrance to adopting lean practices in the service sector (Comm, Mathaisel 2005; Coowar *et al.* 2016; Radnor, Bucci 2011; Waterbury

2015; Francis 2014). Also, many studies highlight that lack of top management support restricts the organization from adopting implementing lean practices (Demirkesen *et al.* 2019; Rahman *et al.* 2013; Singh *et al.* 2010). One of the other barriers in the education sector is the misunderstanding of concepts, tools, and vocabulary (Waterbury 2015; Radnor, Bucci 2011; Kruger 2015). Consequently, resistance to change, poor management of conflicts affects the implementation of lean thinking in the sector (*ibid*)

1.7. Lean thinking manages wastes in higher education

Antony et al. (2015) Discuss the identification of eight wastes of lean for higher education institutions. It also finds a way to eradicate those wastes in the sector. With the help of observation and brainstorming, the study finds out the wastes. The study uses higher education academic staff and convenience sampling techniques applied to find an effective outcome. The study's findings show that inventory and human resources waste, excessive movement of people, and overproduction. It pinpoints that 5s, point of use storage, process mapping, and level scheduling used to eradicate the wastes in the education sector.

Klein et al. (2021) have pointed out how the lean approach helps eliminate waste in public higher education institutions. AHP methodology was applied to identify the wastes in a Brazilian higher education institution. The study identified seven wastes with knowledge wastes also taken into account. The study finds an outcome that the waste management framework uses to orientate academic and service industry staff of wastes. Out of wastes, loss of knowledge and over-processing waste is considered the most emerging waste in university campuses. Having a waste prioritization framework permits the university to plan the activities, organize them, select appropriate tools and practices, and optimize the final users' efforts and value.

The researcher observes that statistical tools' application helps determine the most significant wastes that affect the higher education institution.

1.8. Lean thinking in education

Balzer *et al.* (2016) focus on assessing lean thinking in the higher education sector. The authors consider using qualitative research to provide an outcome that lean creates a significant impact on the higher education sector and increases its value. Improvements in the respective department are substantial throughout the organization. Finally, the implementation of lean concepts has the highest impact, which extends it for strategic planning.

Narayanamurthy *et al.* (2017) are keen on developing a framework to offer a standardized procedure for implementing lean thinking in education institutes. To frame the researcher, adopt an action research methodology for 28 months. Consequently, the process assessed it using the case study method—comparing performance measures made between two batches. Batch 1 has performance without LT, whereas Batch2 has performance with lean thinking. The findings of the study highlight that both collections have absenteeism in the class. The magnitude of increase was lesser in batch 2. Lean thinking assists the students in increasing the utilization of seats in the elective course. Thus, the implementation of the framework guide students to accelerate their performance in their respective institutions.

Antony *et al.* (2015) said that the study finds out the eight wastes of lean concepts related to higher education institutions. Eight wastes include delay, duplication, unnecessary movement, unclear communication, incorrect inventory, opportunity loss, errors, and people. Findings of the study highlight that scraps were high at an educational institution. The application of lean concepts can reduce wastes, eliminate it, and improve performance at reduced costs. Besides, it can have the power to accelerate student satisfaction in the institution.

Vukadinovic *et al.* (2017) has stated how lean tools and principles increase the effectiveness of education. Besides, it also assesses how it makes professionals develop multidisciplinary skills and knowledge. Finally, the study finds that leans tools and principles improve the educational system of engineers. Also, it creates a platform for engineers to develop multidisciplinary nature of solving the concerns and meet the challenges made in the modern environment.

Antony et al. (2015) has claimed that implementing lean in higher education programs offers benefits to the university and individuals and employees. The focus is on analyzing the

success and constraints behind implementing the lean higher education program's useful application. The study finds that improving institutional readiness, creating awareness for supporting the program, making strategic planning, effective lean leadership, and facilitating lean higher education programs reduce the organization to a great extent.

Petrusch (2019) has shown how value attributes associated with academic and administrative services influence higher education institutions. The study assesses higher education institution students in Brazil. Integrating lean services and service theory assist in developing a conceptual framework to address the concerns. With the help of theory, the study determines the attributes like reliability, empathy, access, responsiveness, self-service technology convenience, communication, personalization, and imperceptibility. Finally, the outcome states that value attributes prioritization may vary based on the service and strategic positioning of the organization

Sunder (2016) has pointed out that identifying the quality constructs, its application followed by success and challenges faced in higher education services. The study observes the quality constructs relating to TQM, kaizen, six sigma, lean, and lean six sigma. It follows that applications of quality constructs improve the higher education industry. However, challenges were incapability in implementing it in the organization, creating resistance to change, economic and financial difficulties ruining the higher education industry face unable situation to implement lean concepts in the industry.

Dragomir (2013) has shown that how lean concepts are implementing in higher education universities. The case study techniques define the lean implementation made at US and UK universities. The findings of the study state that the primary driver for implementing the lean concept is budget reduction. Process improvement, continuous improvement influence the higher education institution to adopt lean practices in the university. Besides, it helps to enrich the communication between the department in the university.

Iswanto investigated lean practices in the higher education sector. Attributes like digitization, preparedness factors, faculty involvement, and academic leadership are the drivers behind universities adopting lean practices in the respective university. The above attributes influence the university to face success attribute's for exemplary lean implementation. Lean

implementation in business schools increases student satisfaction, reduces ambiguity, facilitates team assignment, and improves classroom time management.

Tılfarlıoğlu (2017) has pointed out that applying lean thinking and creating a lean culture classroom increases student performance. Findings of the study state that male students use to learn concepts more than female students. Also, gender is useful in the use of lean concepts in understanding the lean method. Finally, the study concludes that older students use more learning methods than others.

1.9. Research gap

The studies portray precisely that a meager amount of study has been done so far in lean thinking concepts, especially in India. Besides, most of the studies pinpointed above adopt either qualitative concept or meta-analysis methods. Studies have not been conducted to evaluate the lean concept using quantitative research methods. Therefore, the studies are keen on measuring the aspects using quantitative aspects and determine the impact in percentage.

2. RESEARCH METHODOLOGY

The research design intends to provide an appropriate framework for the study. The researcher has to make a significant design in the research design process, and the choice of research approach is in the hands of the researcher. Because it determines how relevant information for the study will be obtained (Jilcha 2019). The study is descriptive because it investigates the present phenomena of lean thinking in India's education sector. The reason behind picking out a descriptive research design is that the researcher needs to collect the data through research instruments. The outcome describes systematically the existing phenomena which have been undertaken for the study

2.1. Structure of University of Delhi

The University of Delhi is a collegiate public central university located in New Delhi, India. The primary function of universities is classified between academic departments of the university and affiliated colleges. In this study, the researcher classified into two types public (Academic departments of the university) and private (affiliated colleges). The academic departments of the university and affiliated colleges had a separate lean department in the respective institution. However, there are one hundred and twenty affiliated colleges associated with the University of Delhi. Each college has a respective lean department in their respective institution. Each lean department has one head member and four subordinates in the institution. The main intention of the department is to create a value stream map, set up a long term ideal state map, optimize the state map using lean techniques, create an implementation plan to turn the current state map into a short, medium- and long-term map, implement the plan and to provide leadership in the day-to-day operations of the value stream. The researcher approached all the lean department heads, assess the lean thinking principle of the respective institution.

2.2. Population

It refers to all members who meet the specific criteria of the research for investigation (Alvi 2016). Similarly, the study includes the employees who belong to the University of Delhi as a population.

Samples are a relatively small number of people from the huge population for investigation purposes (Ryan 2013). The present study considers the lean department employees who belong to the affiliated colleges of the University of Delhi

Sampling is the process of extracting a sample from the population is known as sampling. It is quite difficult to assess every member of the population, and hence a small group of the sample have taken through statistically and utilize the samples for assessment (*ibid*). In this study, the researcher has utilized affiliated colleges under the University of Delhi have taken into account.

To acquire an exact sample, it is vital to use appropriate sampling techniques. It is of two types, namely probability as well as non-probability sampling. Probability sampling has included each member of the population, and their probability of included in the sample is known. However, In non-probability sampling, the population unit did not give an equal chance of participating in the research (*ibid*). Out of two techniques, the most suited sampling technique is non-probability sampling. Among many non-probability sampling techniques, judgemental sampling has been taken into account. The sampling technique sets inclusion criteria as the colleges should be affiliated with the University of Delhi, and it should be within the geographical limit of Delhi. They should follow lean practices in their respective institutions. Besides, the study excludes the colleges, which are not within the geographical area of Delhi.

The sample size for the study is 78, which determines from the sample size calculator. The population is 120 institutions, 95% of the confidence interval, 5% as the level of significance which altogether gives the sample size is 85. The researcher has approached 85 institutions and the respective lean department head member of the particular institution, out of 85 (lean head) respondents, of which 78 have replied. The most suitable person to answer our survey is the head of the lean department. Therefore, the response rate for the study is 91.76%.

Data collection methods are a real challenge for the researcher who needs time and effort (Shekharan¸ Bougie 2010). There are two types of data collection methods. Qualitative and quantitative data collection methods. Quantitative methods measure the Likert scale, and it can be mathematically computed, whereas qualitative is descriptive. Among two, the researcher has picked out quantitative data collection methods. Because the researcher had Likert scale questions and hence the most suited approach is quantitative data collection methods. The strategies were applied to collect data from respondents through a questionnaire. The researcher has framed the questions so that it has open-ended, close-ended, and Likert scale questions. The study has framed the questions in google form, sent the link to respective institutions. Respondents who are head of the lean department in respective institutions have provided their opinions in google forms. The researcher downloaded the responses, coded them into SPSS, exhibits the analysis in the subsequent section.

2.3. Reliability and validity

Reliability refers to an indication of stability and consistency. The instrument can measure the concept and assist in measuring the goodness of measure (*ibid*; Zikmund 2003). The researcher measures the internal consistency of items, which indicates the homogeneity of items in the measure that tap the construct. Cronbach alpha has been used to evaluate the internal consistency of constructs. It is commonly used to estimate the reliability of constructs for a sample of examines (Cronbach 1951). Measuring thirty-five questions shows that the Cronbach value is 0.90, which shows that the internal consistency is higher. It excludes respondents' profiles and includes the constructs that have been measured through a five-point Likert scale. However, validity defines as how well the particular constructs measures the right concept or not (Shekharan¸ Bougie 2010). The researcher has validated the constructs through content validity. It reveals that the more contents represent the content, the higher the content validity. The researcher intimated the educational experts to rate the constructs. Nearly raters have asked to express their opinion through dichotomous scale in terms of readability, clarity, and comprehensiveness of constructs. Three raters have provided their opinion; evaluated the opinion through Cohen's kappa coefficient. It provides the kappa value is 0.93, which indicates that the constructs have a perfect agreement.

2.4. Tools

The study has utilized frequency distribution, descriptive statistics, and independent-sample t-test. Frequency distribution applies to express the profile of respondents who participate in the survey. Respondents' opinion exhibits in the form of tables and graphs. Consequently, descriptive statistics assess the variables that have been asked in the form of a Likert scale. The primary purpose of using descriptive statistics is to know the average value of Likert scale questions and measure those variables' accuracy. Average values have gained from mean whereas accuracy through standard deviation. Both aspects have been taken into account. An Independent sample t-test uses to dissimilar the mean of two different groups.

2.5. Ethical consideration

The researcher has to give more importance to ethics while selecting appropriate methodology and methods to conduct the study. The study has to identify the respondents, and their names and opinion should be kept confidential. Also, the researcher is keen on avoiding self-identifying statements and information. The main intention of eliminating such questions to safeguard the respondents from potential harm. Respondents' identity is completely unknown in the study; opinions have recorded confidentiality and used only for the present research purpose. The researcher is sure not to harm respondents physically, emotionally, or psychologically.

3. DATA ANALYSIS

3.1. Demographic profile of respondents

The researcher assesses the demographic profile of respondents through frequency distribution. It contains categories as age, gender, and education qualification. Age has a sub-category like 20-25 years, 25-30 years, 30-35 years, and above 40 years. Gender includes males and females. Education qualification has a sub-category like a bachelor's degree, master's degree, and Ph.D. A detailed analysis of the demographic profile of respondents highlighted below

Table 1: Demographic profile of respondents

Particulars		number of respondents	percentage
Age	20 to 25 years	12	15.4
	25 to 30 years	27	34.6
	30 to 35 years	24	30.8
	Above 40 years	15	19.2
Gender	Male	48	61.5
	Female	30	38.5
Education qualification	Bachelor degree	21	26.9
	Master's degree	27	34.6
	PhD	30	38.5
Total		78	100.0

Author: own calculation

Age: Out of 78 respondents (100%), 34.6% of respondents are between 25-30 years, followed by 30.8% of respondents between 30-35 years of age. Also, 19.2% are above 40 years of age, and 15.4% are between 20-25 years of age. Thus, the researcher observes that most respondents are between 25-30 years of age.

Gender: The researcher classifies into male and female. Among 78 respondents, 48 are male, whereas 30 respondents are female. Hence, it is clear that the highest number of respondents willing to participate in this survey are male respondents

Education qualification: The researcher categories education qualification into bachelor's degree, master's degree, and Ph.D. Out of 100% of respondents, 38.5% Ph.D., 34.6% possess a master's degree as their education qualification, and 26.9% have. Thus, it found that the highest number of respondents have education qualifications is Ph.D.

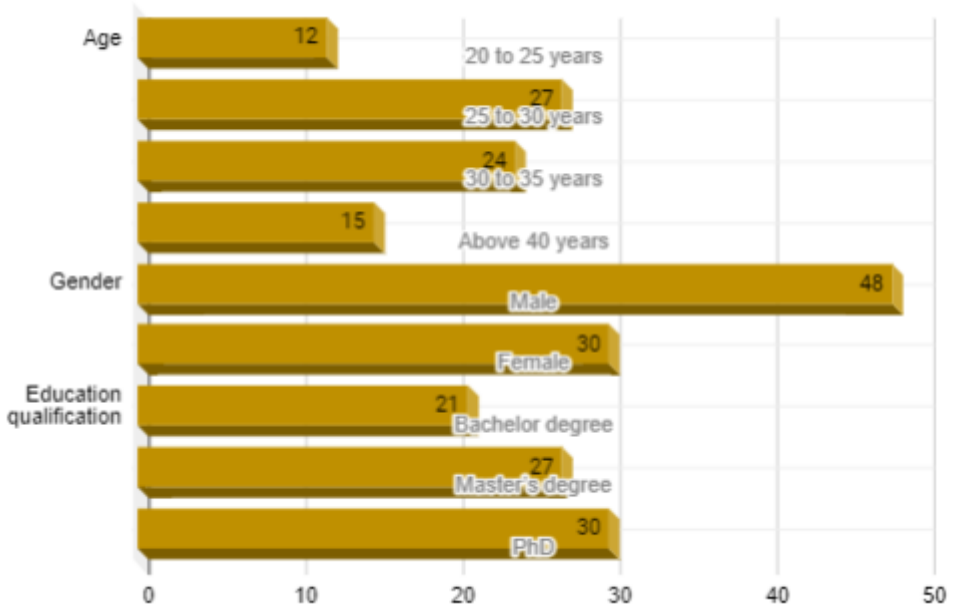

Figure 2 Demographic profile of respondents
Source: Author calculation

3.2. Higher education institution

The researcher observes that the respondents who belong to the public and private institutions have taken into account. The frequency distribution of classification of higher education institution have shown below

Table 2: Higher education institution

Particulars	frequency	percent

Institution	Public	35	44.9
	Private	43	55.1
Total		78	100.0

Author: own calculation

The table shows that the institutions are classified into public institutions and private institutions. Among 78 respondents, 43 respondents (55.1%) belong to private institutions, whereas 35 respondents (44.9%) belong to a public institution. Thus, it observes from the table that the highest respondents who participated in this survey are private institutions.

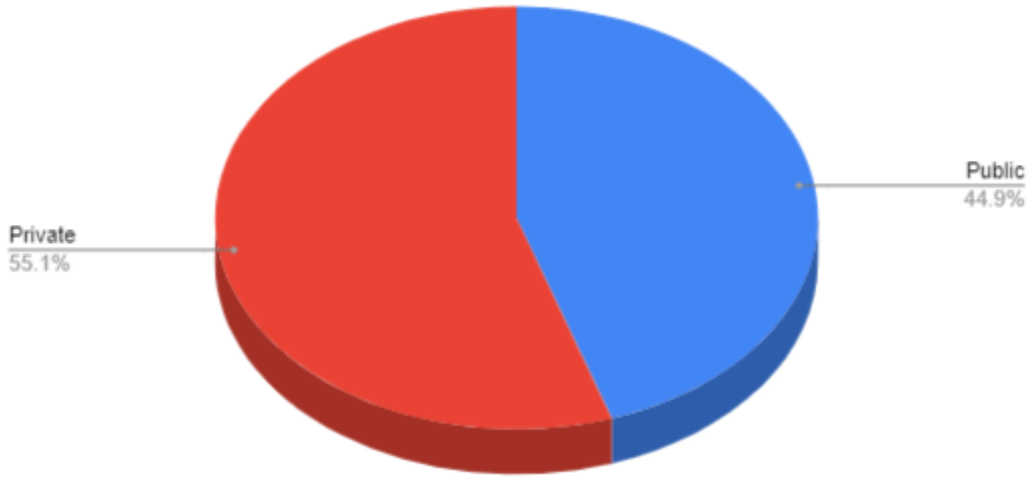

Figure 3: Higher education institution
Source: Author calculation

3.3. Challenges face in a higher education institution

Some of the challenges are the climate of uncertainty, increased scope of the mission, unstable enrollments, higher costs, and diminished government support. The table has shown that the institutions' highest constraints are diminished government support and the minor challenges are unstable enrollments.

Table 3: Challenges

Particulars		frequency	percent
Challenges	Climate of uncertainty	21	26.9
	Increased scope of the mission	12	15.4
	Unstable enrollments	6	7.7
	Higher costs	15	19.2
	Diminished government support	24	30.8
Total		78	100.0

Author: own calculation

The table highlights their opinion that 30.8% of faced diminished government support followed by 26.9% of facing a climate of uncertainty, 19.2% had faced constraints due to higher costs, 15.4% had an increased scope of the mission at last 7.7% of had unstable enrollments. Thus, it concludes that the highest constraints that institutions faced are diminished government support. Therefore, institutions have already taken steps to overcome the constraints through adopting lean practices in their respective institutions.

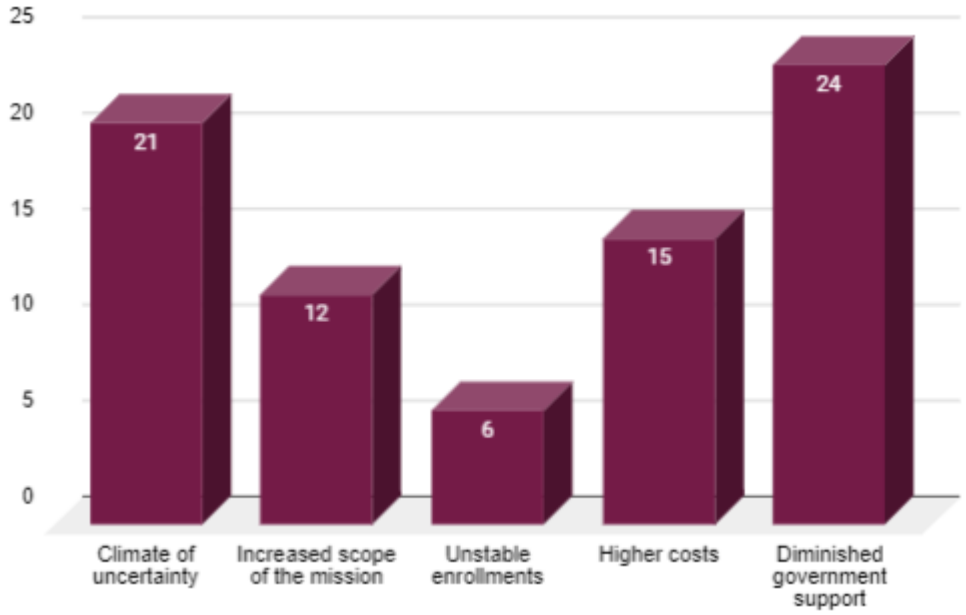

Figure 4: Challenges
Source: Author calculation

3.4. Descriptive statistics

Reasons to adopt lean thinking in the institutions: Apart from the challenges, there are various reasons for the institutions to adopt lean thinking. Some of the reasons include faster communication, greater flexibility, and innovative environment, support to change initiatives, and quick decision making. All the aspects are measuring using a five-point Likert scale. From the opinion, the study observes that the average mean value ranges between 3.5 and 3.9. The mean value of the reasons is highly agreed concerning lean thinking practices in the institutions. The highest mean value for the statement "faster communication "is 3.9231, and the least mean value indicates the statement "greater flexibility" and "innovative environment—consequently, the accuracy of the statements measured using standard deviation. The value of standard deviation ranges from 0.9 to 1.117; the highest standard deviation for the statement is "Quick decision-making," which has the least precision in lean thinking. Subsequently, the least value is 0.9, which indicates "greater flexibility" that have the highest precision

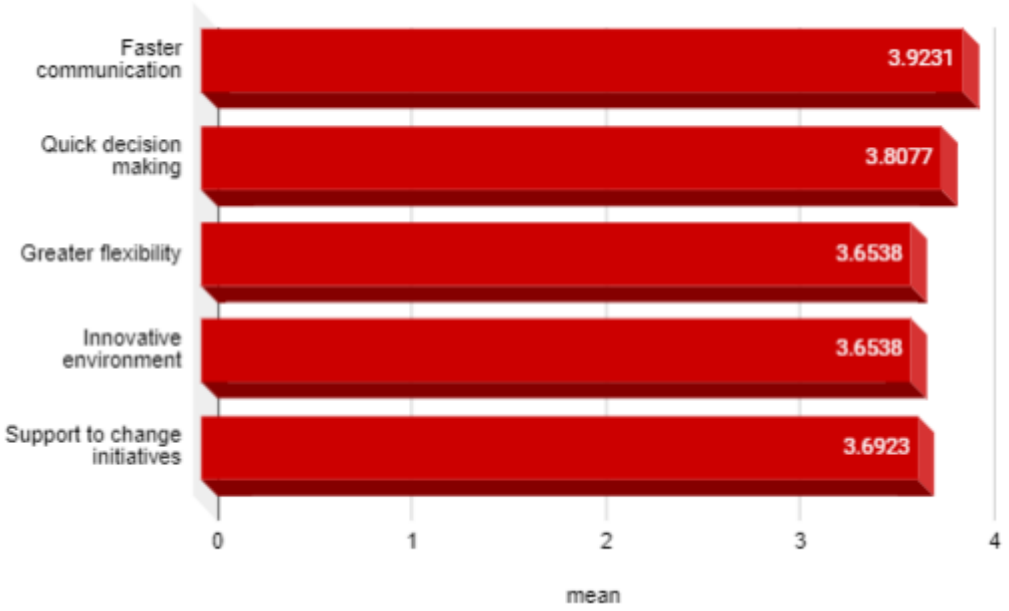

Figure 5: Reason to adopt lean thinking in the institution
Source: Author calculation

Barriers in implementing lean thinking in the institution: All the institutions have faced barriers while implementing lean practices in their institutions—some of the critical barriers which the researcher has taken into account. Barriers include the absence of commitment from top management, lack of clarity and openness in communication, misunderstand the concepts, tools, and techniques, minimal resources allocated to interventions, insufficient

planning, coordination, and coherence of the actions and the changes brought to processes, there is no precision definition to resolve the problem, resistance to change, inadequate justification and poor management of conflicts—all the mean values ranging from 2.7 to 3.8. The most striking results that emerge from the data are that the highest mean value for the statement is "absence of commitment from top management" In contrast, the least mean value indicates, "Sometimes I can misunderstand the concepts, tools, and techniques." The precision of the statement lies between 0.8 and 1.1. The accuracy of the barriers is high in "Sometimes, I can misunderstand the concepts, tools, and techniques" whereas less in "Minimal resources allocated to interventions."

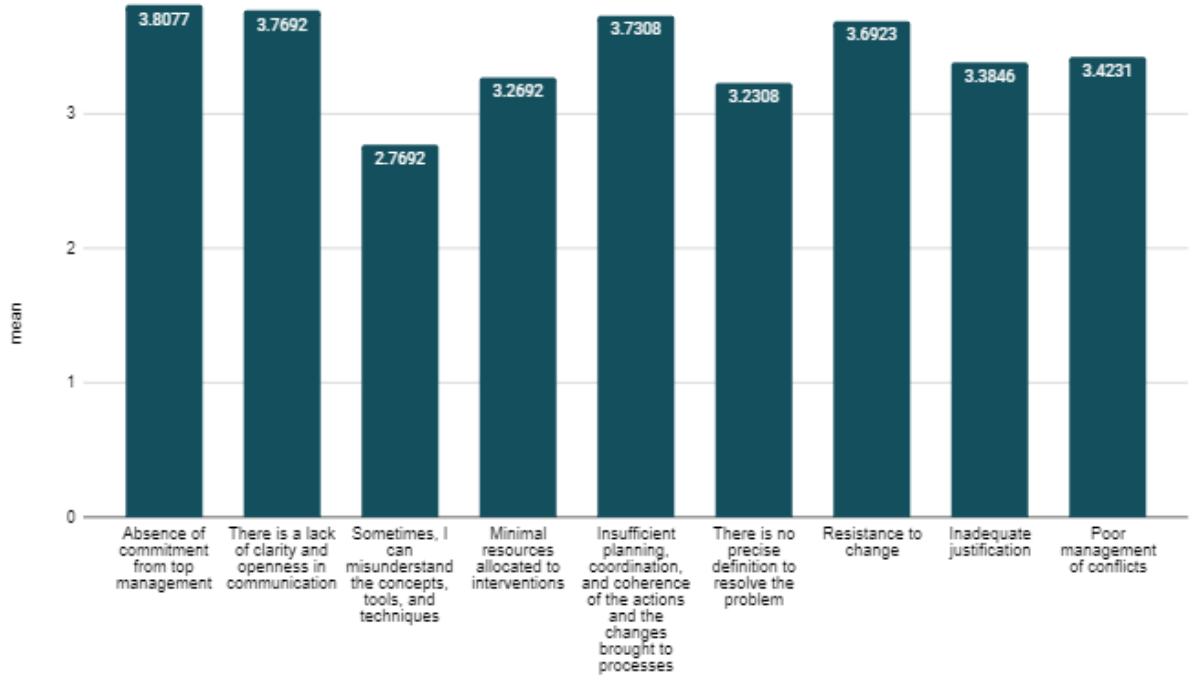

Figure 6: Barriers
Source: Author calculation

The institution manages wastes in the education sector: All the institution has implemented lean thinking practices to manage wastes emerge in the education sector. In this study, the researcher concentrates on four wastes: people, process, assets, and information. The mean values of wastes ranging from 3.3 to 4.00, and the values are high. The highest mean value for the statement is "process waste," i.e., 4.03, whereas the least mean value indicates the statement "People waste." Also, precision for the wastes lies between 0.7 and 1.0. The highest precision indicates the information waste, whereas the most miniature precision represents assets to waste.

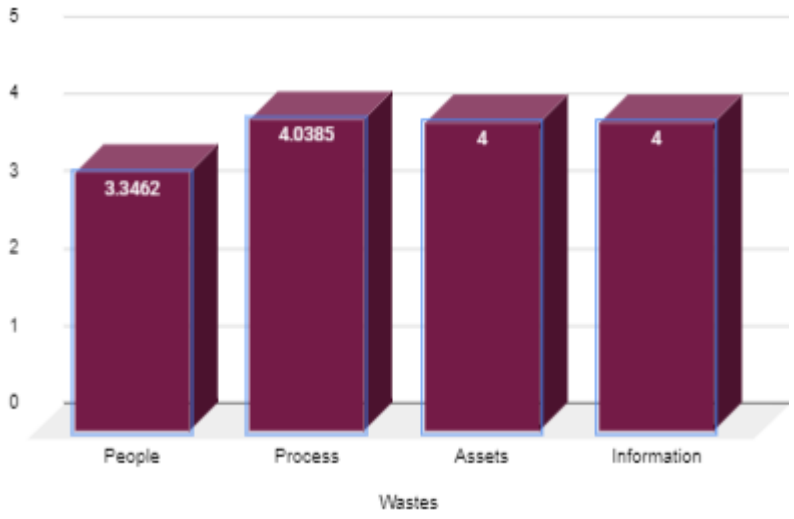

Figure 7: Institution manage wastes in the education sector
Source: Author calculation

People waste: The study represents the people wastes using four statements. Statements are "Teachers do not teach based on specialist area course," "Teachers don't have time to research and perform scientific activities," "Some of the teachers in the institutions don't work by their expertise," and "The workload of teachers is unbalanced." All the people waste between 2.53 and 2.65, indicating the people's waste is minimal in the institutions. The highest mean value for the statement is "Teachers do not teach based on specialist area course," whereas the least mean value is "The workload of teachers is unbalanced." The precision of people wastes ranging from 1.0 to 1.1. The highest precision represents the statement "The workload of teachers is unbalanced," whereas the most miniature precision for the statement is "Teachers do not teach based on specialist area course."

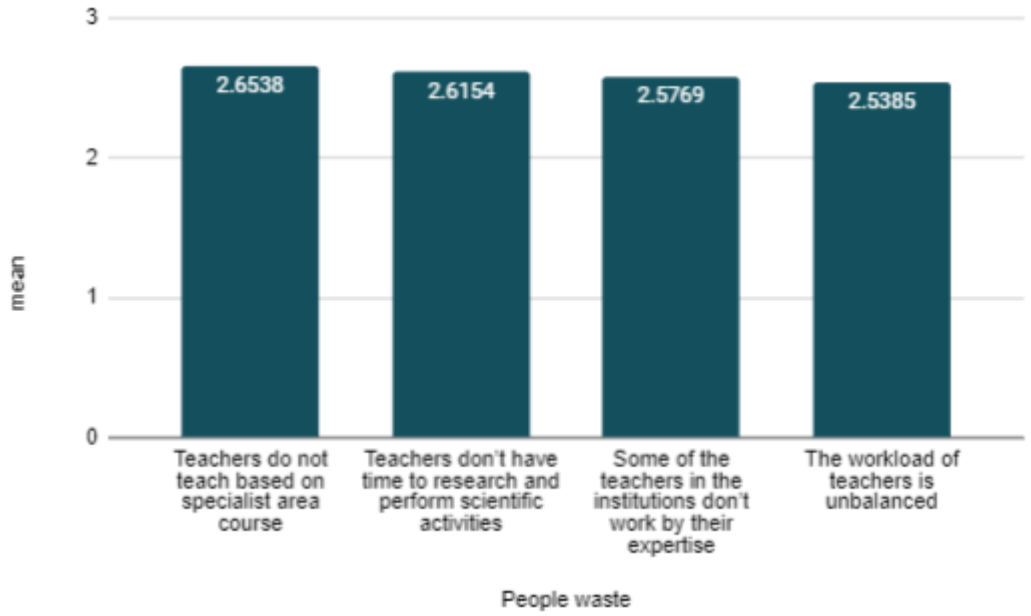

Figure 8: People waste
Source: Author calculation

Process waste: Process wastes are measured using a five-point Likert scale. Process wastes indicate using the statements "Teachers have to perform unnecessary tasks, which leads to errors," "Teachers have to make non-strategic efforts," "There is an unclear process flow of tasks/responsibilities allocated to them." The descriptive statistics analysis reveals that the mean values lie from 2.3 to 2.6, whereas the standard deviation ranges between 0.7 and 1.2. The highest mean value for the statement is "There is an unclear process flow of tasks/responsibilities allocated to them, "In contrast, the least mean value for the statement is "Teachers have to make non-strategic efforts." The precision of process wastes measuring through standard deviation. The highest precision for the statement is "There is an unclear process flow of tasks/responsibilities allocated to them." In contrast, the least precise is "Teachers have to perform unnecessary tasks, which leads to errors."

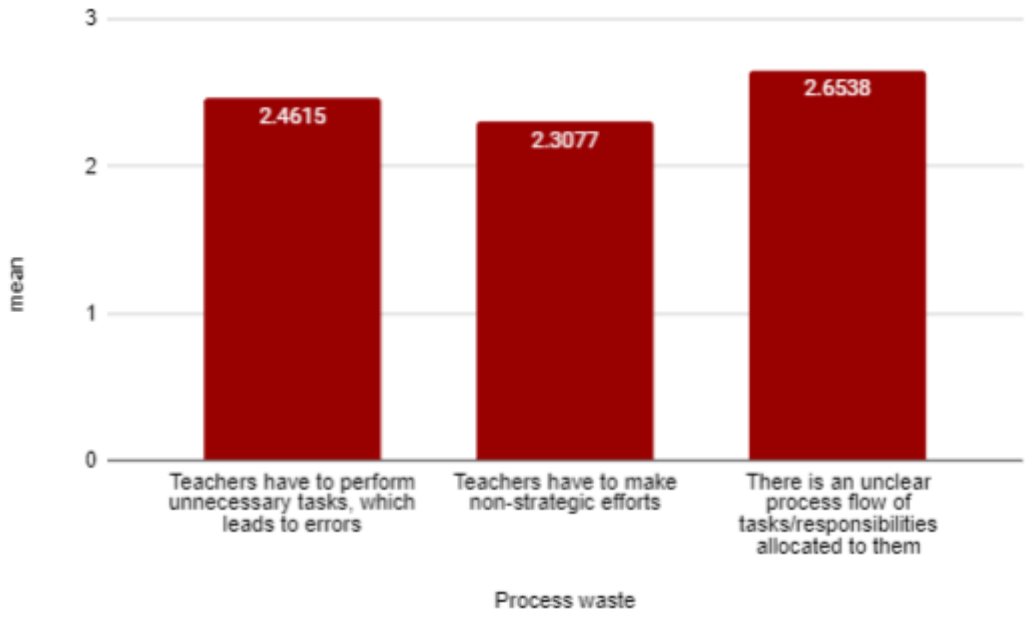

Figure 9: Process
Source: Author calculation

Assets waste: The researcher gathers respondent's opinions on assets waste through a five-point Likert scale. Statements indicating assets wastes are "Teachers have to wait for an empty classroom to begin lecturing," "They have to wait prolonged for repairs or maintenance of computers," "There are inefficient scheduling practices such as having long breaks between the classes," "Lack of academic journals, research materials, equipment, and software in their classes," "Sometimes, teachers may experience several classes that are not balanced," "Teachers have to work in a messy environment." All the statements have secured average mean values ranging from 2 to 3.3, which indicates that assets waste is minimal. The least mean value for the statement is, "Sometimes, teachers may experience several classes that are not balanced." In contrast, the highest mean value indicates, "Teachers have to wait for an empty classroom to begin lecturing." Also, with the help of standard deviation, the researcher can measure the precision of the statement. Assets wastes ranging between 0.93 and 1.159. The highest precision indicates, "There are inefficient scheduling practices such as having long breaks between the classes." In contrast, the least precision represents "Lack of academic journals, research materials, equipment, and software in their classes."

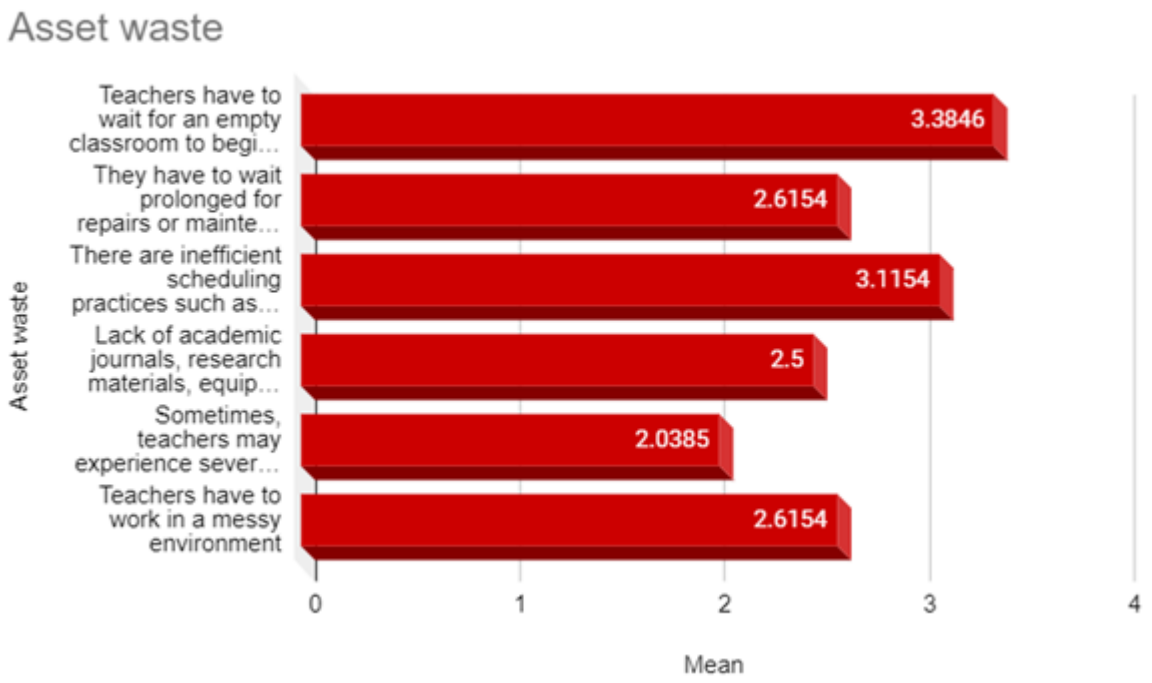

Figure 10: Asset
Source: Author calculation

Information wastes: Information wastes include "Teachers may lose information during delivering lecturers," "They may expose irrelevant information to the students," "Mistakes may arise due to communication problems," and "Teachers may experience unnecessary complexity due to an extended form of continuous assessment." All the statements have a mean value ranging between 2.2 and 2.9, indicating that the information wastes are minimal. The highest mean value represents "Teachers may lose information during delivering lecturers." In contrast, the least mean value indicates, "Teachers may experience unnecessary complexity due to an extended form of continuous assessment." Besides, the precision values ranging between 0.87 and 1.03. Highest precision for information wastes "Teachers may lose information during delivering lecturers," whereas the most miniature precision for "Teachers may experience unnecessary complexity due to an extended form of continuous assessment."

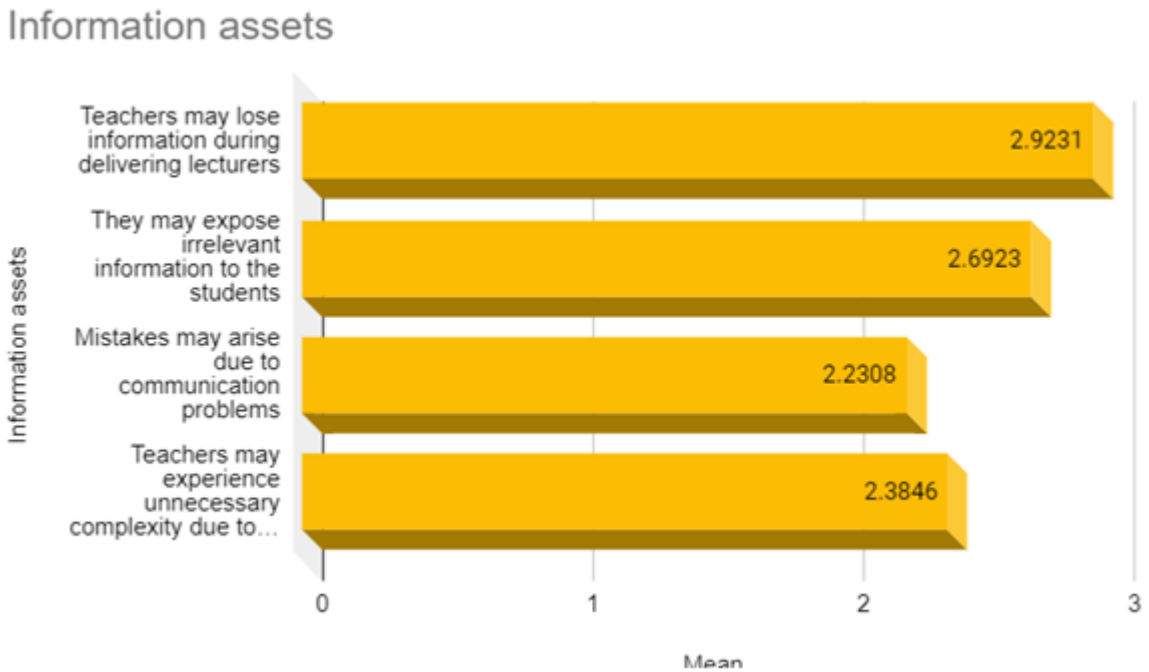

Figure 11: Information
Source: Author calculation

3.5. Independent sample t-test

Table 4. Independent sample t-test to determine differences of lean thinking barriers between the public and private institution

Status of institution		mean	std. deviation	t	sig
Absence of commitment from top management	Public	3.1667	.96309	-4.084	.000*
	Private	4.0926	.83029		
There is a lack of clarity and openness in communication	Public	3.1667	.63702	-5.132	.000*
	Private	4.0370	.80007		
Sometimes, I can misunderstand the concepts, tools, and techniques	Public	2.7083	.69025	-.467	.642
	Private	2.7963	.91897		
Minimal resources allocated to interventions	Public	3.0000	1.02151	-1.504	.139
	Private	3.3889	1.12295		
Insufficient planning, coordination, and coherence of the actions and the changes brought to processes	Public	3.0833	.82970	-4.438	.000*
	Private	4.0185	.92125		
There is no precise definition to resolve the problem	Public	2.7083	.46431	-4.721	.000*
	Private	3.4630	.94595		
Resistance to change	Public	3.4583	.93153	-1.527	.135

	Private	3.7963	.83281		
Inadequate justification	Public	2.8333	.96309	-3.535	.001*
	Private	3.6296	.80789		
Poor management of conflicts	Public	3.3333	.76139	-.612	.543
	Private	3.4630	1.05889		

Source: Author calculation

H0: There are no significant differences of lean thinking barriers(absence of commitment from top management) between the public and private institution

The table shows the differences in lean thinking barriers between public and private institutions. The first barrier is the absence of commitment from top management. With the help t-test, the study observes that the significance is 0.000 ($p<0.05$). Thus, it concludes that the absence of commitment from top management varies between public and private institutions. A private institution has more barriers than a public institution.

H0: There are no significant differences in lean thinking barriers (lack of clarity and openness in the communication) between the public and private institution

The second barrier is a lack of clarity and openness in communication. It varies between public and private institutions. Private institutions have faced high barriers (4.03) than public institutions (3.1). T-test value is -5.132, and sig is 0.000, which is lesser than the significance level. Thus, it is clear that the lack of clarity and openness in communication varies between public and private institutions.

H0: There are no significant differences in lean thinking barriers(Sometimes, I can misunderstand the concepts, tools, and techniques) between the public and private institution

The third barrier is Sometimes, I can misunderstand the concepts, tools, and techniques. The private institution has faced a third barrier than a public institution. The private institution has secured a mean value of. The t value for the barrier is -0.467, and the p-value is 0.642($p>0.005$). Thus, it concludes that there is no significant difference between barriers (Sometimes, I can misunderstand the concepts, tools, and techniques) of a public and private institution.

H0: There are no significant differences in lean thinking barriers (Minimal resources allocated to interventions) between the public and private institution

The fourth barrier is Minimal resources allocated to interventions. The private institution has secured a mean value of 3.38, whereas the public institution is 3.00. Thus, it portrays that minimal resources allocated to interventions are higher in private than public institutions. Consequently, t value for the barrier is -1.504 and p-value is 0.139 ($p>0.005$). Therefore, it concludes that there is no significant difference in implementing lean thinking barriers (Minimal resources allocated to interventions) between public and private institutions.

H0: There are no significant differences of lean thinking barriers(insufficient planning, coordination, and coherence of the action and the changes brought to process) between the public and private institution

The fifth barrier is Insufficient planning, coordination, and coherence of the actions and the changes brought to processes. Private institutions have secured a mean value of 4.01. In contrast, public institutions have 3.0, which indicates that private institutions have faced more barriers in Insufficient planning, coordination, and coherence of the actions and the changes brought to processes than a public institution. The t value for the fifth barrier is -4.438, and the p-value is 0.000 ($p<0.005$). Therefore, it concludes that there is a significant difference in implementing lean thinking barriers(Insufficient planning, coordination, and coherence of the actions and the changes brought to processes) between public and private institutions.

H0: There are no significant differences of lean thinking barriers(there is no precise definition to resolve the problem) between the public and private institution

The sixth barrier is There is no precise definition to resolve the problem. Private institutions have a mean value of 3.46, whereas public has 2.70. Thus, it portrays that private institutions barriers than public institutions. Consequently, the t value for the sixth barrier is -4.721, sig is 0.000 ($p<0.005$). Therefore, it concludes that there is a significant difference in implementing lean thinking barriers (There is no precise definition to resolve the problem) between public and private institutions.

H0: There are no significant differences of lean thinking barriers(resistance to change) between the public and private institution

The seventh barrier is resistance to change which is high in private institutions 3.7 whereas least in a public institution is 3.45. The t value for the seventh barrier is -1.527, and the significance is 0.135 ($p<0.005$). Therefore, it is clear that there is no significant difference in

implementing lean thinking barriers (resistance to change) between public and private institutions.

H0: There are no significant differences of lean thinking barriers (inadequate justification) between the public and private institution

Eight barriers are inadequate justification, high in private institutions 3.6 and least in public institutions(2.8). Subsequently, the t value for the eighth barrier is -3.535; the p-value is 0.001, which is lesser than the significance level. Therefore, it concludes that there is a significant difference of lean thinking barriers (Inadequate justification) between private and public institutions.

H0: There are no significant differences of lean thinking barriers(poor management of conflicts) between the public and private institution

The ninth barrier is Poor management of conflicts high in private institutions(3.4) and least in public institutions (3.3). Consequently, the t value for the barrier is -0.612, the p-value is 0.543, and it is lesser than the significance level. Therefore, it concludes that there is a significant difference in lean thinking barriers (poor management of conflicts) between public and private institutions.

Table 5. T-test to determine differences of people wastes between the public and private institution

Status of institution		mean	std. deviation	t	sig
Teachers do not teach based on specialist area course	Public	3.0833	.97431	2.602	.013*
	Private	2.4630	.96569		
Teachers don't have time to research and perform scientific activities	Public	2.5833	1.01795	-.180	.858
	Private	2.6296	1.12092		
Some of the teachers in the institutions don't work by their expertise	Public	2.7083	.99909	.756	.454
	Private	2.5185	1.07705		
The workload of teachers is unbalanced	Public	2.8333	.81650	1.776	.080
	Private	2.4074	1.26668		

Source: Author calculation

The table clarifies those individual people waste measures using a t-test to determine whether differences exist between public and private institutions.

H0: There are no significant differences in people wastes (Teachers do not teach based on specialist area) between the public and private institution

First, people waste is "Teachers do not teach based on specialist area course," which is high in public institutions (3.08) and least in private institutions (2.46). Also, the t value for the first people waste is 2.602, and sig is 0.013, which is a lesser than 5% level of significance. Thus, it concludes that people waste a significant difference (Teachers do not teach based on specialist area course) between public and private institutions.

H0: There are no significant differences in people wastes (Teachers don't have time to research and perform scientific activities) between the public and private institution

The second people waste is "Teachers don't have time to research and perform scientific activities," which is high in a private institution (2.62) and less in public institutions (2.58). Consequently, the t value for the second people waste is -0.180, and the p-value is 0.858, which is higher than the 5% level of significance. Therefore, it is clear that there is no significant difference in people wastes (Teachers don't have time to research and perform scientific activities) between public and private institutions.

H0: There are no significant differences in people wastes (Some of the teachers in the institutions don't work by their expertise) between the public and private institution

The third waste is "Some of the teachers in the institutions don't work by their expertise," which is high in a public institution (2.70) and least in private institutions (2.5). Consequently, the t value for people waste is 0.756, the p-value is 0.454, which is higher than the level of significance. Therefore, it is clear that there are no significant differences between public and private institutions (Some of the teachers in the institutions don't work by their expertise).

H0: There are no significant differences in people wastes (the workload of teachers is unbalanced) between the public and private institution

Fourth waste is "the workload of teachers is unbalanced," which is high in public institutions (2.8) and least in private institutions (2.4). Also, the t value for the fourth waste is 1.776, and the p-value is 0.080, which is higher than the level of significance. Thus, it concludes that there are no significant differences (Teachers' workload is unbalanced) between public and private institutions.

Table 6. T-test to determine differences of process wastes between the public and private institution

Status of institution		mean	std. deviation	t	sig
Teachers have to perform unnecessary tasks, which leads to errors	Public	3.1667	.96309	3.918	.000*
	Private	2.1481	1.25002		
Teachers have to make non-strategic efforts	Public	2.4167	.77553	.744	.460
	Private	2.2593	1.03131		
There is an unclear process flow of tasks/responsibilities allocated to them	Public	3.3333	.56466	6.650	.000*
	Private	2.3519	.67733		

Source: Author calculation

It observes from the table that how process wastes vary between private and public institutions.

H0: There are significant differences in process waste (Teachers have to perform unnecessary tasks, which leads to errors), which varies between public and private institutions.

The first process of waste is "Teachers have to perform unnecessary tasks, which leads to errors," which is high in a public institution (3.17) and least in a private institution (2.14). The statement has secured the t value of 3.918, and a p-value is 0.000, which is lesser than its significance. Thus, it concludes that there are significant differences in process waste, especially when teachers have to perform unnecessary tasks, leading to errors that vary between public and private institutions.

H0: There are significant differences in-process waste (Teachers have to make non-strategic efforts that vary between public and private institutions.

The second process waste is "Teachers have to make non-strategic efforts," which is high in a public institution (2.41) and more minor in private institutions (2.25). Subsequently, the t value for the second waste is 0.744, the p-value is 0.460, which is higher than 0.005. Therefore, it is clear that there are significant differences in process waste is Teachers have to make non-strategic efforts that vary between public and private institutions.

H0: There are significant differences in process waste (There is an unclear process flow of tasks/responsibilities allocated to them), which varies between public and private institutions.

The third waste is “There is an unclear process flow of tasks/responsibilities allocated to them,” which is high in public institutions (3.3) and less in private institutions (2.35). It also secures the t value of 6.650 and p-value is 0.000, which is less than 5%. Therefore, it concludes that there is a significant difference in-process waste (There is an unclear process flow of tasks/responsibilities allocated to them) between public and private institutions.

Table 7. T-test to determine differences of assets waste between public and private institution

Status of institution		mean	std. deviation	t	sig
Teachers have to wait for an empty classroom to begin lecturing	Public	2.9583	.75060	-2.686	.009*
	Private	3.5741	1.25295		
They have to wait prolonged for repairs or maintenance of computers	Public	2.7083	1.12208	.481	.633
	Private	2.5741	1.17525		
There are inefficient scheduling practices such as having long breaks between the classes	Public	3.2917	.69025	1.283	.204
	Private	3.0370	1.02723		
Lack of academic journals, research materials, equipment, and software in their classes	Public	2.5833	1.24819	.405	.688
	Private	2.4630	1.12791		
Sometimes, teachers may experience several classes that are not balanced	Public	2.2083	.83297	1.131	.263
	Private	1.9630	.98982		
Teachers have to work in a messy environment	Public	2.5417	.77903	-.487	.628
	Private	2.6481	1.10158		

Source: Author calculation

The table shows the assets wastes and how they vary between public and private institutions.

H0: There are significant differences in assets waste (Teachers have to wait for an empty classroom to begin lecturing), which varies between public and private institutions.

The first asset waste is “Teachers have to wait for an empty classroom to begin lecturing,” which is high in private institutions (3.5) and less in a public institution (2.9). The t value is -2.686, and the p-value is 0.000, which is lesser than the 5% level of significance. Thus, it concludes that significant differences in assets waste (Teachers have to wait for an empty classroom to begin lecturing) between public and private institutions.

H0: There are significant differences in assets waste (They have to wait prolonged for repairs or maintenance of computers), which varies between public and private institutions.

The second asset waste is They have to wait prolonged for repairs or maintenance of computers which is high in a public institution (2.7) and less in a private institution (2.5). Consequently, the t value is 0.481, and the p-value is 0.633, which is higher than the level of significance. Therefore, it concludes that there is no significant difference in asset waste (They have to wait prolonged for repairs or maintenance of computers) between the public and private institutions.

H0: There are significant differences in assets waste (There are inefficient scheduling practices such as having long breaks between the classes), which vary between public and private institutions.

The third asset waste is "There are inefficient scheduling practices such as having long breaks between the classes," which is high in a public institution (3.29) and private institution (3.03). The t value is 1.283, and the p-value is 0.204, which is higher than the 5% level of significance. Thus, it concludes that there are no significant differences in assets wastes (There are inefficient scheduling practices such as having long breaks between the classes) between public and private institutions.

H0: There are significant differences in assets waste (Lack of academic journals, research materials, equipment, and software in their classes) which varies between public and private institutions.

The fourth asset waste is "Lack of academic journals, research materials, equipment, and software in their classes," which is high in a public institution (2.58) and private institution (2.46). Consequently, the t value is 0.405, and the p-value is 0.688, which is higher than the level of significance. Thus, it is clear that there are no significant differences in asset waste (Lack of academic journals, research materials, equipment, and software in their classes) between public and private institutions.

H0: There are significant differences in assets waste (Sometimes, teachers may experience several not balanced classes), which varies between public and private institutions.

Fifth, asset waste is "Sometimes; teachers may experience several classes that are not balanced," which is high in public institutions (2.2) and less in a private institution (1.96). Subsequently, the t value is 1.131, and the significance is 0.263, which is higher than the 5% level of significance. Therefore, it concludes that there are no significant differences in assets

waste (Sometimes, teachers may experience several classes that are not balanced) between public and private institutions.

H0: There are significant differences in assets waste Teachers have to work in a messy environment) which varies between public and private institutions.

The sixth asset waste is "Teachers have to work in a messy environment," which is high in a private institution (2.64) and less in a public institution (2.54). The t value is -0.487, and the sign is 0.628, which is higher than the 5% level of significance. Thus, it concludes that there are no significant asset waste differences (Teachers have to work in a messy environment) between public and private institutions.

Table 8. T-test to determine differences of information waste between public and private institution

Status of institution		mean	std. deviation	t	sig
Teachers may lose information during delivering lecturers	Public	3.0417	.75060	.861	.393
	Private	2.8704	.93256		
They may expose irrelevant information to the students	Public	2.9583	.90790	1.628	.110
	Private	2.5741	1.07461		
Mistakes may arise due to communication problems	Public	2.5417	.77903	2.116	.039*
	Private	2.0926	1.03283		
Teachers may experience unnecessary complexity due to an extended form of continuous assessment	Public	2.4583	.72106	.481	.632
	Private	2.3519	1.21558		

Source: Author calculation

The table shows that information wastes and to what extent vary between public and private institutions.

H0: There is no significant difference in information waste (Teachers may lose information during delivering lecturers) between public and private institutions.

The first information waste is "Teachers may lose information during delivering lecturers," which is high in a public institution (3.04) and less in a private institution (2.8). The t value is 0.861, and sig is 0.393, which is higher than 0.05. Thus, it concludes that there is no significant difference in information waste (Teachers may lose information during delivering lecturers) between public and private institutions.

H0: there is a significant difference in information waste (They may expose irrelevant information to the students) between public and private institutions.

The second information waste is "They may expose irrelevant information to the students," which is high in public institutions (2.54) and less in a private institution (2.09). The t-value is 2.116, and the significance is 0.039, which is lower than the level of significance. Thus, it concludes that there is a significant difference in information waste (They may expose irrelevant information to the students) between public and private institutions.

H0: There is no significant difference in information waste (Teachers may experience unnecessary complexity due to an extended form of continuous assessment) between public and private institutions.

Third, information waste is "Teachers may experience unnecessary complexity due to an extended form of continuous assessment," which is high in a public institution (2.45) and private institution (2.35). The t-value is 0.481. The p-value is 0.632, which is higher than 0.005, which concludes that there is no significant difference in information waste (Teachers may experience unnecessary complexity due to an extended form of continuous assessment) between the public and private institutions.

3.6. Results

The section summarizes and discusses the main findings of the work. The researcher had gathered the respondent's opinions through the web survey method. The respondent's opinion was measured using statistical tools like percentage analysis, descriptive statistics, and independent-sample t-test. All the tools were performed using SPSS and Microsoft Excel 2016.

After a rigorous examination of the demographic profile of respondents, it was identified that the highest number of respondents were between the age category of 25-30 years. Consequently, more than 50% of respondents were male. The highest number of respondents possess a Ph.D. as the education qualification.

From the assessment of higher education institutions, both public and private institutions had taken into account. The challenges faced in higher education institution was high due to

diminished government support and climate of uncertainty. Constraints were less owing to unstable enrollments.

The study analyzed five-point Likert scale questions through descriptive statistics. Reasons to adopt lean thinking in the education institutions had the statement "Quick decision-making," which had a value (1.117) that was quite apart from the mean. However, the statement "greater flexibility" had an SD value (0.9) closer to the mean.

Barriers in implementing lean thinking in the institution: The statement "Sometimes, I can misunderstand the concepts, tools, and techniques" had an SD value (0.8) closer to the mean. However, the statement had "Minimal resources allocated to interventions" SD of 1.1, which indicated that the scores were apart from the mean.

The institution manages wastes in the education sector: Information waste had secured an SD value of 0.7, which indicated that the scores were closer to the mean. Assets waste had an SD value of 1.0 that represented that the values were apart from the mean.

People waste: The statement of people waste "The workload of teachers is unbalanced" indicated the SD value of 1.0, representing that the values were closer to the mean. The statement "Teachers do not teach based on specialist area course" had secured SD (1.1), representing that the values were apart from mean.

Process waste: The statement of process waste, "There is an unclear process flow of tasks/responsibilities allocated to them," had an SD value (0.7) which was closer to the mean. However, "Teachers have to perform unnecessary tasks, which leads to errors" had an SD value of 1.2, which represented that the values were apart from mean

Asset's waste: The statement of assets waste, "There are inefficient scheduling practices such as having long breaks between the classes," had an SD value (0.93), representing that the values were closer to the mean. However, "Lack of academic journals, research materials, equipment, and software in their classes" had an SD value (1.159), indicating that the values were apart from the mean.

Information waste: The statement of information wastes “Teachers may lose information during delivering lecturers” had secured an SD value of 0.87, representing that the values were closer to the mean. Also, the statement “Teachers may experience unnecessary complexity due to an extended form of continuous assessment” had a Secured SD (1.03) value which indicated that the values were apart from the mean.

Moreover, the study findings were surprising because lean thinking barriers differed between public and private institutions. Barriers like the absence of commitment from top management, a lack of clarity and openness in communication, Insufficient planning, coordination, and coherence of the actions and the changes brought to processes, and the lack of precise definition to resolve the problem and inadequate justification differed and its statistically significant.

The results of people, process, information, and asset wastes differed between public and private institutions.

People’s waste was higher in public institutions than in private institutions. People’s waste was higher due to teachers not teaching based on a specialist area course, which was statistically significant.

Process waste was higher in a public institution than a private institution. Most of the waste emerged because of insisting teachers have to perform unnecessary tasks, which leads to errors. There is an unclear process flow of tasks/responsibilities allocated to teachers. The maximum number of process wastes was statistically significant.

Assets wastes were higher in private institutions than public institutions. Assets wastes emerged because insist teachers have to wait for an empty classroom to begin lecturing, which was also statistically significant.

Public institutions had higher information wastes than private institutions. Public institutions had emerged due to mistakes that may arise due to statistically significant communication problems.

3.7. Implications

The results of this work will unravel and shed light on the understanding of lean thinking principles in the higher education sector in India. Some of the implications are described

From the analysis, it is clear that both public and private institutions have faced wastes in the education sector. People's waste can be minimized through the effective utilization of teachers and students in downstream activities. Also, upstream activities of supportive staff level should be delivered in time. Allocate an effective work environment for teachers; good cordial relationship enriches between teachers and students can reduce people's waste in the education sector.

Process wastes find due to shortcomings present in the design and implementation processes. Hence, it is advisable to integrate teaching, coaching, and testing, resulting in students making students pass exams. Allocate the courses to the students who had prerequisite qualifications. Eliminate professionals doing unprofessional tasks. Offering practical training to the teachers can eliminate process wastes that emerge in the institution.

Information wastes to be minimized through design courses and supportive activities that meet the needs of the students. Courses should contribute customer value concepts. The action of doing so can eliminate all the above-stated wastes in public and private institutions.

Private institutions have to give more importance to assets waste because of poor planning of materials and facilities for teaching and coaching. Therefore, it is recommendable to have adequate planning in teaching and coaching activities, effectively utilize people skills.

CONCLUSION

The study aims to determine the challenges and barriers for lean thinking implementation in the education sector and identify how lean thinking eliminates the waste in India's education sector. To achieve the research objectives, the researcher had framed two questions. The first question is to assess the challenges the education institutes face in implementing lean thinking in higher education in India. Challenges are higher due to diminished government support and the climate of the uncertainty of the education sector in India. Also, the education sector has faced barriers while implementing the lean thinking principle in the respective institutions. It may change based on the status of institutions, either public or private. The barriers are high in private institutions than in public institutions. Some of the statistically significant barriers include the absence of commitment from top management, lack of clarity and openness in communication, Insufficient planning, coordination, and coherence of the actions and the changes brought to processes, no precise definition to resolve the problem, and inadequate justifications. The second question focused on assessing how lean thinking eliminates wastes in the education sector. From the extensive literature support, the researcher had identified the predominant four wastes of the education sector, namely people, process, assets, and information wastes. Out of four wastes, people, process, and information wastes are higher in public institutions. However, asset wastes are higher in private institutions. The study has observed that a smaller portion of waste is easily identified, but some waste is still hidden. Thus, the management should work on education wastes through lean thinking principles, keep update with the latest technological advancements, and manage respective institutions to have a strategic focus on improving the quality of services to students. Also, getting feedback from students will determine areas where strict improvement is required and subsequently focuses on accelerating customer service.

Scope for further research: The present study measures the wastes and identifies how it differs between public and private institutions using quantitative research methods. The methods should be improved before carrying out further extensive studies on lean thinking in India's education sector. Adopting qualitative research methods is essential to improve the

speed and efficiency of the outcome. Also, quantitative research methods did not address how wastes influence higher education institutions, and hence a future extension is suggested. The study on the impact of wastes on lean in higher education is reserved for future work. The present study was limited to the University of Delhi. Still, it could be extended for the other universities to know the impact of the lean thinking principle on waste reduction in India's management schools.

Limitations of the study: The present study has considered the maximum number of respondents from affiliated colleges of the University of Delhi. The sample size is small, and hence the outcome did not represent the whole universities in India.

Also, the study measures the challenges of the lean thinking principle to the entire university. But challenges may vary between respective departments in institutions that the researcher did not consider for the study. The primary reason behind not taking into account is the short duration of time.

The study did not measure all the eleven lean thinking wastes of the education sector. The study has considered four selected wastes from the literature and assesses how the wastes reduced through the lean thinking concept is addressed. Increasing more wastes can generalize the outcome significantly.

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APPENDICES

Appendix 1. Questionnaire

1. Name of the institution

2. Age

3. Gender

4. Education qualification

5. What are the challenges do the institution faces?

a. Climate of uncertainty
b. Increased scope of the mission
c. Unstable enrolments
d. Higher costs
e. Diminished government support

6. Does your institution practice lean thinking to overcome the above-stated challenges?

a. Yes
b. No

7. If yes, what is the reason to adopt lean thinking in their institution? (5-Strongly agree to 1-Strongly disagree)

Particulars	5	4	3	2	1
Faster communication					
Quick decision making					
Greater flexibility					
Innovative environment					

Support to change initiatives					

8. What are the barriers do you face while implementing lean thinking in your institution? (5-Strongly agree to 1-Strongly disagree)

Particulars	5	4	3	2	1
Absence of commitment from top management					
There is a lack of clarity and openness in communication					
Sometimes, I can misunderstand the concepts, tools, and techniques					
Minimal resources allocated to interventions					
Insufficient planning, coordination, and coherence of the actions and the changes brought to processes					
There is no precise definition to resolve the problem					
Resistance to change					
Inadequate justification					
Poor management of conflicts					

9. Did your institution implement the lean thinking principle to help manage wastes?

a. Yes

b. No

10. If yes, How does the institution manage wastes in the education sector? (5-Strongly agree to 1-Strongly disagree)

Particulars	5	4	3	2	1
People					
Process					
Assets					
Information					

11. Teachers do not teach based on specialist area course

a. Strongly agree

b. Agree

c. Neutral

d. Disagree

e. Strongly disagree

12. Teachers don’t have time to research and perform scientific activities

a. Strongly agree

b. Agree
c. Neutral
d. Disagree
e. Strongly disagree

13. Some of the teachers in the institutions don't work by their expertise
a. Strongly agree
b. Agree
c. Neutral
d. Disagree
e. Strongly disagree

14. The workload of teachers is unbalanced
a. Strongly agree
b. Agree
c. Neutral
d. Disagree
e. Strongly disagree

15. Teachers have to perform unnecessary tasks, which leads to errors
a. Strongly agree
b. Agree
c. Neutral
d. Disagree
e. Strongly disagree

16. Teachers have to make non-strategic efforts
a. Strongly agree
b. Agree
c. Neutral
d. Disagree
e. Strongly disagree

17. There is an unclear process flow of tasks/responsibilities allocated to them

a. Strongly agree
b. Agree
c. Neutral
d. Disagree
e. Strongly disagree

18. Teachers have to wait for an empty classroom to begin lecturing
a. Strongly agree
b. Agree
c. Neutral
d. Disagree
e. Strongly disagree

19. They have to wait prolonged for repairs or maintenance of computers
a. Strongly agree
b. Agree
c. Neutral
d. Disagree
e. Strongly disagree

20. There are inefficient scheduling practices such as having long breaks between the classes
a. Strongly agree
b. Agree
c. Neutral
d. Disagree
e. Strongly disagree

21. Lack of academic journals, research materials, equipment, and software in their classes
a. Strongly agree
b. Agree
c. Neutral
d. Disagree
e. Strongly disagree

22. Sometimes, teachers may experience several classes that are not balanced

a. Strongly agree
b. Agree
c. Neutral
d. Disagree
e. Strongly disagree

23. Teachers have to work in a messy environment

a. Strongly agree
b. Agree
c. Neutral
d. Disagree
e. Strongly disagree

24. Teachers may lose information during delivering lecturers

a. Strongly agree
b. Agree
c. Neutral
d. Disagree
e. Strongly disagree

25. They may expose irrelevant information to the students

a. Strongly agree
b. Agree
c. Neutral
d. Disagree
e. Strongly disagree

26. Mistakes may arise due to communication problems

a. Strongly agree
b. Agree
c. Neutral
d. Disagree
e. Strongly disagree

27. Teachers may experience unnecessary complexity due to an extended form of continuous assessment

a. Strongly agree
b. Agree
c. Neutral
d. Disagree
e. Strongly disagree

28. Provide your suggestions to improve lean thinking in education institutions

……..

Appendix 2. Tables

Table 9. Reason to adopt lean thinking in the institution

Particulars	mean	standard deviation
Faster communication	3.9231	1.01635
Quick decision making	3.8077	1.11725
Greater flexibility	3.6538	.96466
Innovative environment	3.6538	1.11457
Support to change initiatives	3.6923	1.14311

Author: own calculation

Table 10: Barriers

Barriers	mean	standard deviation
Absence of commitment from top management	3.8077	.96776
There is a lack of clarity and openness in communication	3.7692	.85163
Sometimes, I can misunderstand the concepts, tools, and techniques	2.7692	.85163
Minimal resources allocated to interventions	3.2692	1.10104
Insufficient planning, coordination, and coherence of the actions and the changes brought to processes	3.7308	.98920
There is no precise definition to resolve the problem	3.2308	.89621
Resistance to change	3.6923	.87249
Inadequate justification	3.3846	.92905
Poor management of conflicts	3.4231	.97394

Author: own calculation

Table 11: Institution manage wastes in the education sector

Wastes	mean	standard deviation
People	3.3462	.96466
Process	4.0385	.90371
Assets	4.0000	1.04447
Information	4.0000	.73855

Author: own calculation

Table 12: People waste

People waste	mean	standard deviation
Teachers do not teach based on specialist area course	2.6538	1.00424
Teachers don’t have time to research and perform scientific activities	2.6154	1.08389
Some of the teachers in the institutions don’t work by their expertise	2.5769	1.05090
The workload of teachers is unbalanced	2.5385	1.15873

Author: own calculation

Table 13: Process waste

Process waste	mean	standard deviation
Teachers have to perform unnecessary tasks, which leads to errors	2.4615	1.25556
Teachers have to make non-strategic efforts	2.3077	.95764
There is an unclear process flow of tasks/responsibilities allocated to them	2.6538	.78669

Author: own calculation

Table 14: Asset waste

Particulars	mean	standard deviation
Teachers have to wait for an empty classroom to begin lecturing	3.3846	1.15355
They have to wait prolonged for repairs or maintenance of computers	2.6154	1.15355
There are inefficient scheduling practices such as having long breaks between the classes	3.1154	.93948
Lack of academic journals, research materials, equipment, and software in their classes	2.5000	1.15938
Sometimes, teachers may experience several classes that are not balanced	2.0385	.94584
Teachers have to work in a messy environment	2.6154	1.00945

Author: own calculation

Table 15: Information waste

Particulars	mean	standard deviation
Teachers may lose information during delivering lecturers	2.9231	.87933
They may expose irrelevant information to the students	2.6923	1.03582
Mistakes may arise due to communication problems	2.2308	.97931
Teachers may experience unnecessary complexity due to an extended form of continuous assessment	2.3846	1.08389

Author: own calculation

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