

# A Proposed of Lean Six Sigma Framework for Higher Education Institution (LSSF - for HEdu) To Improve Effectiveness and Efficiency of Higher Education in Indonesia

*by* Ig. Jaka Mulyono

---

**Submission date:** 12-Mar-2022 06:24PM (UTC+0700)

**Submission ID:** 1782615715

**File name:** 4p-A\_proposed\_of\_lean\_six\_sigma\_ig.Jaka.pdf (3.97M)

**Word count:** 7564

**Character count:** 44883

# **A Proposed of Lean Six Sigma Framework for Higher Education Institution (LSSF - for HEdu) To Improve Effectiveness and Efficiency of Higher Education in Indonesia**

**Ig. Jaka Mulyana<sup>1,2</sup>, Moses Laksono Singgih<sup>1</sup> and Sri Gunani Partiw<sup>1</sup>**

<sup>1</sup>Department of Industrial and Systems Engineering  
Institut Teknologi Sepuluh Nopember, Surabaya Indonesia

<sup>2</sup>Department Industrial Engineering  
Widya Mandala Surabaya Catholic University, Surabaya Indonesia  
[jmulyono@ukwms.ac.id](mailto:jmulyono@ukwms.ac.id), [moseslsinggih@ie.its.ac.id](mailto:moseslsinggih@ie.its.ac.id), [srigunani@ie.its.ac.id](mailto:srigunani@ie.its.ac.id)

## **Abstract**

Improvement of the effectiveness and efficiency of Higher education institutions (HEI) are required to alter the teaching and learning process, research, and community service. HEI are also improve student abilities and focus on customers requirement. HEI must redesign business processes to reduce the administrative overhead and improve the services delivered to students, industry partners, faculty, and researchers. As a result, HEI should increase all its resources by using various quality improvement methods. Currently, universities in America, Europe, and Australia adopted several frameworks. Universities can carry out accreditation using these frameworks. Accreditation is comparing specific criteria with established standards. For this reason, HEI must have a framework for improving its quality. Lean Six Sigma (LSS) approach is one of the frameworks for improvements.

LSS is a business strategy and methodology that increases process improvement, resulting in enhanced customer satisfaction and improved processes. Lean Manufacturing (LM) is a manufacturing concept to produce products efficiently by reducing waste. The Six Sigma methodology is a disciplined and structured approach to improving process performance and achieving high levels of quality. Many service industries, including at HEI, implemented Lean Six Sigma (LSS), i.e., the integration of Lean Manufacturing and Six Sigma. So far, the adaptation of LSS has been only partial and has focused on reducing waste rather than a holistic approach. There are not many studies that discuss LSS comprehensively, develop models and carry out cost evaluations. This paper proposes the Lean Six Sigma Framework for Higher Education (LSSF - for HEdu) comprehensively. The framework hopefully can increase the effectiveness and efficiency of the HEI so that it can satisfy all customers and reduce costs

## **Keywords:**

Lean Six Sigma, LSSF - for HEdu, effectiveness, efficiency, HEI.

## **1. Introduction**

Higher Education Institution (HEI) was greatly influenced by the Industrial Revolution 4.0. Digitalization affects all aspects of teaching, research, knowledge transfer, and administrative activities (Dräger et al., 2017). HEI must improve develop teaching and learning strategies, improve student competency and focus on customers, and increase all resource utilization (Davidson et al., 2020; Svensson et al., 2015; Wawan et al., 2018). Currently, universities in America, Europe, and Australia adopt several frameworks. Universities can carry out accreditation using these frameworks. Accreditation is comparing specific criteria with established standards. Accreditation systems widely used include the Accreditation Board for Engineering and Technology (ABET), Association to Advance Collegiate Schools of Business (AACSB), European Quality Improvement System (EQUIS), ASEAN University Network-Quality Assurance (AUN-QA), and Japan Accreditation Board for Engineering Education (JABEE). The framework has no specific methodology for continuous improvement (Davidson et al., 2020). HEI must improve its business processes systematically. Lean Six Sigma is a methodology for improving business processes systematically (Svensson et al., 2015). The American Society for Quality (ASQ) stated many advantages of implementing LSS at HEI, i.e., meeting accreditation requirements, making improvements, encouraging collaboration between organizations, knowing customer desires, identifying, and reducing costs (Simons, 2013).

The concept of quality continues to evolve and results in several methodologies. Total Quality Management (TQM) is a quality management system that improves companies such as Texas Instruments, Xerox, IBM, and Motorola. Furthermore, there are several quality development models, i.e., Malcolm Baldrige Award, European Foundation for Quality Management, the Deming Prize Criteria, and Kaizen quality development models (Sunder M & Antony, 2018). Kaizen is a gradual and continuous improvement. Lean is a quality improvement philosophy that fosters a CI culture in an organization. The Lean concept developed in Japan after World War II. Japanese manufacturers realized that they could not make the significant investments required to rebuild the destroyed facilities (Bhamu & Sangwan, 2014). Lean Manufacturing (LM) is a well-known and widely used approach in companies because of its ability to increase process efficiency and productivity (Bittencourt et al., 2019).

LM implementation began in the automotive industry, followed by other industries, including textiles, construction, food, medical, electricity and electronics, ceramic industry, plywood, furniture, slippers, shell, and the service industry (Alifiya & Singgih, 2019; Bakkali et al., 2017; Bhamu & Sangwan, 2014; Hardiningtyas et al., 2011; Mulyana & Angka, 2014). LM has also been implemented well in HEI (A. C. Alves et al., 2016; Balzer, 2010). Lean Manufacturing in HEI is an adaptation of Lean Thinking to HEI, both in administrative and academic activities (Vukadinovic et al., 2017). The Technical School in Morocco improves quality, reduces waste and costs, and shortens time through the implementation of LM (Bakkali et al., 2017). Other several other studies have shown the contribution of LM implementation in universities. Some benefits of LM implementation are accelerating the administration process, increase student satisfaction, and design curricula (Bârsan & Codrea, 2019; Emiliani, 2004; Koromyslova et al., 2019; Kumar et al., 2016; Sremcevic et al., 2018).

Six Sigma methodology is a disciplined and structured approach to improve process performance and achieve high-quality levels. Lean Manufacturing and Six Sigma, referred to as the Lean Six Sigma (LSS), are complementary methods that have been widely used in companies. Lean Six Sigma (LSS) is a methodology that focuses on eliminating waste and defects by using Six Sigma to achieve customer satisfaction related to quality, delivery speed, and cost and generating financial benefits (Salah et al., 2010). Opportunities for improvement in HEI using LSS can be carried out in several activities, especially teaching, service administration, new student registration processes, marketing, and research (Hess & Benjamin, 2015). There have been several implementation LSS in HEI. Vats & Sujata (2015) reported that the implementation of LSS reduces waste in the teaching and learning process. Svensson et al. (2015) stated that LSS increases efficiency at King Abdullah University of Science and Technology.

Meanwhile, Allameh Tabatabai University in Tehran, Iran, increase student satisfaction levels, reducing the waiting time for consultations by 15 percent and increasing the number of applicants by 5 percent (Haerizadeh & Sunder M, 2019). Another benefit of implementing LSS in HEI is being an enabler to meet accreditation requirements (Sunder M & Mahalingam, 2018). The LSS approach in HEI can be applied to improve teaching methods, administrative processes, improve the quality of HEI and add value that can continuously increase customer/student satisfaction (Cudney et al., 2018). However, much of the research focused on implementing LSS to reduce waste rather than a holistic approach (Hines & Lethbridge, 2008). HEI requires an integrated method to increase business process efficiency and effectiveness. This paper proposes a conceptual framework of Lean Six Sigma for HEI. The framework will be developed in a comprehensive way to manage teaching process, research, and community services.

## **2. Literature Review**

### **2.1 Lean Manufacturing**

The basic principle of Lean Manufacturing (LM) is Lean Thinking. Lean Thinking consists of 5 principles: specify the value, identify value streams, create flow, pull system, and pursue perfection (James P Womack & Jones, 2003). LM implementation benefits include reducing lead time, improving productivity, and reducing WIP (Patel & Patange, 2017). Waste in manufacture consist of (J P Womack & Jones, 1997):

- a. Transportation. Unnecessary transport of parts under production.
- b. Inventory. Stacks of parts waiting to be completed or finished products waiting to be shipped.
- c. Motion. Unnecessary movement of people working on products.
- d. Waiting. Unnecessary waiting by people to begin the next step
- e. Over-Processing the product with extra steps.
- f. Over-Production of products not needed.
- g. Defects in the product.

### **2.2 Lean Six Sigma (LSS) in HEI**

Lean and Six Sigma have a complementary relationship that is widely accepted today, and more companies are establishing Lean Six Sigma (LSS) programs (Salah & Rahim, 2019). The term LSS was introduced around 2000. LSS is widely used in the industry (Antony et al., 2017). Snee (2010) defined LSS as a business strategy and

methodology that increased process performance resulting in enhanced customer satisfaction and improved bottom-line results by improving quality, speed and cost. The LSS methodology helps to improve capabilities within the organization, reduce production costs and improve quality. LSS has become a widely used strategy for continuous improvement in the manufacturing industry (automotive, heavy equipment, small industry, construction, textiles), process industry (paper, sugar, food industry), and service industries (health, finance, education, military, insurance, retail) (Shokri, 2017; M. Singh & Rathi, 2019). Although initially, LM came from the manufacturing industry, it has been implemented successfully in various industries, including HEI (Balzer, 2010). For more than 15 years, LSS has demonstrated its potential for realizing improvements in the delivery of higher education and its supporting services. Examples of improvement noted in the literature include (Balzer et al., 2016):

- reducing student waiting time at counseling centers from an average of 21 days to 0 days without adding staff
- reduce the response time of prospective students from 3 weeks to 1 hour.
- reduced the time to repair campus facilities from an average of 24 working days to an average of less than three working days, where 80 percent of repairs were completed on the same day as requested.
- half the administrative process for recruiting new staff, reducing hiring time from 22 to 8 weeks.
- more than \$ 27.2 B in financial savings at US public universities over four years.

The role of LSS in HEI includes several aspects, both operational and managerial aspects. The number of articles related to the implementation, concept, and study of literature at HEI (Figure 1). Figure 1 shows LSS research in PT has been started in 2006 and continues to increase in number until now. This shows that LSS is needed in PT and needs to be continuously developed.

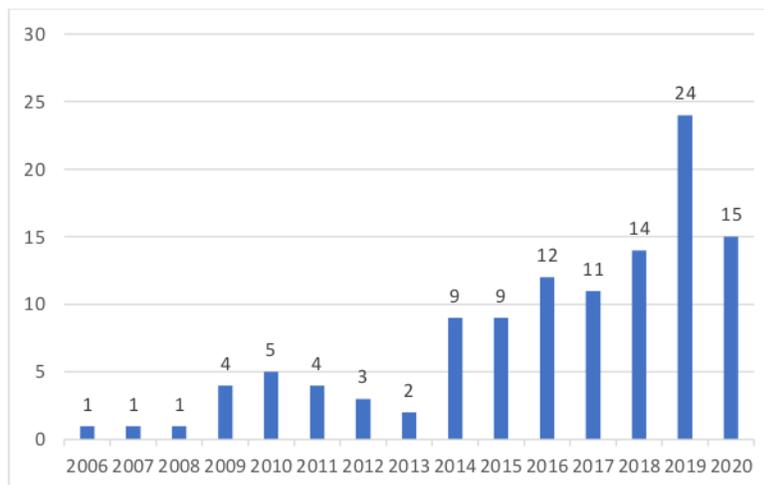


Figure 1. Number of LSS article in HEI  
(Source: Scopus Database, retrieved 30-12-2020)

### 3. Proposed Framework

This article discusses the Lean Six Sigma Framework for Higher Education Institution (LSSF - For HEdu) to improve the effectiveness and efficiency. The framework consists of 4 stages, namely:

- a. Identification and Prioritize of Waste.
- b. Identification of Critical Success Factors (CSF) and Analysis of its Relationship.
- c. Identification Voice of HEI stakeholders.
- d. Development of improvement project selection.

Figure 2 shows the proposed framework.

#### 3.1. Identification and Prioritize of Waste Framework

Kang & Manyonge (2014) identified the types of waste and classified them into three perspectives: students, research, and employees. Meanwhile, according to Sunder (2016), some examples of waste are as follows:

- a. Uncoordinated teaching so that students do not pass the test.
- b. Graduates who cannot get a job and cannot learn for life.
- c. Class schedules that make it difficult for students to graduate.
- d. Course does not contribute to customer value.
- e. Miss planning in teaching schedule that causes students/lecturers to change rooms or locations.
- f. Poor planning of materials and facilities required does not match both cost and quality.
- g. Lecturers and students wait because of activities that are not on time.
- h. Curricula design and supporting activities that are not under the needs of students and industry.

To develop LSS in HEI, it is necessary to identify the type of waste. Hussain & Malik (2016) argued that to develop LM successfully, waste must be identified and prioritized to eliminate. Waste in each HEI should be different both in type and impact on performance so that continuous efforts are needed to find and reduce waste. Unlike in manufacturing, waste in HEI is not clearly defined, and there is still no agreement (Kazancoglu & Ozkan-Ozen, 2019). Hartanti et al. (2020), in their study, classified waste in HEI into nine types, i.e., **overproduction, over-processing, waiting, motion, transportation, inventory, defect, people, and information**. Douglas et al. (2015) and Kazancoglu & Ozkan-Ozen (2019) used semi-structured interviews and brainstorming with academic staff to identify waste. Due to a lack of definition, it is necessary to involve HEI leaders, faculty members and staff, and LSS experts in identifying waste.

The process for identifying waste is not accessible due to overlapping processes and interrelatedness between waste. Rawabdeh (2005) proposed assessing seven types of waste in the manufacturing industry using the **Waste Relationship Matrix (WRM)**. WRM was used to determine the relationship between 7 wastes and determine their ranking. Another researcher, El-namrouy & Abushaban (2013), also used WRM to assess waste. Pessoa et al., (2009) identified ten types of waste in a product development system and ranked the waste using the Waste Net. The other methods were used to prioritize waste in manufacture are *Quality Function Deployment (QFD)* (Rawabdeh, 2011), *Weighted Average* (Arunagiri & Gnanavelbabu, 2014), *Failure Mode Effect Analysis (FMEA)* (Souza & Cagnetti, 2014), *Fuzzy Analytical Hierarchy Process (AHP)* (Arunagiri & Gnanavelbabu, 2016), questionnaire (Aka et al., 2019), *Decision Making Trial and Evaluation Laboratory (DEMATEL)* (Gupta et al., 2019) dan *Modified Failure Mode Effect Analysis (FMEA)* (Sutrisno et al., 2020). Hussain et al. (2016) and Hussain & Malik (2016) used AHP, and Bharsakade et al. (2021) used AHP in the healthcare industry. Regarding HEI, the rating of waste by using Fuzzy DEMATEL (Kazancoglu & Ozkan-Ozen, 2019) and AHP (Klein et al., 2021).

### **3.2. Identification of Critical Success Factors (CSF) and Readiness of Lean Six Sigma (LSS) Framework.**

Laureani & Antony (2012) surveyed to determine the critical success factors for LSS in various industries. The survey results show that 19 factors determine the success of LSS, namely **management commitment, organizational culture, the relationship between LSS and business strategy, leadership, communication, the relationship between LSS and customers, concern, selection of LSS staff, database approach, selection of improvement projects, review of LSS projects, LSS staff resources, training, technical LSS, project management skills, finance, organizational infrastructure, expansion of the LSS to the supply chain, and linkage of the LSS to the reward system**. Antony (2014) identified the readiness factors of 7 universities in the United Kingdom consisting of **leadership and vision, management commitment and resources, linking LSS to the university's strategy, customer focus, and selecting the right people**. By knowing the level of readiness to develop LSS (Lean Six Sigma Readiness/LESIRE), organizations can identify obstacles in developing LSS. Bayou & de Korvin (2008) measured the leanness of two automotive industries using fuzzy logic. Meanwhile, Vinodh & Chintha (2011) dan Vinodh & Vimal (2012) measured the leanness index and score. Wong et al. (2014) conducted an integrated leanness level (index) measurement, which includes three aspects (quality, cost, and on-time delivery). In addition to identifying CSFs, determining relationships between factors is also essential (Swarnakar et al., 2019, 2020; Yadav & Desai, 2017). The relationship between factors in a system is very complex, and it is difficult to determine the influence between factors (Swarnakar et al., 2020). Some researchers investigated the relation and interaction of CSF in the manufacturing industry. The method that is widely used to analyze the relationship between factors and categorize factors is the integration between **Interpretive Structural Modeling (ISM) and Fuzzy Matrices Impacts Croise's Multiplication Applique'e'a'un Classement (Fuzzy MICMAC)** (Ben Ruben et al., 2018; Cherrafi et al., 2017; Malek & Desai, 2019; Raval et al., 2018; Swarnakar et al., 2019; Yadav & Desai, 2017). However, the limitations of ISM are (i) only describes the variables that are directly related (ii) does not explain the reasons for the relationship between variables. Total Interpretive Structural Modeling (TISM) can overcome these limitations by identifying and interpreting direct and indirect relationships between variables. By interpreting the relationship, directly and indirectly, TISM can be more easily applied in real life (Sushil,

2012). According to Sushil (2012), TISM only considers the interactions between existing variables. To consider the possibility of other interactions, TISM can be developed into Fuzzy TISM.

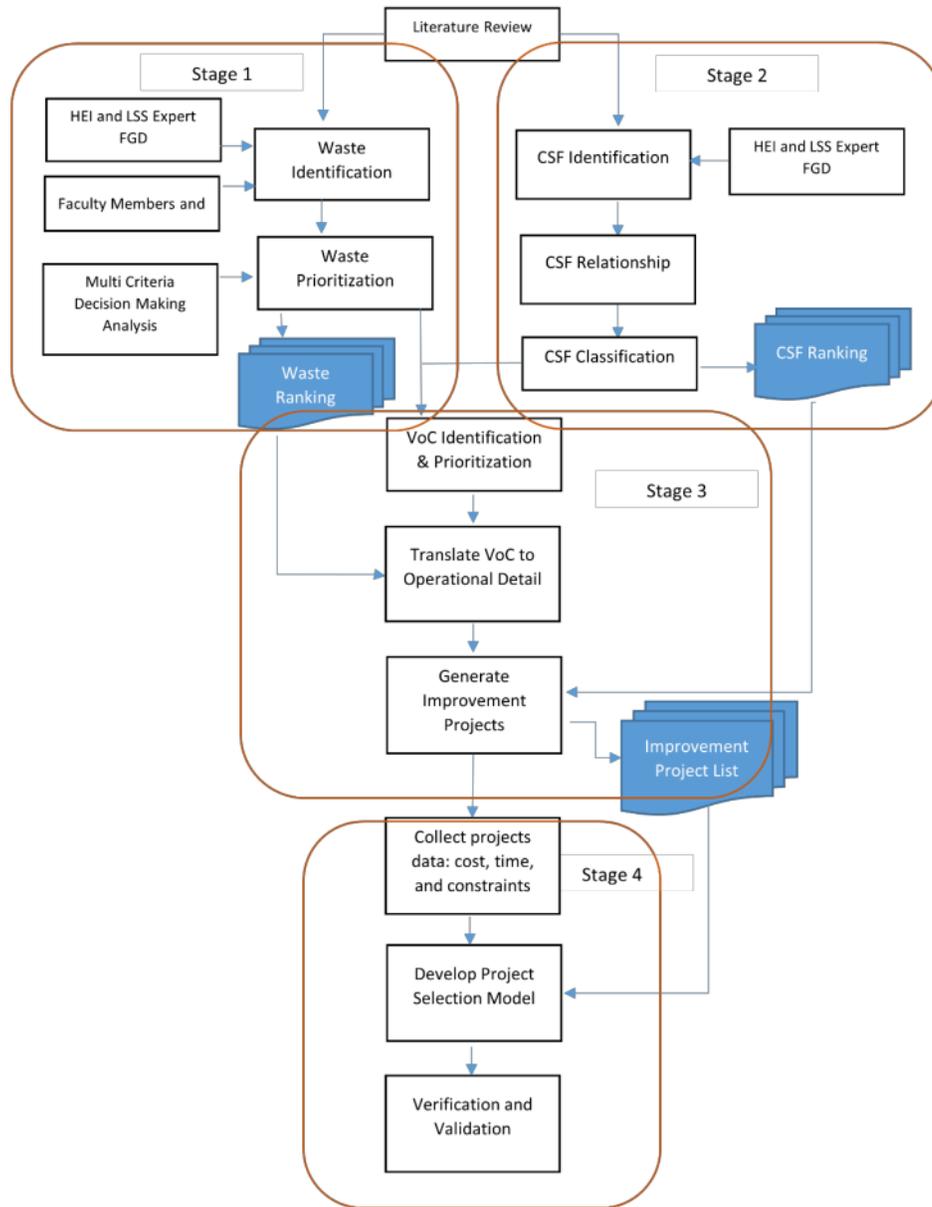


Figure 2. Proposed Framework of LSS in HEI

### 3.3. Voices of Customer in HEI.

In the competition era, an organization, including HEI, must improve quality. In facing competition, HEI ought to adopt a customer-oriented approach (Wulandari & Jager, 2018). HEI that adopt customer-oriented will understand and assess stakeholders' perceptions about education to find out their needs. The question that often arises in education, especially HEI, is who the stakeholders are? (Pereira & Silva, 2003). Reavill (1998) identified twelve stakeholders

HEI, namely owners, student families, university leaders and employees, suppliers, high schools, other universities, industry, state, government, taxpayers, and professional organizations. Based on a study conducted by Pereira & Silva (2003), HEI customers consist of students, owners, lecturers, family, community/government, and employees. Of course, every stakeholder has their own desires that may be the same or different. HEI that can fulfill the desires of stakeholders can be said to have good quality. Like an industry, HEI must also focus on the desires of its stakeholders. The question now is not how important quality is but how to organize qualified HEI. Most of the articles indicated that students as customers of HEI (H. Alves & Raposo, 2007; Brkanlić et al., 2020; Campos et al., 2018; Cavallone et al., 2020; Clemes et al., 2007; Elliott & Healy, 2001; Hwang & Teo, 2001; Koris & Nokelainen, 2015; Mark, 2013; Santini et al., 2017; Skea, 2017, 2019; Wiers-Jenssen et al., 2002; Wulandari & Jager, 2018; Zineldin et al., 2011). Some other articles did not merely consider students as the customer. Chen et al. (2006) developed a satisfaction measurement model of faculty members. Gonzalez et al. (2011) used employees as customers in designing curriculum. Sandmaung & Khang (2013) determined quality indicators from students, faculty members, university leaders, and staff perspectives.

To find out the Voice of Customer (VoC) and determine the priority of VoC, the KANO method can be used. KANO model was able to identify product attributes that meet customer desires (Sharif Ullah & Tamaki, 2011; Suef et al., 2014, 2017). Several articles show the effectiveness of KANO in identifying VoC HEI. Sahney (2011) uses the KANO method to determine priorities for improving HEI services in India. Mcdowall (2016) conducted research to determine quality attributes and measure student satisfaction using the KANO method. Hamzah et al. (2018) used the KANO method to classify the quality attributes of HI in Indonesia. In its use, KANO also integrated with other methods such as Quality Function Deployment (Hamzah et al., 2018; Sahney, 2011) and Importance Performance Analysis (Ku & Shang, 2020).

### 3.4.5 LSS Project Selection Model in HEI.

One of the critical factors for the success or failure of LSS development is determining improvement projects (Albliwi et al., 2014; Laureani & Antony, 2012; Sreedharan V et al., 2019). The improvement project is a process improvement project. A process improvement project is defined as a systematic approach to improving organizational performance, which consists of activities, tools, techniques, and technology, as well as implementing a series of improvement projects. In determining project selection, there are several criteria: the customer perspective, financial perspective, conformity with business strategy objectives, employee perspective, availability of resources, time, and risk. The model for determining the LSS project is grouped into 3, namely the unstructured peer review/ scoring/ranking model, Multiple Criteria Decision Making (MCDM) model, and mathematical programming (Padhy, 2017).

Researchers most widely use the Multiple Criteria Decision Making (MCDM) model to select improvement projects. One of the methods used is the Analytical Network Process (ANP). Some researchers use ANP or combine it with other methods, for example, Meade & Presley (2002) combining it with AHP, Büyükoçkan & Öztürkcan (2010) integrating with Decision-Making Trial and Evaluation Laboratory (DEMATEL) and Vinod Swarnakar (2015) using an approach based on Fuzzy DEMATEL, ANP, and TOPSIS. Meanwhile, Abdel-Basset et al. (2019) integrated the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) with DEMATEL to determine project priorities.

## 4. Conclusion

In this article, we have proposed an integrated LSS framework in HEI. The proposed framework is integrated, starting from identifying waste to determining the improvement project. Lean Six Sigma is a fundamental concept in the development of this framework. This framework helps HEI management to increase the efficiency and effectiveness of HEIs. This framework is unique in that HEI customers are different from other manufacturing or service industries. HEI customers consist of students, lecturers, staff, government, industry. In this framework, the Voice of the customer considered are lecturers, students, administrative staff, and industry. The method of developing LSS in HEI uses some MCDM methods. Some examples of MCDM methods are AHP, ANP, TOPSIS, DEMATEL, MICMAC.

## References

- Abdel-Basset, M., Atef, A., & Smarandache, F. (2019). A hybrid neutrosophic multiple criteria group decision making approach for project selection. *Cognitive Systems Research*, 57, 216–227. <https://doi.org/10.1016/j.cogsys.2018.10.023>
- Aka, A., Saidu, I., & Balogun, O. M. (2019). A conceptual framework for waste identification and reduction in Nigerian sandcrete blocks production process. 19(3), 405–423. <https://doi.org/10.1108/CI-11-2017-0091>
- Albliwi, S., Antony, J., Lim, S. A. H., & van der Wiele, T. (2014). Critical failure factors of lean Six Sigma: A

- systematic literature review. *International Journal of Quality and Reliability Management*, 31(9), 1012–1030. <https://doi.org/10.1108/IJQRM-09-2013-0147>
- Alifiya, A., & Singgih, M. L. (2019). Re-design Production Process Using Lean Manufacturing Approach for Pressure Vessel 421 Psi. *IOP Conf. Series: Mater. Sci. Eng.*, 598. <https://doi.org/10.1088/1757-899X/598/1/012005>
- Alves, A. C., Flumerfelt, S., & Kahlen, F. J. (2016). Lean education: An overview of current issues. In *Lean Education: An Overview of Current Issues*. <https://doi.org/10.1007/978-3-319-45830-4>
- Alves, H., & Raposo, M. (2007). Conceptual model of student satisfaction in higher education. *Total Quality Management and Business Excellence*, 18(5), 571–588. <https://doi.org/10.1080/14783360601074315>
- Antony, J. (2014). Readiness factors for the Lean Six Sigma journey in the higher education sector. *International Journal of Productivity and Performance Management*, 63(2), 257–264. <https://doi.org/10.1108/IJPPM-04-2013-0077>
- Antony, J., Snee, R., & Hoerl, R. (2017). Lean Six Sigma: yesterday, today and tomorrow. *International Journal of Quality and Reliability Management*, 34(7), 1073–1093. <https://doi.org/10.1108/IJQRM-03-2016-0035>
- Arunagiri, P., & Gnanavelbabu, A. (2014). Identification of major lean production waste in automobile industries using weighted average method. *Procedia Engineering*, 97, 2167–2175. <https://doi.org/10.1016/j.proeng.2014.12.460>
- Arunagiri, P., & Gnanavelbabu, A. (2016). Identification of Major Lean Waste and Its Contributing Factors Using The Fuzzy Analytical Hierarchy Process. *Transaction of the Canadian Society for Mechanical Engineering*, 40(3), 371–382.
- Bakkali, S., Hadek, A., Chaibate, H., & Ajana, S. (2017). The Lean thinking approach: Implementation in Moroccan engineering education. *International Journal of Engineering Research and General Science*, 5(3), 1–8.
- Balzer, W. K. (2010). *Lean Higher Education Increasing the Value and Performance of University Process*. Productivity Press. <https://doi.org/10.1201/ebk1439814659>
- Balzer, W. K., Francis, D. E., Krehbiel, T. C., & Shea, N. (2016). A review and perspective on Lean in higher education. *Quality Assurance in Education*, 24(4), 442–462. <https://doi.org/10.1108/QAE-03-2015-0011>
- Bârsan, R. M., & Codrea, F.-M. (2019). Lean university: applying the ECRS method to improve an administrative process. *MATEC Web of Conferences*, 290, 07003. <https://doi.org/10.1051/mateconf/201929007003>
- Bayou, M. E., & de Korvin, A. (2008). Measuring the leanness of manufacturing systems-A case study of Ford Motor Company and General Motors. *Journal of Engineering and Technology Management*, 25(4), 287–304. <https://doi.org/10.1016/j.jengtecman.2008.10.003>
- Ben Ruben, R., Vinodh, S., & Asokan, P. (2018). ISM and Fuzzy MICMAC application for analysis of Lean Six Sigma barriers with environmental considerations. *International Journal of Lean Six Sigma*, 9(1), 64–90. <https://doi.org/10.1108/IJLSS-11-2016-0071>
- Bhamu, J., & Sangwan, K. S. (2014). Lean manufacturing: Literature review and research issues. *International Journal of Operations and Production Management*, 34(7), 876–940. <https://doi.org/10.1108/IJOPM-08-2012-0315>
- Bharsakade, R. S., Acharya, P., Ganapathy, L., & Tiwari, M. K. (2021). A lean approach to healthcare management using multi criteria decision making. *Opsearch*, 0123456789. <https://doi.org/10.1007/s12597-020-00490-5>
- Bittencourt, V. L., Alves, A. C., & Leão, C. P. (2019). Lean Thinking contributions for Industry 4.0: A systematic literature review. *IFAC-PapersOnLine*, 52(13), 904–909. <https://doi.org/10.1016/j.ifacol.2019.11.310>
- Brkanlić, S., Sánchez-García, J., Esteve, E. B., Brkić, I., Ćirić, M., Tatarski, J., Gardašević, J., & Petrović, M. (2020). Marketing mix instruments as factors of improvement of students' satisfaction in higher education institutions in Republic of Serbia and Spain. *Sustainability (Switzerland)*, 12(18), 1–16. <https://doi.org/10.3390/SU12187802>
- Büyüközkan, G., & Öztürkcan, D. (2010). An integrated analytic approach for Six Sigma project selection. *Expert Systems with Applications*, 37(8), 5835–5847. <https://doi.org/10.1016/j.eswa.2010.02.022>
- Campos, D. F., Dos Santos, G. S., & Castro, F. N. (2018). Measuring students' expectations of service quality of a higher education institution in a longitudinal design. *International Journal of Services and Operations Management*, 31(3), 303–324. <https://doi.org/10.1504/IJSOM.2018.095559>
- Cavallone, M., Manna, R., & Palumbo, R. (2020). Filling in the gaps in higher education quality: An analysis of Italian students' value expectations and perceptions. *International Journal of Educational Management*, 34(1), 203–216. <https://doi.org/10.1108/IJEM-06-2019-0189>
- Chen, S. H., Yang, C. C., Shiau, J. Y., & Wang, H. H. (2006). The development of an employee satisfaction model for higher education. *TQM Magazine*, 18(5), 484–500. <https://doi.org/10.1108/09544780610685467>
- Cherrafi, A., Elfezazi, S., Garza-Reyes, J. A., Benhida, K., & Mokhlis, A. (2017). Barriers in green lean

- implementation: A combined systematic literature review and interpretive structural modelling approach. *Production Planning and Control*, 28(10), 829–842. <https://doi.org/10.1080/09537287.2017.1324184>
- Clemes, M. D., Gan, C., & Kao, T. H. (2007). University student satisfaction: An empirical analysis. *Journal of Marketing for Higher Education*, 17(2), 292–325. <https://doi.org/10.1080/08841240801912831>
- Cudney, E. A., Venuthurumilli, S. S. J., Materla, T., & Antony, J. (2018). Systematic review of Lean and Six Sigma approaches in higher education. *Total Quality Management and Business Excellence*, 31(3–4), 231–244. <https://doi.org/10.1080/14783363.2017.1422977>
- Davidson, J. M., Price, O. M., & Pepper, M. (2020). Lean Six Sigma and quality frameworks in higher education – a review of literature. *International Journal of Lean Six Sigma*. <https://doi.org/10.1108/IJLSS-03-2019-0028>
- Douglas, J. A., Antony, J., & Douglas, A. (2015). Waste identification and elimination in HEIs: the role of Lean thinking. *International Journal of Quality and Reliability Management*, 32(9), 970–981. <https://doi.org/10.1108/IJQRM-10-2014-0160>
- Dräger, J., Friedrich, J.-D., Mordhorst, L., Müller, U., & Röwert, R. (2017). Higher Education Institutions Need Strategies for The Digital Age. In *Prospects and Future Tasks of Universities : Digitalization - Internationalization - Differentiation*. Austrian Council for Research and Technology Development.
- El-namrouty, K. A., & Abushaaban, M. S. (2013). Seven wastes elimination targeted by lean manufacturing case study “ gaza strip manufacturing firms ”. *International Journal of Economics, Finance and Management Sciences*, 1(2), 68–80. <https://doi.org/10.11648/j.ijefm.20130102.12>
- Elliott, K. M., & Healy, M. A. (2001). Key Factors Influencing Student Satisfaction Related to Recruitment and Retention. *Journal of Marketing for Higher Education*, 10(4), 1–11. <https://doi.org/10.1300/J050v10n04>
- Emiliani, M. L. (2004). Improving business school courses by applying lean principles and practices. *Quality Assurance in Education*, 12(4), 175–187. <https://doi.org/10.1108/09684880410561596>
- Gonzalez, M. E., Quesada, G., Mueller, J., & Mueller, R. D. (2011). International business curriculum design: Identifying the voice of the customer using QFD. *Journal of International Education in Business*, 4(1), 6–29. <https://doi.org/10.1108/18363261111170568>
- Gupta, A., Sharma, P., Jain, A., Xue, H., Malik, S. C., & Jha, P. C. (2019). An integrated DEMATEL Six Sigma hybrid framework for manufacturing process improvement. *Annals of Operations Research*. <https://doi.org/10.1007/s10479-019-03341-9>
- Haerizadeh, M., & Sunder M, V. (2019). Impacts of Lean Six Sigma on improving a higher education system: a case study. *International Journal of Quality and Reliability Management*, 36(6), 983–998. <https://doi.org/10.1108/IJQRM-07-2018-0198>
- Hamzah, Purwati, A. A., & Kadir, E. A. (2018). Quality Evaluation on Private Higher Education Institutions in Pekanbaru , Indonesia ( Integrating Kano Model and Quality Function Deployment ). *Espacios*, 39(17).
- Hardiningtyas, D., Partawi, S. G., & Sudiarno, A. (2011). Evaluasi Hasil Implementasi Lean Production Dengan Pendekatan Cost-Time Profile Di Pt . ECCO Indonesia. *Prosiding Seminar Nasional Manajemen Teknologi XIV*.
- Hartanti, L., Mulyana, I. J., & Hartiana, T. (2020). Waste In Higher Education Institution: A Systematic Literature Review. *INTERNATIONAL JOURNAL OF SCIENTIFIC & TECHNOLOGY RESEARCH*, 9(9), 16–22.
- Hess, J. D., & Benjamin, B. A. (2015). Applying Lean Six Sigma within the university: Opportunities for process improvement and cultural change. *International Journal of Lean Six Sigma*, 6(3), 249–262. <https://doi.org/10.1108/IJLSS-12-2014-0036>
- Hines, P., & Lethbridge, S. (2008). New development: Creating a lean university. *Public Money and Management*, 28(1), 53–56. <https://doi.org/10.1111/j.1467-9302.2008.00619.x>
- Hussain, M., & Malik, M. (2016). Prioritizing Lean Management Practices in Public and Private Hospitals. *Journal of Health Organization and Management*, 30(3).
- Hussain, M., Malik, M., & Neyadi, H. S. Al. (2016). AHP framework to assist lean deployment in Abu Dhabi public healthcare delivery system. *Business Process Management Journal*, 22(3), 546–565. <https://doi.org/10.1108/BPMJ-08-2014-0074>
- Hwang, H. B., & Teo, C. (2001). Translating customers’ voices into operations requirements: A QFD application in higher education. *International Journal of Quality and Reliability Management*, 18(2), 195–225. <https://doi.org/10.1108/02656710110379075>
- Kang, P., & Manyonge, L. (2014). Exploration of Lean Principals in Higher Educational Institutes – Based on Degree of Implementation and Indigence. *Nternational Journal of Scientific & Engineering Research*, 5(2).
- Kaswan, M. S., & Rathi, R. (2020). Investigating the enablers associated with implementation of Green Lean Six Sigma in manufacturing sector using Best Worst Method. *Clean Technologies and Environmental Policy*, 22(4), 865–876. <https://doi.org/10.1007/s10098-020-01827-w>

- Kazancoglu, Y., & Ozkan-Ozen, Y. D. (2019). Lean in higher education: A proposed model for lean transformation in a business school with MCDM application. *Quality Assurance in Education*, 27(1), 82–102. <https://doi.org/10.1108/QAE-12-2016-0089>
- Klein, L. L., Tonetto, M. S., Avila, L. V., & Moreira, R. (2021). Management of lean waste in a public higher education institution. *Journal of Cleaner Production*, 286, 125386. <https://doi.org/10.1016/j.jclepro.2020.125386>
- Koh, J., & Singgih, M. L. (2020). Implementation Lean Manufacturing Method of Plywood Manufacture Company. *IPTEK Journal of Proceedings Series*, 2, 25. <https://doi.org/10.12962/j23546026.y2020i2.9022>
- Koris, R., & Nokelainen, P. (2015). The student-customer orientation questionnaire (SCOQ): application of customer metaphor to higher education. *International Journal of Educational Management*, 29(1), 115–138. <https://doi.org/10.1108/IJEM-10-2013-0152>
- Koromyslova, E., Steinlicht, C., Hall, T. J. K., Yordanova, A. Y., & Garry, B. G. (2019). Implementing lean practices in an academic department: A case study. *ASEE Annual Conference and Exposition, Conference Proceedings*.
- Ku, G. C. M., & Shang, I. W. (2020). Using the integrated kano–RIPA model to explore teaching quality of physical education programs in Taiwan. *International Journal of Environmental Research and Public Health*, 17(11), 1–14. <https://doi.org/10.3390/ijerph17113954>
- Kumar, A., Shankar, R., Choudhary, A., & Thakur, L. S. (2016). A big data MapReduce framework for fault diagnosis in cloud-based manufacturing. *International Journal of Production Research*, 54(23), 7060–7073. <https://doi.org/10.1080/00207543.2016.1153166>
- Laureani, A., & Antony, J. (2012). Critical success factors for the effective implementation of Lean Sigma: Results from an empirical study and agenda for future research. *International Journal of Lean Six Sigma*, 3(4), 274–283. <https://doi.org/10.1108/20401461211284743>
- Malek, J., & Desai, T. N. (2019). Interpretive structural modelling based analysis of sustainable manufacturing enablers. *Journal of Cleaner Production*, 238, 117996. <https://doi.org/10.1016/j.jclepro.2019.117996>
- Mark, E. (2013). Student satisfaction and the customer focus in higher education. *Journal of Higher Education Policy and Management*, 35(1), 2–10.
- Mcdowall, M. P. (2016). *Applying the Kano Model To Higher Education: Moving Beyond Measuring Student Satisfaction*. University of North Dakota.
- Meade, L. A., & Presley, A. (2002). R&D project selection using Analytical Network Process. *IEEE TRANSACTIONS ON ENGINEERING MANAGEMENT*, 49(1). <https://doi.org/10.1109/45.998087>
- Mulyana, I. J., & Angka, P. R. (2014). Peningkatan Produktivitas Usaha Kecil Menengah (UKM ) Sentra Industri Sepatu Wedoro Kabupaten Sidoarjo Jawa Timur Dengan Pendekatan Lean Production Productivity. *Jurnal Integra*, 4(2), 151–160.
- Narottam, Mathiyazhagan, K., & Kumar, K. (2020). Modelling the common critical success factors for the adoption of Lean Six Sigma in Indian industries. *International Journal of Business Excellence*, 20(3), 375–397. <https://doi.org/10.1504/IJBEX.2020.106382>
- Padhy, R. (2017). Six Sigma project selections: a critical review. *International Journal of Lean Six Sigma*, 8(2). <https://doi.org/10.1108/ijlss-06-2016-0025>
- Parmar, P. S., & Desai, T. N. (2020). Evaluating Sustainable Lean Six Sigma enablers using fuzzy DEMATEL: A case of an Indian manufacturing organization. *Journal of Cleaner Production*. <https://doi.org/10.1016/j.jclepro.2020.121802>
- Patel, J. S., & Patange, G. S. (2017). A Review on Benefits of Implementing Lean Manufacturing. *International Journal of Scientific Research in Science and Technology*, 3(1), 249–252.
- Pereira, M., & Silva, M. Da. (2003). A key question for higher education: Who are the customers. ... of the 31st Annual Conference of the ... , 4–7. <http://www.marco.eng.br/publicacoes/2002-POMS- A Key Question.PDF>
- Pessôa, M. V. P., Seering, W., Rebentisch, E., & Bauch, C. (2009). Understanding the waste net: A method for waste elimination prioritization in product development. *Global Perspective for Competitive Enterprise, Economy and Ecology - Proceedings of the 16th ISPE International Conference on Concurrent Engineering*, 55(21), 233–242. [https://doi.org/10.1007/978-1-84882-762-2\\_22](https://doi.org/10.1007/978-1-84882-762-2_22)
- Raval, S. J., Kant, R., & Shankar, R. (2018). Lean Six Sigma implementation: modelling the interaction among the enablers. *Production Planning and Control*, 29(12), 1010–1029. <https://doi.org/10.1080/09537287.2018.1495773>
- Rawabdeh, I. A. (2005). A model for the assessment of waste in job shop environments. *International Journal of Operations and Production Management*, 25(8), 800–822. <https://doi.org/10.1108/01443570510608619>
- Rawabdeh, I. A. (2011). Waste elimination using quality function deployment. *International Journal of Services and*

- Operations Management*, 10(2), 216–238. <https://doi.org/10.1504/IJSOM.2011.042518>
- Reavill, L. R. p. (1998). Quality assessment, total quality management and the stakeholders in the UK higher education system. *Managing Service Quality: An International Journal*, 8(1), 55–63. <https://doi.org/10.1108/09604529810199395>
- Sahney, S. (2011). Delighting customers of management education in India: A student perspective, part II. *TQM Journal*, 23(5), 531–548. <https://doi.org/10.1108/17542731111157635>
- Salah, S., & Rahim, A. (2019). *An Integrated Company -Wide Management System : Combining Lean Six Sigma with Process Improvement*. Springer.
- Salah, S., Rahim, A., & Carretero, J. A. (2010). The integration of Six Sigma and lean management. In *International Journal of Lean Six Sigma* (Vol. 1, Issue 3). <https://doi.org/10.1108/20401461011075035>
- Sandmaung, M., & Khang, D. B. (2013). Quality expectations in Thai higher education institutions: Multiple stakeholder perspectives. *Quality Assurance in Education*, 21(3), 260–281. <https://doi.org/10.1108/QAE-11-2012-0044>
- Santini, F. de O., Ladeira, W. J., Sampaio, C. H., & da Silva Costa, G. (2017). Student satisfaction in higher education: a meta-analytic study. *Journal of Marketing for Higher Education*, 27(1), 1–18. <https://doi.org/10.1080/08841241.2017.1311980>
- Sharif Ullah, A. M. M., & Tamaki, J. (2011). Analysis of Kano-model-based customer needs for product development. *Systems Engineering*, 14(2), 154–172. <https://doi.org/10.1002/sys.20168>
- Shokri, A. (2017). Quantitative analysis of Six Sigma, Lean and Lean Six Sigma research publications in last two decades. *International Journal of Quality and Reliability Management*, 34(5), 598–625. <https://doi.org/10.1108/IJQRM-07-2015-0096>
- Singh, C., Singh, D., & Khamba, J. S. (2020). Analyzing barriers of Green Lean practices in manufacturing industries by DEMATEL approach. *Journal of Manufacturing Technology Management*, 32(1), 176–198. <https://doi.org/10.1108/JMTM-02-2020-0053>
- Singh, M., & Rathi, R. (2019). A structured review of Lean Six Sigma in various industrial sectors. In *International Journal of Lean Six Sigma* (Vol. 10, Issue 2). <https://doi.org/10.1108/IJLSS-03-2018-0018>
- Skea, C. (2017). Student satisfaction in higher education: settling up and settling down. *Ethics and Education*, 12(3), 364–377. <https://doi.org/10.1080/17449642.2017.1343560>
- Skea, C. (2019). *Student Satisfaction in Higher Education: Philosophical Perspectives on Voice, Settlement, and Customer Relations* (Issue March). <http://etheses.whiterose.ac.uk/24133/>
- Snee, R. D. (2010). Lean Six Sigma – getting better all the time. *International Journal of Lean Six Sigma*, 1(1), 9–29. <https://doi.org/10.1108/20401461011033130>
- Sodhi, H. S., Singh, D., & Singh, B. J. (2019). An empirical analysis of critical success factors of lean six sigma in Indian SMEs. *International Journal of Six Sigma and Competitive Advantage*, 11(4), 227–252. <https://doi.org/10.1504/IJSSCA.2019.103556>
- Souza, R. V. B. De, & Carpinetti, L. C. R. (2014). A FMEA-based approach to prioritize waste reduction in lean implementation. *International Journal of Quality & Reliability Management*, 31(4), 346–366. <https://doi.org/10.1108/IJQRM-05-2012-0058>
- Sreedharan V, R., Raju, R., Sunder M, V., & Antony, J. (2019). Assessment of Lean Six Sigma Readiness (LESIRE) for manufacturing industries using fuzzy logic. *International Journal of Quality and Reliability Management*, 36(2), 137–161. <https://doi.org/10.1108/IJQRM-09-2017-0181>
- Sremcevic, N., Lazarevic, M., Krainovic, B., Mandic, J., & Medojevic, M. (2018). Improving Teaching and Learning Process by Applying Lean Thinking. *Procedia Manufacturing*, 17, 595–602. <https://doi.org/10.1016/j.promfg.2018.10.101>
- Stankalla, R., Koval, O., & Chromjakova, F. (2018). A review of critical success factors for the successful implementation of Lean Six Sigma and Six Sigma in manufacturing small and medium sized enterprises. *Quality Engineering*, 30(3), 453–468. <https://doi.org/10.1080/08982112.2018.1448933>
- Suef, M., Singgih, M. L., Sukwadi, R., & Widawati, E. (2014). Utilizing Claims , Complaints , and Company Initiatives as Voc in a Product Development using QFD-Kano Approach. *International Journal of Applied Engineering Research*, 9(22), 15383–15393.
- Suef, M., Suparno, S., & Singgih, M. L. (2017). Categorizing product attributes efficiently in QFD-Kano: A case analysis in telecommunication. *TQM Journal*, 29(3), 512–526. <https://doi.org/10.1108/TQM-03-2015-0036>
- Sunder M, V., & Antony, J. (2018). A conceptual Lean Six Sigma framework for quality excellence in higher education institutions. *International Journal of Quality and Reliability Management*, 35(4), 857–874. <https://doi.org/10.1108/IJQRM-01-2017-0002>
- Sunder M, V., & Mahalingam, S. (2018). An empirical investigation of implementing Lean Six Sigma in Higher

- Education Institutions. *International Journal of Quality and Reliability Management*, 35(10), 2157–2180. <https://doi.org/10.1108/IJQRM-05-2017-0098>
- Sunder M, V., & Prashar, A. (2020). Empirical examination of critical failure factors of continuous improvement deployments: stage-wise results and a contingency theory perspective. *International Journal of Production Research*, 58(16), 4894–4915. <https://doi.org/10.1080/00207543.2020.1727044>
- Sunder, V. (2016). Constructs of Quality in Higher Education Services. *International Journal of Productivity and Performance Management*, 65(8).
- Sushil. (2012). Interpreting the Interpretive Structural Model. *Global Journal of Flexible Systems Management*, 13(2), 87–106. <https://doi.org/10.1007/S40171-012-0008-3>
- Sutrisno, A., Gunawan, I., Vanany, I., Asjad, M., & Caesarendra, W. (2020). An improved modified FMEA model for prioritization of lean waste risk. *International Journal of Lean Six Sigma*, 11(2), 233–253. <https://doi.org/10.1108/IJLSS-11-2017-0125>
- Svensson, C., Antony, J., Majed, M. B.-E., & Bakhsh Saja Albliwi. (2015). A Lean Six Sigma program in higher education. *International Journal of Quality & Reliability Management*, 32(9). <https://doi.org/http://dx.doi.org/10.1108/IJQRM-09-2014-0141>
- Swarnakar, V., Singh, A. R., Antony, J., Kr Tiwari, A., Cudney, E., & Furterer, S. (2020). A multiple integrated approach for modelling critical success factors in sustainable LSS implementation. *Computers and Industrial Engineering*, 150(September), 106865. <https://doi.org/10.1016/j.cie.2020.106865>
- Swarnakar, V., Singh, A. R., & Tiwari, A. K. (2019). Evaluating importance of critical success factors in successful implementation of Lean Six Sigma framework. *AIP Conference Proceedings*, 2148(September). <https://doi.org/10.1063/1.5123970>
- Vats, T., & Sujata, M. (2015). Lean Six Sigma Frameworks “An Improvement in Teaching-Learning Process.” *International Journal of Science and Engineering Applications*, 4(1), 17–23. <https://doi.org/10.7753/ijsea0401.1003>
- Vinodh, S., & Chintha, S. K. (2011). Leanness assessment using multi-grade fuzzy approach. *International Journal of Production Research*, 49(2), 431–445. <https://doi.org/10.1080/00207540903471494>
- Vinodh, S., & Swarnakar, V. (2015). Lean Six Sigma Lean Six Sigma project selection using hybrid approach based on fuzzy DEMATEL– ANP–TOPSIS. *International Journal of Lean Six Sigma*, 6(4), 313–338.
- Vinodh, S., & Vimal, K. E. K. (2012). Thirty criteria based leanness assessment using fuzzy logic approach. *International Journal of Advanced Manufacturing Technology*, 60(9–12), 1185–1195. <https://doi.org/10.1007/s00170-011-3658-y>
- Vukadinovic, S., Djapan, M., & Macuzic, I. (2017). Education for lean & lean for education: A literature review. *International Journal for Quality Research*, 11(1), 35–50. <https://doi.org/10.18421/IJQR11.01-03>
- Wawan, B., Zulkifli, D., & Syaputra, A. (2018). Pacu Berfikir Kreatif dan Inovatif di Era Revolusi Industri 4.0. *Majalah Ristekdikti*, 8, 10–11.
- Wiers-Jenssen, J., Stensaker, B., & Grøgaard, J. B. (2002). Student Satisfaction: Towards an empirical deconstruction of the concept. *Quality in Higher Education*, 8(2). <https://doi.org/10.1080/1353832022000004377>
- Womack, J P, & Jones, D. T. (1997). Lean Thinking—Banish Waste and Create Wealth in your Corporation. *Journal of the Operational Research Society*, 48(11), 1148–1148. <https://doi.org/10.1038/sj.jors.2600967>
- Womack, James P, & Jones, D. T. (2003). Lean Thinking : Banish Waste and Create Wealth Our Corporation. In *Free Press*. <https://doi.org/10.1007/BF01807056>
- Wulandari, N., & Jager, J. W. De. (2018). Students’ Expectations of Higher Educational Experience in Public vs. Private Universities in Indonesia. *The New Educational Review*. <https://doi.org/10.15804/tner.2018.54.4.12>
- Yadav, G., & Desai, T. N. (2017). Analyzing Lean Six Sigma enablers: A hybrid ISM-fuzzy MICMAC approach. *TQM Journal*, 29(3), 488–510. <https://doi.org/10.1108/TQM-04-2016-0041>
- Zineldin, M., Akdag, H. C., & Vasicheva, V. (2011). Assessing quality in higher education: New criteria for evaluating students’ satisfaction. *Quality in Higher Education*, 17(2), 231–243. <https://doi.org/10.1080/13538322.2011.582796>

## **Biographies**

**Ig. Jaka Mulyana** is a Senior Lecturer at Industrial Engineering Department, Widya Mandala Surabaya Catholic University Surabaya Indonesia. Before joining as a lecturer, he has experience in the plastic and furniture industry. He earned **3** S. in Agricultural Industrial Technology from Gadjah Mada University Jogjakarta Indonesia and Master Degree in Industrial Engineering from Institut Teknologi Sepuluh Nopember, Surabaya Indonesia. He has published journal and conference **10** papers. His research interests include quality engineering, lean manufacturing, and supply chain management. Currently, he is pursuing doctoral studies at the Department of Industrial and Systems Engineering, Institut Teknologi Sepuluh Nopember Surabaya Indonesia. His research topic is Lean Six Sigma in Higher Education Institution (HEI).

**Moses Laksono Singgih** is a Professor at the Department of Industrial and Systems Engineering, Institut Teknologi Sepuluh Nopember Surabaya, Indonesia. He received his Bachelor and Master degree from Industrial Engineering Department, Institut Teknologi Bandung (ITB), Indonesia. He received Ph.D. from the University of Queensland, Australia. His research interests are productivity, quality, and manufacturing systems. Currently, he supervises postgraduate students with topics: a design for manufacturing and assembly (DFMA); quality management; lean six Sigma; internet of things; sharing economy; circular economy and product-service systems. He is a Professional Member of the IEOM Society. His publications can be found at [www.moseslsinggih.org/publications](http://www.moseslsinggih.org/publications)

**Sri Gunani Partwi** is an Associate Professor at the **8** Department of Industrial and Systems Engineering, Institut Teknologi Sepuluh Nopember Surabaya Indonesia **14**. She received Bachelor and Doctoral degree from Agroindustrial Technology Department, Bogor Agricultural University, Indonesia. She received Master degree from Industrial Engineering Department, Institut Teknologi Bandung (ITB), Indonesia. Her research interests **in** industrial system design, industrial cluster, and human-organization interaction.

# A Proposed of Lean Six Sigma Framework for Higher Education Institution (LSSF - for HEdu) To Improve Effectiveness and Efficiency of Higher Education in Indonesia

## ORIGINALITY REPORT

16%

SIMILARITY INDEX

15%

INTERNET SOURCES

7%

PUBLICATIONS

10%

STUDENT PAPERS

## PRIMARY SOURCES

1	<a href="http://www.emeraldinsight.com">www.emeraldinsight.com</a> Internet Source	5%
2	<a href="http://www.tandfonline.com">www.tandfonline.com</a> Internet Source	2%
3	Submitted to Laureate Higher Education Group Student Paper	2%
4	Submitted to University of Warwick Student Paper	1%
5	<a href="http://publications.aston.ac.uk">publications.aston.ac.uk</a> Internet Source	1%
6	<a href="http://docplayer.net">docplayer.net</a> Internet Source	1%
7	Mahipal Singh, Rajeev Rathi, Jose Arturo Garza-Reyes. "Analysis and Prioritization of Lean Six Sigma Enablers with Environmental facets using Best Worst Method: A Case of	1%

# Indian MSMEs", Journal of Cleaner Production, 2020

Publication

---

8	<a href="http://ijebm.ie.nthu.edu.tw">ijebm.ie.nthu.edu.tw</a> Internet Source	1 %
9	Submitted to University of Oklahoma Student Paper	<1 %
10	Submitted to Udayana University Student Paper	<1 %
11	Submitted to Embry Riddle Aeronautical University Student Paper	<1 %
12	Submitted to Asian Institute of Technology Student Paper	<1 %
13	Fernando Juliani, Otávio José de Oliveira. "Lean Six Sigma principles and practices under a management perspective", Production Planning & Control, 2019 Publication	<1 %
14	Submitted to Academic Library Consortium Student Paper	<1 %
15	Submitted to Management Development Institute Student Paper	<1 %
16	<a href="http://link.springer.com">link.springer.com</a> Internet Source	<1 %

---

17

repository.wima.ac.id

Internet Source

<1 %

18

e-tarjome.com

Internet Source

<1 %

19

sekarl.euba.sk

Internet Source

<1 %

Exclude quotes On

Exclude matches < 10 words

Exclude bibliography On