

AN OVERVIEW OF THE IMPLEMENTATION OF QUALITY FUNCTION DEPLOYMENT (QFD) IN ACADEMIA

Lt. Sanoj Thonakkot,
Department of Mechanical Engineering,
Nehru College of Engineering & Research Centre,
Thrissur, India
sanoj.thonakkot@gmail.com

Dr. V R Pramod,
Department of Mechanical Engineering,
NSS College of Engineering,
Palakkad, India
pramodvram@rediffmail.com

Abstract: The current study makes an effort to illustrate how Quality Function Deployment (QFD) might be used in the sector of education. QFD technique enables better strategic planning and design of educational systems to ensure better adherence to the societal criteria for sustainability. As well improved the educational process's resistance to disruption and readiness for urgent circumstances. The modification of QFD factors increased the improvement of PEIs' service quality and the application of certain variables necessary expertise and information as demanded by the sector and aid in the level of unemployment. The use of PSDM with Salability Quotient could guarantee quick hiring because students and recruiters have clear minds. To meet the demands of the moment and in response to changes in the business environment, we must modify more consumer wants and broaden the channels for entrepreneurship education feedback. This will help us create a dynamic improvement process. The suggested methodology also offered secondary schools a roadmap for identifying issues and finding solutions in order to raise the bar and improve the caliber of instruction.

Keywords: Quality Function Deployment, education, salability, voice of Parents, entrepreneurship

I. INTRODUCTION

Numerous studies on QFD in education have been carried out. Applications for QFD in education include curriculum creation in colleges and universities as well as the usage of QFD in engineering education. A QFD approach has been used in several research for engineering education. The study demonstrates how QFD can be used to assess the level of service provided by undergraduate nursing programmes. The four goals of QFD principles in engineering education should be: Initial training goal, second training method, third training system, and fourth training evaluation. The academic administrators will undoubtedly benefit from implementing the QFD analysis in curriculum development for engineering education as well as the models of curriculum design and delivery.

II. BALANCED SCORECARD APPROACH

A. M. Al-Bahi et al. (2021) devised a system for combining the Balanced Scorecard (BSC) approach with the Quality Function Deployment (QFD) method in order to assess how successfully an engineering education programme can meet society's needs for sustainability. A substantial number of system quality indicators

covered each aspect of the BLC. Instead of the design elements, or HOWs, of the system being indicated by the quality indicators of the BSC, the sustainability norms of society and their indicators were taken into consideration in the QFD technique while analysing the WHATs of the customer, or WHATs. Condensed binary zeros and ones were used to express the BSC indicators' level of customer requirement satisfaction. Utilising the House of Quality enabled for an evaluation and enhancement of the performance metrics by determining how closely they fit societal sustainability needs. The technique required multiple rounds to guarantee that the components of the HOWs are adequate to deal with all of the WHATs. It was occasionally required to suggest new HOWs and related performance indicators, update certain success metrics, and/or redefine certain WHATs in order to make some WHATs and their metrics more suitable to the desired system under discussion. With the aid of engineering education, all 17 of the Sustainable Development Goals (SDGs) of the UN might be at least partially met by 2030. Even though there didn't seem to be a direct relationship between the SDGs in the current formulation, it was clear that the engineering education system's input to financial development contributed in realising each of the most important goals of ending hunger (SDG1) and a world free from poverty (SDG3). Only a small portion of engineering specialisations are relevant to both the SDGs for life on land (SDG7) and life at sea (SDG8). Last but not least, the notion employed to connect engineering education with the peace and justice sustainable development goal (SDG) was anything but simple. But in order to achieve the goal of sustainable development, engineering education can be very important. SDG8: economic growth is another goal alongside SDG4: excellent educational opportunities, SDG3: decent well-being and health, SDG9: infrastructures. By utilising the method described in their paper, engineering education systems can be more carefully thought out and strategically organised, resulting in a better fit with the needs of society for sustainability. The resilience and preparedness for emergencies of the educational process were also enhanced. The authors did, however, make the observation that, in order to successfully implement the strategy, greater emphasis should be given to comprehending what society expects of the engineering educational structure. Not just academics and education experts, but also informed social organisations from a number of sectors of society should carry out this acknowledgment.

III. QFD-TISM-MICMAC METHODOLOGY

To improve the standard of service offered by PEIs, P. Kinker et al. (2020) developed a framework. A structural hierarchical interrelationship-based model was developed utilising an integrated QFD-TISM-MICMAC technique after the service quality components were defined and the connection between customer expectations and service quality metrics established. It is feasible to improve PEIs' level of service. The polytechnic educational system places a great focus on service quality. A hierarchical structural framework was developed to aid instructional executives, decision-makers, and administrators in improving the standard of service. The research findings can be used to determine the driving and dependent variables for the service quality framework. The establishment of the institute's vision, mission, and educational goals; the creation of a curriculum based on employment and a distinct teaching-learning process; the communication of information to faculty and assurance of their contribution; the maintenance of financial resources and institutional support; the provision of necessary facilities and technical support to clients; and these actions were all considered to be the driving forces behind the improvement. The modifications to these service quality indicators have an effect on the other reliant elements. The dependent variables and those that could be influenced by the factors that drive are the results of the courses

and programmes, the creation of a system to track ongoing evaluations of student-teacher performance, the implementation of a standardised customer service programme, and maintaining the continuous improvement of the institution. The study advised administration to put more emphasis on matters like establishing a strong vision, mission, and educational emphasise for the institute, maintaining monetary and institutional in nature backing, and providing the necessary amenities, developing a curriculum for employment-based programmes, establishing a clear method of instruction, providing information to faculty and ensuring their participation, and providing technical assistance.

IV. KANO QFD APPROACH

From the viewpoint of the students, P. Kinker et al. (2021) defined and chose the features of quality-of-service improvement connected to the polytechnic educational institutions (PEIs) of the state of Madhya Pradesh in India. Additionally, using the fuzzy Kano method, three categories—must be, attractive, and one-dimensional—were created from the chosen leading criteria. In order to further the goals of both students and the certification body regarding the development of PEIs' service quality, various service quality characteristics were coupled with the NBA system quality standards using the "Quality Function Deployment (QFD)" technology. They noticed that students who are committed to academic success receive greater job possibilities. The goal of the study was to maintain and support PEIs' high level of service in order to please students and increase enrollment. When the study's findings were presented to educational specialists, they received unanimous support. With the administration of case PEIs, the priority list was also examined, and recommendations were made for its implementation. The committee gave its support for execution and was largely in agreement with the priority list. The findings of this study were beneficial to institutions seeking NBA certification.

In 2021, Y. Hwangbo et al. proposed a complete education and training plan that can include QFD—previously only employed by individual companies in certain industries—into technologically advanced SMEs across a range of industries. In order to address the sales and net profit standstill of technologically driven SMEs that were 3 to 7 years old and still in the early stages of growth, one of the options adopted was this programme. The efficacy of these programmes was studied. Empirical analysis demonstrated the effectiveness of the Kano QFD programme for SMEs with a technology basis that are 3–7 years old. The Kano QFD programme had the following characteristics when it was used by technology-based SMEs across several industries. First, there were three phases to the Kano QFD programme: the planning phase for the product idea, the VOC phase of implementation, and the product specification confirmation phase. It was developed for SMEs with a focus on technology and staff members ages 3 to 7. 3- to 7-year-old technologically driven SMEs were required to check the entrance market that would create sales that were anywhere from five to ten times larger than the present sales during the product idea development stage in order to prepare the necessary components prior to employing Kano QFD. Technology-based to maintain selling popularity, SMEs in particular must strategically refocus on services or products which can more precisely fulfil client requirements than competitors. Targeting a market with competing businesses or options was vital, as was having access to more consumer happiness elements than rivals. The Kano survey for the intended clients of the chosen marketplace was browsed and analysed during the VOC implementation stage for the formulation phase of the product idea for the target customers. The internal environment of SMEs between 3 and 7 years old with a technology focus that participated in the Kano survey and was completed by 15 to 20 clients was subpar. The objective of the product definition confirmation stage

was to identify the preferable investment characteristic of the service or product that satisfied the client's satisfaction element by comparing internal capability and competition capability to fulfil the customer's happiness element. The second benefit of Kano QFD was the presence of an expert trainer who could assist SMEs in overcoming obstacles if they lacked the skills required to use QFD and the Kano Method. Each student in the educational and guidance programme is paired with the trainer. The third trait was the preference for representative directors, who were important in determining the approach and course of action of SMEs, when it came to involvement in technology-based SMEs. The fourth component of the worksheet made it easier for participants from SMEs to communicate with already trained coaches and allowed the Kano QFD process to be finished in a total of 16 hours split over two days. This was accomplished by logging every step of the process, from the conceptualization phase of the final product concept to the level of specification validation, on the spreadsheet. It was created to provide an objective evaluation of the current and long-term objectives of technology-based SMEs with a three to seven-year lifespan. The fifth feature was that, instead of using the current Timko's categorization chart of quality attributes, a modified matrix of the Timko's classification table was used to choose the demand elements of priority consideration customers by quantitatively analysing consumer satisfaction aspects. While the traditional Timko's Analysis had a limit on how much the appealing excellence element could be calculated with a five-point average weight and a four-point weight for the one-dimensional quality component., this classification table allowed for more precise weighting of the attractive as well as one-dimensional quality components.

For the purpose of identifying and prioritising service quality improvement elements from both the students' and teachers' perspectives, P. Kinker et al. (2022) suggested a framework. The fuzzy Kano technique was used to prioritise several aspects of the attributes (should be, appealing, and one-dimensional). The fuzzy Kano method results had been included into QFD in order to rank the DCs. Students had been seen to be concentrating on a programme curriculum that was employment-based and on the teaching-learning processes, with a method to record frequent reviews of the student-teachers' performance while preserving the course and programme outcomes with the vision, mission, and educational goal of the institute. They saw that teachers employed financial resources, institutional support infrastructure, and technical assistance to build a curriculum centred on employment and establish a clear teaching-learning process while focusing on the institute's vision, goal, and educational objective. The study's conclusions were crucial for academics, practitioners in the field of education, and other PEI stakeholders. The use of factors would result in the necessary skills and knowledge as required by the industry and help to reduce unemployment. The adaption of factors helped to improve the service quality of PEIs. The study's drawback was that it was impossible to weigh each aspect that fell into the imprecise Kano categories. Researchers were urged to apply fuzzy MCDM tools with fuzzy Kano technique to address such problems. The study was designed to identify strategies for maintaining and enhancing PEIs' level of service excellence, which will please students and draw them in as enrollees. The PEIs looking for NBA accreditation would have benefited from the methods for using QFD in the education sector.

V. SALABILITY QUOTIENT

Education, according to R. Chaturvedi et al. (2020), is about how much a school can raise its students' salability quotient. Better career opportunities and a higher return on school expenditure come from greater salability. The marketability

of a person depends on the skills they have and how skilled they have grown in those skills. Each person has certain secret talents, which are displayed to the world on a variety of venues. They have developed a model for skill development in educational institutions that is based on the PDSA Approach developed by Dr. Deming. Any educational institution must apply quality function deployment in order to understand where they are in relation to their rivals. The writers came to the conclusion that each institution should have a skill development strategy that is in line with either the Government of India Strategy or the National Skill Development Centre Strategy. Another suggestion was to sketch out the college-level students' competencies so that they could be given to hiring managers, higher education institutions, or parents when they were chosen. Parents and recruiters will both benefit from knowing how much the student has learned while attending the educational institution. It will also be a proactive move on the part of the educational institutions to help students shape their careers. Due to the clarity of idea among students and recruiters, the practise of PSDM/Salability Quotient may guarantee a quick recruitment. The PSDM assisted in determining the candidate's position with regard to the position of their choice, and the recruiter will be clear about who meets the requirements for selection.

VI. CK DESIGN THEORY

The concept-knowledge theory, often known as the C-K design theory, was first forth by S. Ahmed in 2022. According to this argument, innovation is the conceptualization of a design that is distinct from other design fields. The possible uses of design processes for creativity, creation, and discovery were examined. Creativity is primarily needed for engineering design. The "engineering design and creativity course" at the institution's department of engineering, according to several people with experience in curriculum design, was created utilising the QFD method. The suggested methodology complied with accreditation standards as part of continuing curriculum change. The integration of the educational outcomes with the assessment strategies, the procedures for learning, and the expertise components was successfully accomplished using the QFD course design technique. The course and curriculum were intentional choices for 2030. Learning impairments were decreased by the recommended methodology for course building. It was evaluated using course mapping with learning objectives.

VII. ENTREPRENEURSHIP EDUCATION

Y. Cao et al. (2021) used local colleges and universities as a case study and the quality function deployment concept to investigate the design of instruction and process quality monitoring system for entrepreneurial education. They then created the quality function deployment model of the entrepreneurial education programme in order to give our nation theoretical assistance for developing skilled entrepreneurs. The following characteristics, according to the authors, demonstrate how the QFD approach has enhanced the teaching standards in entrepreneurship education.

Layer by layer, starting with the instruction of quality design, implementation, and control to select the appropriate executant, valuator, etc., customer expectations for entrepreneurship education are implemented. Establish an unambiguous division of labour so that entrepreneurial education delivery is more organised and standardised. The curriculum system setting, practise teaching tied to a teacher's entrepreneur practise skills, and entrepreneur exercise platforms received the highest ratings as proof of the effectiveness of the

entrepreneurship education practise. They recommended developing a curriculum with a stronger practical component, better preparing teachers to deliver practical education, and developing the optimum setting for practical instruction. For entrepreneurial education, classroom instruction—which now accounts for the majority of instruction at regional universities—must be upgraded.

Through interviews with pupils, educators, entrepreneurs, and other participants, this study sought to identify the issues that arise in the teaching of entrepreneurial education. It then thoroughly understood customer needs in order to design the curriculum that entrepreneurship education will follow at nearby colleges. When teaching quality design, execution, and control, the quality function deployment theory is used, it gradually increases consumer demand for entrepreneurship and growth. This will improve both the outcomes and the calibre of entrepreneurship education instruction. The investigation of learners, educators, business owners, and other customers to completely meet the needs of the customer, establish an unambiguous course of entrepreneurship instruction in universities and colleges through the implementation of quality function deployment principle, and successful outcomes were used to address the current issues with the teaching of entrepreneurship education. However, the environment for businesses evolved along with the social and economic climate. For instance, in the 20th century, the 1980s saw a rise in the survival kind of entrepreneurship, which was followed by the low-cost type in the 1990s and the global type in the previous 10 years. This study took into account the need to modify more consumer desires and boost feedback channels in order to satisfy the scenario's requirements and enhance entrepreneurship education in accordance with the changing business climate.

VIII. VOICE OF PARENTS

Z. Iqbal et al. (2020) introduced QFD as a rigorous procedure for translating consumer desires and expectations into suitable answers. Since almost every aspect of life now makes use of QFD, its potential applications are virtually limitless. It assisted in identifying not just the requirements and needs of a certain issue, but also its solutions and the sequence in which they ought to be addressed. Primary education is crucial and establishes the foundation for a child's future upbringing in terms of their instructive, interpersonal, cognitive, social, emotional, and physiological proficiencies. The goal of this study was to look at what Voices of Parents (VOPs) needed and wanted in terms of what their children should learn in primary school. By identifying significant VOPs and then transforming them into technology solutions for better and higher-quality education, this goal was accomplished. In a real-world case study, the QFD technique has been utilised to identify the VOPS, their technological remedies, assess the order in which they were to be implemented, and then offer recommendations as to which technological remedy was most crucial and which option was least crucial. The findings gave elementary school stakeholders direction for determining issues and their fixes in order to raise the bar and standard of education.

In order to adapt what the clients want to accomplish and how their requirements should be included into final technical solutions, Z. Iqbal et al. (2020) suggested a meticulous technique. Through education, students internalise highly valued traits of social and cultural significance, intellectual health, emotional stability, and better physical abilities. The degree to which these attributes are exhibited in education is referred to as quality. This essay discussed the Voices of Students (VOSs) (students' needs and demands) in relation to their secondary school educational needs. By identifying important VOSs and then figuring out their

technical solution, known as an SVOS, to resolve VOSs, the goal was achieved. The guidelines for the SVOSs were then presented, indicating which SVOSs were the most and least important. The suggested methodology also offered secondary schools a roadmap for identifying issues and finding solutions in order to raise the bar and improve the calibre of instruction.

IX. CONCLUSION

By putting the QFD methodology to use, engineering education systems can be better designed and strategically planned, ensuring better alignment with societal demands for sustainability. It also increased the preparedness for emergencies and resilience of the educational process. For the improvement to be successful, the leadership team has to put more emphasis on things like creating a compelling vision, mission, and educational goal for the setup, maintaining financial backing and institutional backing, providing the necessary amenities, developing a curriculum based on employment, establishing a clear instructional method, providing faculty data, and ensuring their scientific assistance for clients. The chances of finding employment are better for students who prioritise their academic success. The industry's requisite knowledge and skills would be attained as a result of the implementation of QFD elements, which would also aid in reducing the unemployment rate. The QFD elements' adaptation enhanced PEIs' ability to provide high-caliber services. Due to the clarity of idea among students and recruiters, the practise of PSDM/Salability Quotient may guarantee a quick recruitment. The PSDM assisted in determining the candidate's position with regard to the position of their choice, and the recruiter will be clear about who meets the requirements for selection. To meet the demands of the moment and in response to changes in the business environment, we must modify more consumer wants and broaden the channels for entrepreneurship education feedback. This will help us create a dynamic improvement process. The suggested methodology also offered secondary schools a roadmap for identifying issues and finding solutions in order to raise the bar and improve the calibre of instruction.

Conflicts of Interest: “The authors certify that they have no competing interests with regard to this research.”

REFERENCES

- [1]. M. Al-Bahi, M. S. Abd-Elwahed, A. Y. Soliman, (2021), “Implementation of Sustainability Indicators in Engineering Education Using a Combined Balanced Scorecard and Quality Function Deployment Approaches.”, *Sustainability* 2021, 13, 7083.
- [2]. P. Kinker, V. Swarnakar, R. Jain, A.R. Singh (2020), “A QFD-TISM approach for service quality improvement in polytechnic education institutes: a case study.”, *Int. J. Applied Systemic Studies*, Vol. 9, No. 2, pp. 85-113
- [3]. P. Kinker, V. Swarnakar, A.R. Singh, R. Jain, (2021), “Prioritizing NBA quality parameters for service quality enhancement of polytechnic education institutes – A fuzzy Kano-QFD approach.”, *Materials Today: Proceedings*, Vol. 47, Part 17, pp. 5788-5793
- [4]. P. Kinker, V. Swarnakar, A.R. Singh, R. Jain, (2022), “A fuzzy Kano-QFD approach for prioritising NBA quality parameters for service quality enhancement: a case of Indian PEIs.”, *International Journal of Quality Engineering and Technology*, Vol. 8, No. 4, pp.406-427.

- [5]. R. Chaturvedi, A. Chaturvedi, J. Chaturvedi, (2020), "Skill Development in Educational Institutions.", *International Journal of Trend in Scientific Research and Development*, Vol. 4, Issue-5, pp.1651-1663.
- [6]. S. Ahmed, (2022), "Measuring Innovation and Creative Content in Course Content and Learning Effectiveness: A Case Study with QFD.", *International Journal of Information and Communication Technology Education*, Vol, 18, Issue 1.
- [7]. Y. Cao, H. Jiang, (2021), "Research on continuous improvement of teaching quality of entrepreneurship education in Colleges and Universities Based on QFD theory.", *E3S Web of Conferences* 251, 03064.
- [8]. Y. Hwangbo, Y. Yang, M. Kim, Y. Kim, (2020), "The Effectiveness of Kano-QFD Approach to Enhance Competitiveness of Technology-Based SMEs through Transfer Intention Model.", *Sustainability* 2020, 12(19), 7885.
- [9]. Z. Iqbal, L. Shoukat, M. Waheed, H. Zakir, (2020), "Identification of Technical Solutions to Improve Primary Education: A Real-Life Application.", *Journal of Business and Social Review in Emerging Economies*, 6(2), pp. 821-828.
- [10]. Z. Iqbal, L. Shoukat, M. Waheed, L Zafar, (2020), "Enhancing the Academic Performance of Students: A Real-Life Application of Quality Function Deployment.", *Review of Economics and Development Studies*, 6(2), pp. 501-511.