TECHNICAL UNIVERSITY OF CLUJ-NAPOCA

ACTA TECHNICA NAPOCENSIS

Series: Applied Mathematics, Mechanics, and Engineering
Vol. 67, Issue II, June, 2024

CONCEPTION OF A FRAMEWORK FOR CONTINUOUS IMPROVEMENT OF STUDENT SERVICES BASED ON ANALYTIC HIERARCHY PROCESS MODEL

Mihai - Ioan COSTA, Maria Elena BOATCĂ, Bosco LOPEZ LANDA, Ionel LUNGU, Matei TAMASILA

Abstract: *Support services for students became a prominent component of academic marketing in the past decade. The quality and diversity of these services have a major influence on student's perception regarding the university and enhance reports of positive experiences when the perceived quality of these services is good. Thus, universities need to consider implementation of a total quality management system to enable continuous improvement of support services for students. The paper focuses on the proposal of a framework for continuous improvement of support services based on the principles of analytic hierarchy process (AHP) model. At theoretical level, the main contribution of the paper is the bibliometric analysis performed using VOS Viewer software. The study possibilities provided by the proposed framework demonstrate originality of the approach. Nonetheless, the proposed framework opens the path for a stringent need of universities to improve the management of support services for students with the major objective of obtaining improved rankings at national and international levels and strong reputation in the academic world.*

Key words: *support services, students, continuous improvement, analytical hierarchy process, total quality management.*

1. INTRODUCTION

In the past decade, universities changed the paradigm when promoting their educational offer. The intensified competition at international level, combined with increasing pressure to occupy a favorable position in European and global rankings forced universities to shift from an academic-focused approach to a marketing-type of promotion. Along with their academic reputation, universities can attract students with high-quality support services [1].

Here, the discussion expands from monetization to enhancement of all services to ensure improved educational and support services for all categories of students.

The paper focuses on identification of a framework for implementation of continuous improvement management of support services for students using the analytic hierarchy process (AHP) model. Considering that continuous improvement is a component of total quality management (TQM) approach, the literature review section addresses both TQM and AHP implications for the proposed model.

Total quality management (TQM) represents a renowned approach in industrial settings. However, the expanded applications to various organizations providing services created the proper context for researching applicability of TQM services in higher education settings [2, 3].

The paper is structured as follows: introduction, literature review (encompassing both the matter of continuous improvement as

Received: 04.04.24; **Similarities**: 29.05.24: **Reviewed**: 03.06./02.06.24: **Accepted**:25.06.24.

part of total quality management, and a bibliometric analysis on the topic of analytical hierarchy process), proposed framework on continuous improvement for support services in universities and conclusions.

2. LITERATURE REVIEW

2.1 Continuous improvement as part of total quality management

TQM philosophy is focused on continuous improvement, customer satisfaction and employees' participation in all aspects of organizational activity [2]. In the higher education context, students can be regarded as customers/beneficiaries, meaning that academic management should be focused around the needs and expectations of students. Furthermore, a considerable share of higher education employees are academic staff who interact with students. The involvement and vivid voice of the academic community of a higher education institution should be a landmark for university management.

However, Khan et al. [4] underline a major concern regarding the limited number of empirical studies analyzing benchmarking, continuous improvement and process management as TQM practices in universities. The conclusion of this research is irrefutable: quality is a cardinal enhancer of university performance, especially when data analytics are put into the services of performance management [4]. Moreover, the same study reveals that continuous improvement is in direct relationship with university performance [4].

To meet the main objective of the paper, innovative approaches are to be considered. As per the results presented by Hairul and Periyadi [5], organizational learning enhances organizational capacity for innovation. Thus, in the context of analyzing support services for students, universities must learn from the feedback obtained from students to be able to improve the quality of these services and generate new types of services needed in the current post-pandemic context.

Another innovative approach comes from Sann et al. [6] who propose a framework for university service quality assessment based on 16 items. The framework was validated through expert interviews and literature review and is oriented toward assessment of quality for university services [6].

Yang et al. [7] focused on the assessment of the perceived quality of e-learning services in universities. Although the object of the assessment is different from the one proposed in this paper, the approach proposed by Yang et al. [7] generates valuable insights on the optimal approach toward correlation of various factors contributing to the perceived quality of an educational component in higher education institutions.

One important note refers to the existence of ISO 21001:2018 standard for educational institutions. This standard provides the general context of an efficient management system customized for educational service providers. ISO 21001 standard can be successfully used as TQM framework for universities, especially in the increasingly competitive educational market worldwide [8].

2.2 Analytic Hierarchy Process (AHP) – a bibliometric analysis

Analytic hierarchy process (AHP) is a renowned model for assessment of various organizational and environmental challenges. Literature on the topic of AHP applications is vast and extremely diverse.

To identify the main concepts connected to AHP, the authors performed a bibliometric analysis using VOS Viewer software.

The analysis was based on 1,255 unique research papers indexed in Web of Science database. As per figure 1, the keywork network analysis revealed that the core concept connected to AHP is "process". "Problem", "criterium", "selection", "area" and "map" are other prominent keywords connected to the literature on the topic of AHP model. The size of each bubble reflects the frequency of occurrence of each keywork in the analyzed dataset.

Figure 2 further shows the overarching variety of applications of AHP model. An important aspect is the limited preoccupation for applying AHP model for assessment and continuous improvement of support services for university students.

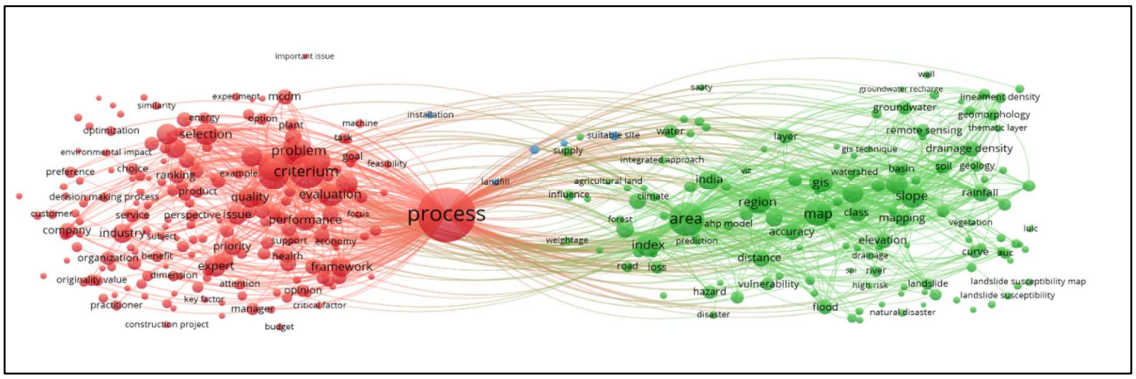

Fig. 1. Bibliometric analysis of AHP research literature by keywords frequency (generated with VOS Viewer)

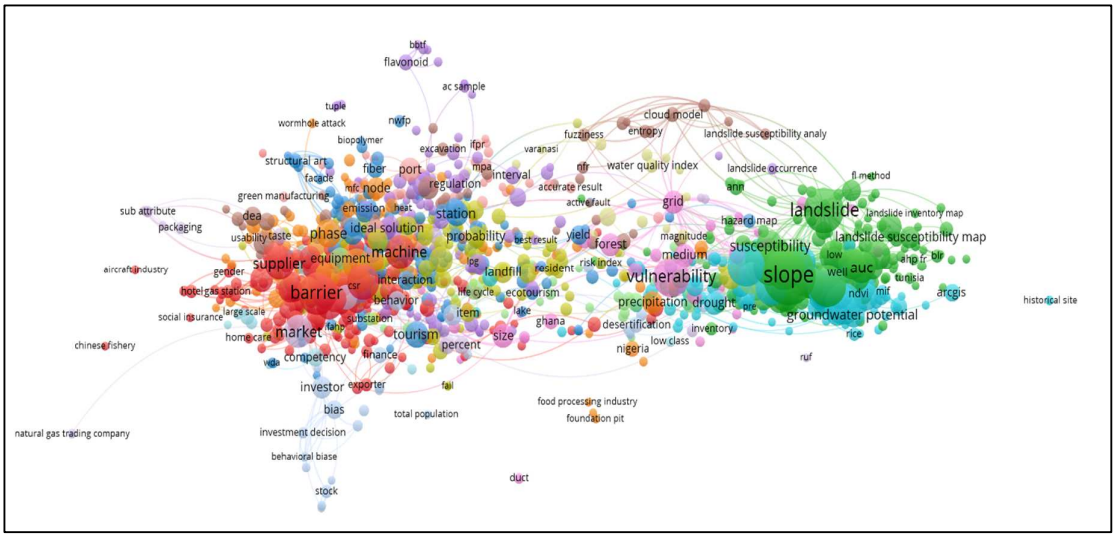

Fig. 2. Bibliometric analysis of AHP research literature by frequency of research fields (generated with VOS Viewer)

3. PROPOSAL OF CONTINUOUS IMPROVEMENT FRAMEWORK FOR SUPPORT SERVICES IN UNIVERSITIES

3.1 AHP model design

Analytic Hierarchy Process (AHP) is a method dedicated to decision-making process using multiple criteria. Its applications enable improvement of the quality of university support services for students [9, 10]. AHP supports prioritization and decision-making by structuring complex problems into a hierarchy of criteria and alternatives, and then systematically comparing and weighting these elements [11]. The main advantage of AHP is the possibility of combining qualitative and quantitative criteria in the analysis [12]. The typical application of AHP involves the ten steps described in Figure 3.

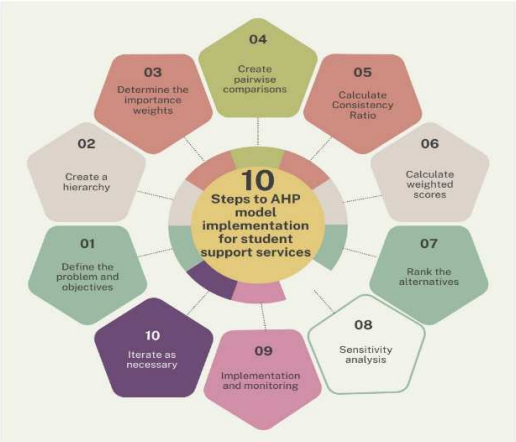

Fig. 3. Description of AHP model iteration (source: authors' conception based on [12])

The main steps required to apply AHP model are:

- Define the problem and objectives;

- Creation of a hierarchy by breaking down the problem into its constituent components and divining them into three levels: goal, criteria and alternatives;
- determination of importance weights by assigning relative importance weights and using pairwise comparisons to rank the importance of criteria in relation to the goal.
- Creation of pairwise comparisons to determine the relative importance of each alternative concerning each criterion;
- calculating the consistency ratio (cr): assessing the consistency of the judgments made during the pairwise comparisons, to ensure the reliability of the results;
- Calculating the weighted scores by multiplying the importance weights of criteria by the relative scores of alternatives for each criterion, followed by summing up the values of each alternative to calculate their overall weighted scores;
- Ranking the alternatives based on the calculated weighted scores;
- Performing sensitivity analysis to assess robustness of the decision (i.e., understanding how changes in the importance weights of criteria impact the rankings);
- Implementation and monitoring refer to implementation of the selected alternative and monitoring the results to gather feedback from students and staff to further refine the process (as per continuous improvement principle);
- Iterate as necessary – considering that AHP is a dynamic process, the model may and should be revisited to update analysis criteria and reevaluate pertinence of the selected alternative.

Using the AHP model in this manner can help universities make informed decisions about how to allocate resources and efforts to improve the quality of support services for students, ultimately enhancing their educational experience and success [13].

A successful example of using AHP model is the assessment of university campus buildings performed by Blachowski et al. [14]. The analysis performed on the 119 buildings of the Wroclaw University of Science and Technology enabled the development of digital guides dedicated to students with various disabilities.

The successful application of AHP model for university-related facilities represents the proof of the relevance of a model that relies on AHP as decision-making instrument. From a similar perspective, in section 3.2 the authors propose a framework for continuous improvement of student support services.

3.2 Proposed framework for support services in universities

Starting from the AHP model presented in section 3.1, the authors conceived a framework based on the following components:

1. five-year financial analysis of university spending for support services
2. analysis of support services offering
3. collection of students' perception on quality of support services (questionnaire-based investigation)
4. identification of main analysis criteria for AHP model and validation with experts (organizing focus groups)
5. implementation of AHP model
6. proposal of best-suited decisions to ensure continuous improvement of support services in the analyzed university.

Figure 4 offers a visual presentation of the proposed framework.

According to the above-described framework, there are multiple key action steps to be taken:

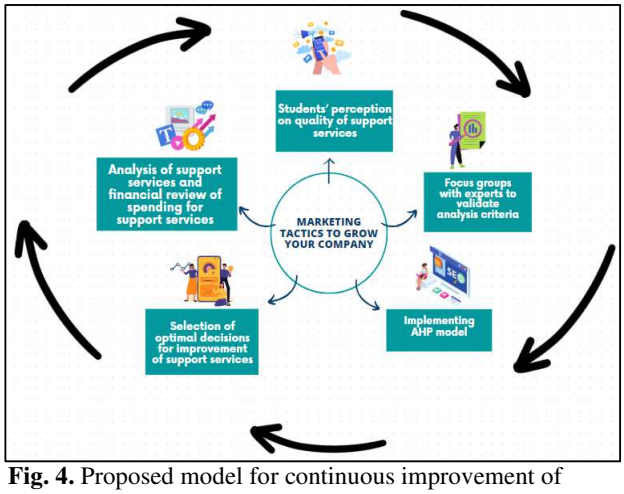

Fig. 4. Proposed model for continuous improvement of support services in universities (source: authors' conception)

1. Collect financial information and perform the financial analysis for a five-year period, to identify strengths and weaknesses of the spending and investments in support services at university level.
2. A revision of the support services provided at the moment of analysis.
3. Questionnaire-based research to identify perception of students on support services and their suggestions for improvement.
4. Decision-making on the criteria to be included in the AHP model.
5. Focus groups or brainstorming sessions organized with internal and external specialists to validate the selected criteria.
6. Implementation of the AHP model to identify the optimal decisions in the context of the analyzed university.
7. Discussion and implementation of the decisions identified in the previous step, followed by periodical assessment of the results obtained.

In accordance with the PDCA (plan-do-check-act) cycle, this set of actions should be re-iterated periodically to effectively implement continuous improvement principles.

Along with AHP model, a valuable input in the proposed framework is involvement of students in identification of strengths and weaknesses of the support services already provided. To efficiently collect feedback, the authors propose the conception of a questionnaire aimed both at assessment of perceived quality and satisfaction with the current offering and students' feedback to identify key improvement areas.

Also, organizing focus groups with key experts in the field of university management, representatives of student organizations and university staff will enable pertinent validation of the assessment criteria to be introduced in the AHP model.

In accordance with TQM principles, the proposed framework involves re-iteration of the steps every year, as students' needs, and the already-implemented measures will change the internal environment of the university.

4. CONCLUSION

The paper addresses a topic of high interest in the current educational landscape: achieving competitive advantage by implementing continuous improvement of student support services.

Starting from the literature review of total quality management and analytical hierarchy process (AHP) model, the authors present the methodological flow leading to proposal of an original framework for continuous improvement of support services for students.

Aiming to cover a comprehensive set of input data, the proposed framework reunites secondary data (statistical and financial analysis of support services) with primary data collected from students (their perception and feedback), all validated by experts to generate a strong set of analysis criteria as input for AHP model. Finally, the framework enables decision-making for optimization of current services and identification of opportunities to expand the offering. The process is a cyclic iteration involving assessment and improvement on an annual basis to permanently respond to students' needs and expectations.

The main limitation of the paper is that the framework is not validated yet. However, the proposal constitutes the basis for further research as part of a doctoral program.

The proposed framework is the initiation of a valuable applicative research with potentially impactful results for universities in Romania and abroad.

5. REFERENCES

[1] Boatca, M. E., Costa, I. M., Tamasila, M. *Analysis of Support Services in A Romanian University: Prospects for Continuous Improvement*, Acta Technica Napocensis-Series: Applied Mathematics, Mechanics, and Engineering, 65(3S), 2023.

[2] Hairul, P. *The Interdependence of Total Quality Management and Organisational Learning to Managerial Innovation*, Polish Journal of Management Studies, 27(1), 2023.

[3] Mahdikhani, M. *Total quality management and lean six sigma impact on supply chain research field: systematic analysis*, Total Quality

Management Business Excellence, pp. 1-19, 2023.
[4] Khan, M. A., Borgia, M., Di Virgilio, F., La Torre, M. (2023). The relationship between total quality management practices and performance is mediated by data analytics knowledge. Are universities ready to adopt changes?. Global Local Economic Review, 27(1), 23-66.
[5] Sann, R., Lai, P. C., Liaw, S. Y., Chen, C. T. *Multidimensional scale development and validation: University service quality (UNIQUAL)*, Journal of Hospitality and Tourism Insights, 2023.
[6] Yang, R., Wibowo, S., Mubarak, S., Rahamathulla, M. *Managing students' attitude, learning engagement, and stickiness towards e-learning post-COVID-19 in Australian universities: a perceived qualities perspective*, Journal of Marketing for Higher Education, pp. 1-32, 2023.
[7] Ülker, N. *Total quality management in the context of university 4.0: New game new rules*, Frontiers in Education, 8, p. 1146965, 2023.
[8] Zhang, X., Wang, S., Cao, Y., Chen, G. *Application of analytical hierarchy process in teaching quality analysis of English writing*, International Journal of Emerging Technologies in Learning (IJET), 15(14), pp. 137-150, 2020.
[9] Pawar, S.S., Rathod, R.R. *A Decision Support System Using Analytical Hierarchy Process for Student-Teacher-Industry Expectation Perspective*, Advances in Intelligent Systems and Computing, pp. 523–534, 2019.
[10] Purwaamijaya, I. M., Masri, R. *Analytical Hierarchy Process (AHP) To Determine Zoning Region Vocational Education,* Journal of Engineering Science and Technology, 16(4), pp. 3048-3056, 2021.
[11] Atheros, H. *Decision Making Using the Analytic Hierarchy Process (AHP); A Step-by-Step Approach*, International Journal of Economics and Management Systems, 2017.
[12] Kritchanchai, D., Wahab, S. N., Tan, A., Mak, T. *An analytical hierarchy process-based decision making for sustainable medical devices development*, LogForum, 18(4), 2022.
[13] Blachowski, J., Hajnrych, M., Trybała, P., Tankielun, M. *Multi-criteria methodology for evaluating university campus facilities using the AHP approach*, Zeszyty Naukowe Politechniki Poznańskiej seria Organizacja i Zarządzanie, 86, pp. 57-72, 2023.

Concepția unui cadru de îmbunătățire continuă a serviciilor suport pentru studenți pe baza modelului procesului de ierarhie analitică

Serviciile suport pentru studenți au devenit o componentă proeminentă a marketingului academic în ultimul deceniu. Calitatea și diversitatea acestor servicii au o influență majoră asupra percepției studenților cu privire la universitate și cresc numărul raportărilor de experiențe pozitive atunci când calitatea percepută a acestor servicii este bună. Astfel, universitățile trebuie să ia în considerare implementarea unui sistem de management total al calității care să permită îmbunătățirea continuă a serviciilor suport pentru studenți. Lucrarea se concentrează pe propunerea unui cadru pentru îmbunătățirea continuă a serviciilor suport bazat pe principiile modelului procesului de ierarhie analitică (AHP). La nivel teoretic, principala contribuție a lucrării este analiza bibliometrică realizată cu ajutorul software-ului VOS Viewer. Posibilitățile de studiu oferite de cadrul propus demonstrează originalitatea abordării. Astfel, cadrul propus deschide calea unei nevoi stringente a universităților de a îmbunătăți managementul serviciilor suport pentru studenți, cu obiectivul major de a obține poziții mai bune în clasamentele naționale și internaționale și o bună reputație în lumea academică.

Ioan - Mihai COSTA, PhD Student, Politehnica University of Timisoara, Department of Management, ioanmihai.costa@upt.ro, +40256404284, 14 Remus Street, 300194 Timișoara, Romania.
Maria Elena BOATCĂ, Assistant, PhD, Politehnica University of Timisoara, Department of Management, maria.boatca@upt.ro, +40256404284, 14 Remus Street, 300194 Timisoara, Romania.
Bosco Lopez LANDA, PhD Candidate, Politehnica University of Timisoara, Department of Management, bosco.lopez-landa@student.upt.ro, +40256404284, 14 Remus Street, 300194 Timișoara, Romania.
Ionel LUNGU, PhD Candidate, Politehnica University of Timisoara, Department of Management, ionel.lungu@student.upt.ro, +40256404284, 14 Remus Street, 300194 Timișoara, Romania.
Matei TAMASILA, Prof. Dr. habil., Politehnica University of Timisoara, Faculty of Management in Production and Transportation, +40256404284, matei.tamasila@upt.ro, 14 Remus str., Timisoara, Romania.