

Performance Audit and Improvement of Engineering Institutions for Sustainability of Human Capital Development

Thanikachalam Vedhathiri, B.E., M.Tech., Ph.D., M.S.

*Former Professor, National Institute of Technical Teachers Training and Research,
Chennai, India, <https://orcid.org/0000-0002-5902-0319>
vthani2025@yahoo.in*

Abstract

Institutional Performance Audit has become a tool for evaluating institutional performance in 360 degrees. The outstanding accomplishments of the faculty team, alumni, and students are to be assessed. Without this, educational institutes can't sustain their existence. The contribution of the high-performing faculty teams will significantly accelerate the knowledge and human capital. Their publications, patents, and services that are rendered will assist the nation to grow at a faster speed in the competitive world. It also assists in the generation of internal revenue so that the institutes can have sufficient corpus funds for growth. An academic audit has become an important academic quality management process for all educational institutions. This is a well-focused process based on the self-reflection and self-improvement of educational programs and it provides soft interventions in improving the curriculum, developing effective instructional design, and evaluating the performance of the engineering students. This research provides many case studies, questionnaire preparation for collecting data, analysis, and planning interventions in the total transformations of the engineering graduates. A methodology has been developed to plan and conduct an academic audit in various institutions.

Keywords: *Sustainability of engineering institutes, Performance audit, Contribution to knowledge and human capital academic audit, Purpose, Planning, Identification of short-falls, Interventions, and utility*

1. Introduction

In the last three years around 1000, engineering colleges were closed in India due to poor resources, want of qualified faculty members, improper curricula, and poor instructional methods. Performance audit is based on "self-reflection and self-improvement". The institution's performance audit is a faculty-driven model of ongoing self-reflection, collaboration, teamwork, and peer feedback. It is based on structured conversations among faculty, stakeholders (graduates, parents, employers, government, and community at large) and peer reviewers all focused on a common goal: to continuously improve transformation quality processes in curriculum design, planning instructional materials, learning aids, and thus enhance engineering graduate success in performing the tasks. The purpose of an Academic Audit is to encourage departments and faculty members to evaluate their engineering education transformation quality processes. The prime faculty activities required

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are to plan, develop, assure, and regularly improve the quality of teaching and learning in applied science, economy, engineering, technology, and management. An audit encourages needed faculty to approach educational decision-making and how they organize their instructional design and delivery using the resources available to them and work collegially to improve a quality engineering educational transformation process in the best interests of a branch of specialization, creating human capital and knowledge capital. Many international universities implement strategic planning and develop vision and mission statements for diversifying their research enterprises to achieve unparalleled impact, fostering an inclusive environment in which their students are given tools, programs, and experiences to excel in the 21st century, and in which their faculty and staff thrive. That will require new levels of awareness, recognition, and pride in what they achieve together, a new focus on giving all their people a chance to grow to their full potential, and the ability to effectively secure and deploy the resources they will need to succeed (University of Illinois, Urbana- Champaign) [1].

The purpose of the performance Audit is to collect the accomplishments of the departments, faculty members, students, and alumni and check the growth of the institute in all activities. Further, the institute has to strategically plan for continuous growth in all branches of engineering, applied science, applied mathematics, interdisciplinary research, consultancy works, sports, balanced life of the faculty, creating of intellectual properties, and contribution to the human needs of the society. Institutes in Asia Pacific Region have to evaluate the performance of their engineering institutions and ensure excellent performance so that these institutes substantially contribute to the regional competitiveness in the digital economy.

1.1. Purpose and utility of performance audit

- To identify the most significant performance rendered by the faculty teams, graduates, and alumni in creating knowledge and human capitals
- If there is a significant shortfall, the administrators can design suitable interventions.
- To identify the academic ecosystem that is responsible for all accomplishments
- This is essential for continuous and uninterrupted growth.
- To check the deviations, low performance, and shortcomings so that suitable steps can be introduced

1.2. Desirable outcomes that indicate the significant institutional performance:

The following outcomes are desired and would significantly accelerate the generation of knowledge capital. Every educational institution is focusing on them through strategic planning.

- Developing human capital through graduates of the institute based on the programs and services offered in all areas of specialization
- Building an open and creative environment that cultivates economic growth and development
- Growing basic and translational research impact
- Launching the fearless frontiers research initiatives
- Delivering high-impact, personalized educational experiences at a scale

- Developing knowledge capital through research, patents, the alternate development process for innovative products, maintenance, and improvement.
- Establishing ubiquitous diversity, equity, access, and inclusion
- Rendering services to the industry, government, and society through consultancy works
- Enhancing teaching, learning, and research with disruptive technologies
- Managing the digital disruptions through continuous multidisciplinary research and development through the high-performing faculty teams
- Acquiring, stewarding, and aligning resources with priorities
- Creating borderless engineers and assisting peace engineering education
- Offering development programs for the diverse global students and faculty members through various channels
- Undertaking sponsored research and development projects from Multinational Corporations (MNCs) s and International Development Agencies (IDAs)
- Reducing the gaps between the industries and engineering educational programs
- Developing the satisfied faculty, students, alumni, clients, government, and the community at large
- Establishing an academic ecosystem that facilitates the growth of the faculty as world-class leaders in their area of specialization
- Continuous contribution to the state, regional and national competitiveness
- Continuous internal resources and revenue generation and effective utilization
- Enabling the faculty members and students to achieve their potential
- Ensuring adequate return on investments (ROI)
- Should also focus on intangible outcomes
- Suggesting suitable interventions for accelerating the performance

1.3. Purpose of the academic audit

With an academic audit, it will be very difficult to plan development. It also helps in undertaking focused research on curriculum planning, faculty development, and instructional resource development.

- Define the academic quality in terms of course outcomes to match various tasks in employment
- Focus on the transformation process
- Develop the learners collaboratively
- Implement curriculum decisions on proven shreds of evidence
- Strive for program educational objectives
- Develop transformation process from best industrial practices
- Institutionalize continuous improvement as a priority

1.4. Outcomes of academic audit

The following are the most desirable outcomes of the academic audit.

- Establishing a faculty-centered methodology that encourages institutional effectiveness in producing knowledge and human capital in engineering and technology and improving national competitiveness
- Ensuring a thoroughly documented evaluation process that meets the requirements for educational funding

- Increasing the reputation of the institute,
- Following ethics in all activities
- Sustaining the rapid academic growth
- Continuously developing suitable instructional packages

A process that sustains continuous quality improvement of teaching, learning, interdisciplinary research, consultancy, and human and knowledge development. The objectives of the research are 1). To synthesize the state of the art in the institutional performance evaluation; 2). To design an evaluation model for the institute's performance; 3). To suggest a process to implement the outcomes of the evaluation; 4). To assess the academic performance through an academic audit; and 5). To suggest interventions to improve academic performance. The research methodology consists of a survey method on the current theories, models, and suggestions for evaluating the performance of engineering institutions. The participants involved and their characteristics are presented in [Table 1].

Table 1. Participants Characteristics

People Involved	Government/Parliament/Board of Governors	CEO & Heads of the Departments	Faculty Members	Students
Primary Concern	Creating the Knowledge Capital & Human Capital based on the needs of the nation	Resource Allocation, Faculty Development, Curriculum Development, Examination, Degree Awarding, Quality Assurance	Instructional Planning, Continuous Transformation Development	Gaining the Cognitive skills, Motor skills, Attitudes, Human Relations, & High Performance.
Ultimate Concern	Return on Investment	Institutional Development, Program Development, faculty, Quality Services to Industries and Society.	Creating knowledge capital and human capital	Jobs, entrepreneurship development, researchers, and high-performance.

After synthesizing, an implementable institutional performance evaluation process has been designed. Suitable interventions are identified and presented. The limitations of this study are due to the focus on the Indian situation, norms, rules, and standards. However, most of the concepts developed would apply to other countries. Necessary precautions are to be used for generalizing the methodology.

2. Literature survey

Since Academic Audit has been recognized as a tool for assessing the gains of the programs, a large number of researchers focused their work on creating suitable models of an audit. Further, the faculty can be assisted to improve the transformation processes. Alexia and Anthony Mills (2014) [2] researched project performance audit to overcome several issues experienced in the building industry. Their methodology codifies elements of the audit into modules, enabling a customizable approach to defining a scope that is reasonable for both the project and the owner. Illinois Institute of Technology considers the performance review process is about helping the faculty succeed which helps the university to succeed. Stefan and Dmitri state that investors and investment managers need timely and accurate information on the performance of their investment portfolios. Suresh Kumar [4] stated that the role of higher education institutions is reflected in their learning outcomes that contribute to developing quality professionals by enhancing cognitive capability, grooming professionalism, and employability skills. According to him, the academic audit should focus on the teacher

quality, curriculum design, instructional delivery and pedagogy, research and training, skill development of the students, etc. According to Oyewole Oduwusi [5], employee training and development enable organizational success. According to Sanjay Nasta (2012) [5], return on investment (ROI) is a metric commonly used in business and financial circles to compare competing investments. According to UNEVOC [6], return on investment refers to a measurement of the benefit of an investment relative to the cost of the investment. Returns to education refer to the individual investing in more education, especially in the relationship between educational attainment and earnings. Technical education and training comprise education, training, and skills development for a wide range of occupations. There is a need to measure the ROI and promote the financing of engineering education. Providing information on the ROI from Engineering Education is important as it provides governments and funders analytical information or direct evidence on the performance of the system, and further justifies the expenditure on engineering education. Information on the ROI is very useful at the institute and administrator levels and the role it can play in the evaluation of public policies related to engineering education. An ROI analysis can be used as a tool for strategic planning and for promoting business improvement and efficiency. Jack J. Phillips [7] concluded that high ROI values are achieved only when a learning program is needed, addresses a specific performance gap, and is applied and supported in the workplace. According to Rashied Bashir [8], the strategic plan will guide the Grainger College of Engineering of the University of Illinois to greater heights in pursuit of its mission over the next five years. Their vision includes unparalleled impact, fostering inclusive growth, and diversifying their research enterprise to achieve unparalleled impact, fostering an inclusive environment in which their students are given tools, programs, and experiences to excel in the 21st century, and in which their faculty and staff thrive.

2.1. Synthesis

The performance audit helps in finding the excellence and deficiencies in academic accomplishments, human capital development, and knowledge capital development. The academic audit focuses on the academic activities, curricula, instruction, placement of the graduates, and contribution to society through services. ROI assists the rate of return to the institute. Strategic planning provides a tool to accelerate growth.

In the following section, the types of a performance audit to be conducted in various institutions and their purposes are presented.

Performance Audits for Polytechnic Colleges, Affiliated Engineering Colleges, Autonomous Engineering Colleges, Technical Universities (Deemed/ State), and Human Resource Development Units/ Academic Staff Colleges and National Institute of Technical Teacher Training and Research (NITTTR) (a think tank)

3. Types of performance audits

Six case studies are presented that were implemented in India in the last 20 years in various projects/ institutes.

3.1. External performance audit of an institute

This type of Audit is initiated by Project Managers: Mostly constituted by the funding organizations, project managers, donors, the Ministry of Education (MoE), and the state and central governments. Example-1: Joint Review Mission (JRM) of the World Bank (World

Bank Country Manager), Director of the Project from the Ministry of Education, Technical Education Expert like Dr. C.S. Jah, State Secretary, Director of National Project Implementation Unit (NPIU), State Project Implementation Unit (SPIU), Academic Consultant, Procurement Consultant, Building Construction Consultant, and Principals of Project Polytechnics.

Purpose: To audit the achievements and short-falls, suggest improvements, grant additional funds, if needed, and add new components in capacity development, quality improvement, and efficiency improvement.

Process: Review the progress in the last six months against the Project Implementation Document (Data from the State Project Implementation Unit (SPIU) and Reviewed by the Academic Consultant). The Academic Consultant periodically collects data on various academic activities and prepares a report and indicates the achievement or deficiencies for the consideration of the high-power committee.

Intermediate interventions: Decision to grant funds for additional programs, Recovering the funds used for unapproved activities, and suggestions to accelerate the project completion,

Final Outcome: Project Impact Document to highlight the benefits for the state, higher return on the investment, impact on the human capital, and knowledge capital. Poorly performing institutions would be eliminated from the projects.

3.2. External academic performance audit: accreditation by the national board of accreditation (NBA) based on the mandate

This audit assures the quality of the programs. The main purpose is to accord accreditation for the programs for five years. The institutions have to prepare self-assessment reports and submit them to NBA based on the NBA Guidelines. The experts constituted by the NBA will visit the institute and departments. Poorly performing institutes can't be accredited and they will not be eligible for funds for research. Further, they can't charge higher tuition fees. The graduates will not be recruited by the companies. The accreditation is only for five years. Employers will recruit the graduates only from accredited institutes.

3.2.1. Alumni audit

To review the goals, and objectives, highlight the best practices, point out the obsolete topics, and practices and suggest changes in the curriculum and instructional methods, create linkages with the industry, suggestions for the on-the-job training, and raise funds for development works. This audit is only a voluntary process.

3.2.2. Audit by the standing committee members of the parliament and the board of governors

The purpose is to verify the academic achievement of the centrally funded institutes and report to the parliament. It revolves around the overall contribution of the institute to the economy of the nation. The standing committee members will suggest developing the institute with additional grants. An internal audit by the Board of Governors/ Governing Council/Trustees is based on the total accomplishments of the whole institute in each quarter. This enables them to verify the extent of accomplishments based on the annual planning presented to them and the funds allocated. They may provide new goals and additional funds for developing the resources.

3.2.3. Internal Audit by the Faculty Members

Done by the faculty members of an institution to identify the accomplishments, weaknesses, and strengths in various programs conducted, instructional methods used, performance of the students in the examination, placement of the students, etc. This process is usually initiated by the director of the institute.

Place: Academic Council of the Institute or Committee Room with a Round Table

Example: Self-evaluation Report for Accreditation by National Board of Accreditation (NBA) / National Accreditation Council (NAC). Suggest interventions like improving the curriculum, practical works, introducing new courses, electives, industrial training, improving the learning materials, library, internal evaluation system, projects, etc. Suggestions for further faculty development, new courses, and suggestions for eliminating the barriers.

3.3. Engineering and development institutions

Five different institutions are considered for the Indian context.

1. Polytechnic Colleges/ Community Colleges
2. Engineering Colleges
3. Autonomous Engineering Colleges
4. Technical Universities/ Deemed Universities
5. NITTTRs/ Academic Staff College/ Human Resource Development Units of the Universities

In the following section, around 21 issues have been identified as performance indicators. It is desirable to know the status, implementation, review, outcomes, and deficiencies, if any so that one can appropriately implement interventions [Table 1]. These issues center around the total performance audit, accomplishments in various institutional development activities, student placements, etc. One can choose the needed evaluation of any development area. Some areas may not be required.

The areas Considered are presented in [Table 2].

Table 2. Areas and the issues considered

Focus Area	Issues	Focus Area	Issues	Focus Area	Issues	Focus Area	Issues
Institute	Strategic planning	Faculty	Recruitment	Curriculum	Academic Council	Students	Soft-skills Training
	Leadership Development		Training under the Quality Improvement Program of All India Council for Technical Education (AICTE)		Massive Open access Online Courses (MOOCs)		Placement
	Training of office Administrator		Adjunct Faculty		Formative Development		Internships
	Financial Management		Part-time Faculty		Industry-specific Long-term Programs		Teaching-Learning Aids
	Grants in Aid		In-house Training		Cooperative Programs		Finishing Schools
	Donners		Performance Evaluation		Dual programs		Tracer Studies

	Internal Revenue Generation		Training of Diverse Faculty Members		Formative Evaluation of On-the-Job Training		Instructional materials
	Global Networking		Seminar/ Symposia/ Conferences/ Workshops		Instructional Material Development		Services
	Institutional Development		Supporting Well-Performing Faculty Members		Certificate and Diploma Programs		On-the-job Training
	Centers of Excellence		Letters of invitation		Undergraduate programs		Counseling
	Capacity Development		Sponsorship for global programs		Postgraduate Programs		Coaching
	Quality Improvement		Rewards		M.S. by research		Mentoring
	Efficiency Improvement		Removing the barriers		Ph.D.		Dual Programs
	Modernization and Removal of Obsolesce		Grievance Redressal		Interdisciplinary Research		Flexible programs
	Student Personnel Administration		Mentoring		Accreditation		Sports facilities
	Consultancy Projects						Resources
	Research Parks						Scholarships
	Industry-Institute-Government-Community-Partnerships			Alumni	Tracer Studies, Suggestions, Placement, On-The-Job-Training (OJT) Feedback on the instructional methods		Quiz programs Under the Confederation of Indian Industries (CII), Federation of Indian Chambers of Commerce and Industries (FICCI)
	Impact Studies				Feedback on the curriculum		Transport
	Return On Investment (ROI)				Mentoring		Hostel
	Global Networking				Entrepreneurs		Playground

3.4. Factors/Issues Considered for conducting Performance Audit by Various Institutions

These factors are focused on the performance indicators, status, implementation, review, outcome, and deficiencies. Performance indicators provide focus on the planning and providing resources linked to the strategic planning of the institute. Sixty areas have been selected for audit. The status indicates the current position. The implementation shows the action taken. The outcome indicates the achievement. Deficiency indicates shortcomings. Based on the identified deficiencies appropriate interventions can be undertaken. In a Performance Audit, the stakeholders can provide considered feedback on the achievements

and deficiencies. The administrators can procure needed resources, recruit faculty, conduct training, updating the instructional designs and research programs [Table 3].

Table 3. Performance indicators

Sl. No.	Performance Indicators	Status	Implementation	Review	Outcome	Deficiency
1	Strategic Planning of the Institution (SPI)	Whether the strategic planning has been done by involving the faculty members?	Whether it has been implemented with adequate planning of all the resources and services?	Whether it has been reviewed by the Board/ Government?	What are the significant outcomes?	Is there any deficiency in SPI?
2	Leadership Development	Whether the Heads of Departments (HODs) and other senior faculty members undergone any program?	Have they reflected any development in administration?	Whether the Chief Executive Officer (CEO) and the Board reviewed the achievement?	What are the significant achievements?	Are there any deficiencies in various leaders of the institute?
3	Training of Office Administrator	Whether the Administrator has been trained in various rules, laws, and Acts connected with the institute administration?	Whether the norms, rules, acts, and standards followed in administering the institute?	Whether the disputes settled as per the norms by the administrator?	Are the funds are utilized as per the standards?	Are there persistent deficiencies and unsolved disputes?
4	Financial Management (FM)	Whether standard process has been followed in the financial management?	Whether appropriate implementation process has been adopted?	Whether a review has been made?	Whether desired outcomes have been achieved?	Are there any deficiencies in FM?
5	Grants-in-aid (GID)	Whether the institute getting the grants-in-aid from the government?	Are the grants used for meeting the legitimate expenditure as per the rules?	Are there any additional funds to implement any new programs?	Whether the outcomes as per planning?	Are there any deficiencies in getting the GID?
6	Donners	Whether donners have been identified by the Institute's foundation?	Have the funds been accredited to the Institute's funds?	Whether the funds meant for specific activities?	What is the average amount received per year?	Is there any deficiency in the expected collection of donations?
7	Alumni Cell	Whether an alumni cell has been established?	Is there any alumni magazine?	Have you identified all the alumni?	Is there any significant feedback on the curriculum and instructional methods followed?	Are there any deficiencies in the alumni activities?
8	Internal Revenue Generation	Whether the Institute has planned to generate sufficient internal revenue?	Whether the institute established a consultancy cell?	Are the faculty members are facilitated to provide consultancy programs?	Whether the income generated has been utilized as per the standards?	Are there any deficiencies in generating the internal revenue?
9	Global Networking (GNW)	Has the Institute initiated any global networking of the Institutions?	Whether the Institute implemented any faculty exchange, joint programs, and student exchanges?	Whether any review has been undertaken?	What are the significant outcomes of global networking?	Are there any significant deficiencies in the functioning of GNW?
10	Institutional	Whether	Whether strategic	Whether linkages	Whether	Are there any

	Development (ID)	institutional development has been undertaken? Whether perspective plans been prepared?	partnerships at the state, national and international levels have been established?	with funding agencies been established?	desired outcomes have been realized?	deficiencies in the functioning of the ID?
11	Centers of Excellence (COE)	Whether any centers of excellence have been planned?	Whether they have been established with the necessary faculty and resources?	Whether the functioning been reviewed?	What are the significant outcomes of the centers of excellence?	Are there any deficiencies in the performance of COE?
12	Academic Council (AC)	Whether an Academic Council has been established?	Whether the needed experts have been included in the council?	Whether the functioning been reviewed?	What are the significant outcomes of the Academic Council?	Are there any deficiencies in the functioning of the AC?
13	Faculty Recruitment	Whether the needed faculty members have been recruited as per the AICTE criteria?	Whether the preservice training has been offered to the faculty members?	Whether the faculty members' qualifications been reviewed?	What are the most significant outcomes for the faculty members?	Are there any deficiencies in the newly joined faculty members?
14	Faculty Training	Are the needed faculty training been identified for each semester?	Whether the faculty training has been systematically implemented?	Whether the skills and competencies learned to meet the needs of the students?	What are the significant outcomes of the faculty training underwent by the faculty members?	Are there any significant deficiencies in planning, implementing, and evaluating the benefits?
15	Adjunct Faculty (AF)	Whether the needs of adjunct faculty members have been identified?	Whether appropriate adjunct faculty members have been recruited as per the needs?	Whether the performance reviews been completed as per the schedule?	What are the significant outcomes of the adjunct faculty members?	Are there any significant deviancies in the utilization of the services of AF?
16	Part-time Faculty (PTF)	Whether part-time faculty members have been identified?	Whether their services have been incorporated into the instructional planning?	Have you reviewed the academic works with the part-time faculty members?	What are the significant outcomes regard to graduates' attributes?	Are there any deficiencies in their contribution?
17	In-house Faculty Training (IHFT)	Have you planned any in-house training programs to meet the needs of the faculty members?	Whether the development programs have been implemented?	Have you received feedback from the faculty on the utility of the IHFT programs?	What are the significant outcomes of IHFT programs?	Are there any deficiencies in the IHFT programs?
18	Massive Open Online Courses (MOOCs)	Are you planning any mass open online courses for your faculty/ students?	Have you implemented any courses? Is it related to the curriculum?	Have you reviewed the course content, relevance, and utility?	What are the significant outcomes of the MOOCs that are offered to your faculty and students?	Are there any deficiencies in these MOOCs?
19	Performance Evaluation of the departments (PED)	Have you evaluated the performance of the departments?	Have you reviewed the overall outcomes of the departments?	What are the most significant outcomes of the departments in human capital and knowledge capital development?	Whether the outcomes as per the strategic planning?	Are there any significant deficiencies in consultancy projects, research papers, and student

						attributes?
20	Capacity Development (CD)	Whether the authorities planned CD to meet the requirements?	Whether new departments, labs, workshops, buildings, etc. been constructed?	Whether a review of the utility and adequacy of the CD has been undertaken?	What are the significant outcomes of CD projects completed?	Are there any deficiencies in the CD project?
21	Quality Improvement Program (QIP)	Whether the steps been undertaken to periodically evaluate and improve the curricula and the faculty competencies?	Whether the gaps between the industry and the curriculum been reduced? Whether the outcome of learning matches with task performances?	Whether the existing curricula have been evaluated against the needs of the employers and career needs of the students?	What are the significant outcomes of QIP?	What are the significant deficiencies in curricula revision, adding new curricula in emerging technologies, and the instructional packages?
22	Efficiency Improvement (EI)	Whether steps have been undertaken to improve administrative efficiencies?	Whether any improvements have been introduced in the function of administration?	Whether any reviews have been undertaken in EI?	What are the significant outcomes due to EI introduction?	What are the significant deficiencies in EI strategies?
23	Modernization and Removal of Obsolesces (MODROB)	Whether the administrator has undertaken modernization of resources?	Whether new equipment, machine tools, software, classroom facilities, etc. been added?	Whether any review been conducted on the MODROB?	What are the significant outcomes due to MODROB?	What are the significant deficiencies in the MODROB?
24	Curriculum Development (CD)	Whether new curricula have been planned in meeting the needs of Industry-4.0?	Whether the curricula in various cutting-edge technologies have been implemented?	Whether any purposeful review been conducted on the new curricula?	What are the significant outcomes due to CD?	What are the significant drawbacks of CD?
25	Formative Evaluation of the Curriculum	Whether the designed curricula have been evaluated?	Whether the improved curricula have been implemented?	Whether the faculty members involved in the formative evaluation?	What are the significant outcomes of the updated curricula?	What are the deficiencies of the updated curricula?
26	Student Personnel Administration cell (SPAC)/ Student Services	Whether a cell for the SPAC has been planned?	Whether the faculty and staff have been trained to handle all the functional issues of the students?	Whether the functions of the SPAC been reviewed?	What are the significant accomplishments of the SPAC?	What are the significant deficiencies of SPAC?
27	Students' Soft Skill Development	Whether the needs of the students been identified?	Whether soft skills training courses have been implemented?	Whether the soft skills programs been reviewed?	What are the significant outcomes of soft skill training programs?	What are the major deficiencies?
28	Placement Cell (PC)	Whether the placement has been established?	Whether MNCs and Corporates recruit the graduates through the PC?	Whether the feedback given by the recruiters reviewed?	What are the significant outcomes of the PC?	What are the key deficiencies of PC?
29	Internships	Whether the needed internships been identified?	Whether the companies have offered desired internships?	Whether any review been undertaken on the internships?	What are the significant outcomes of the internships?	What are the key deficiencies of internships offered?
30	Industry-Specific	Have you developed any ISLTPs?	Have you implemented any	Have you reviewed the	What are the most	What are the key

	Long-Term Programs (ISLTP)		ISLTPs?	course outcomes of ISLTPs?	significant outcomes of ISLTP?	deficiencies of ISLTP?
31	Cooperative Programs (CP)/ sandwich programs.	Have you planned any cooperative programs with local companies?	Have you implemented any CP?	Have you reviewed any CP?	What are the significant outcomes of CPs?	What are the key deficiencies of CPs?
32	Part-time Programs for the working employees. (PTPWEs)	Have you offered any PTPWEs?	Have you implemented any PTPWEs?	Have you reviewed the implementation of PTPWEs?	What are the most significant outcomes of PTPWEs?	What are the key deficiencies of PTPWEs?
33	Dual Programs (Bachelor and Masters combined) (DP)	Have you planned any DPs in engineering/ technology?	Have you implemented any DPs in your institution?	Have you reviewed the implementation of any DPS in your institution?	What are the most significant outcomes of DPS?	What are the key deficiencies of DPS?
34	Formative Evaluation of on- the-job training (FE OJT)	Have you planned any FE?	Have you conducted any Fes for the draft curriculum?	Have you reviewed the suggestions for the improvements?	What are the most significant outcomes of FEs?	What are the key deficiencies of FEs?
35	Instructional Materials Development	Have you planned needed instructional materials for all courses as per the objectives?	Have you implemented the instructional materials in any long-term programs?	Have you validated the instructional materials for a course?	What are the significant outcomes relegalized in learners' skills and competencies due to instructional materials?	What are the key deficiencies in the instructional materials?
36	Teaching-Learning Aids Development (TLAs)	Whether TLAs been designed?	Have you utilized appropriate TLAs for a course?	Have you reviewed the effectiveness TLAs for a course?	What are the significant outcomes of using TLAs?	What are the key deficiencies in TLAs?
37	Finishing School/Short-Term Courses Development (FS/STCs)	Whether any FS/STCs have been identified for all engineering programs?	Have you prepared any FS/STCs have been developed to fill up the gaps in the curricula?	Have you reviewed any FS/STCs against the needs of the graduate attributes?	What are the significant outcomes in implementing appropriate FS/STCs?	What are the key deficiencies in planning, developing, and implementing FS/STCs?
38	Certificate and Diploma Programs (CDP) for the executives	Whether any CDP have been planned for executives?	Have you implemented any CDP successfully?	Have you reviewed the feedback of the participants?	What are the most significant outcomes of CDPs?	What are the shortcomings of CDPs?
39	Undergraduate Programs (UGP)	Have you planned the UGPs based on the needs analysis?	Have you implemented the UGP with improved curricula and resources?	Have you reviewed the outcomes of the UGPs to graduate attributes?	What are the significant outcomes of UGPs based on the needs analyses?	What are the shortcomings of the UGPs based on the needs analyses?
40	Postgraduate Programs (PGP) based on the needs of a sector?	Have you planned any PGP based on the needs of a sector?	Have you implemented any UGPs?	Have you reviewed/ evaluated the course outcomes of PGP for a sector?	What are the significant outcomes of PGPs?	What are the significant shortcomings of PGPs?
41	Flexible Programs (FP)	Have you planned any FPs?	Have you implemented any FPs?	Have you reviewed the feedback of the	What are the significant outcomes of	What are the most significant

				participants of FPs?	FPs?	shortcomings of FPs?
42	M.S. (Research)	Have you planned any M.S (research) Programs?	Have you implemented any M.S. (Research) programs?	Have you reviewed any M.S. (Research) programs?	What are the significant outcomes of M.S. (Research) programs?	What are the most significant shortcomings of M.S. (Research) programs?
43	Part-time Cooperative Programs (PTCP)	Have you planned any PTCPs in collaboration with the industry?	Have you implemented any PTCPs in collaboration with the industry?	Have you reviewed any PTCP based on the feedback from the stakeholders?	What are the most significant outcomes of PTCPs?	What are the most significant shortcomings of PTCP?
44	Interdisciplinary Dissertations (IDD)	Whether the dissertations based on interdisciplinary research work?	Have you implemented any IDD?	Have you reviewed the outcome of the IDD?	What are the most significant outcomes of IDD?	What are the most significant shortcomings of IDD?
45	Doctoral Programs (Ph.D.)	Whether the doctoral programs planned as per the standard norms?	Whether the Ph.D. programs provide opportunities for eligible participants?	Have you reviewed the outcomes of the Ph.D. programs?	What are the most significant accomplishments of Ph.D. programs?	What are the drawbacks of implementing current Ph.D. programs?
46	Consultancy Projects (CPs)	Whether the well-accomplished faculty members offered CPs?	Whether the CPs completed satisfactorily?	Have you reviewed the planning, bidding, and implementation of the CPs?	What are the most significant accomplishments of CPs?	What are the key drawbacks in planning and implementing CPs?
47	Sponsored Research Projects (SRP)	Whether the Institute received any SRPs from the government and/or IDAs?	Whether the SRPs completed as per the norms?	Have you reviewed the implementation of SRPs?	What are the most significant accomplishments of SRPs?	What are the key drawbacks of implementing SRPs?
48	Research Park (RP)	Whether your institute has established any RP?	Whether the resources and faculty collaborating with the clients for product development?	Have you reviewed the functioning of the RP?	What are the significant outcomes of the RP?	Are there any drawbacks in the functioning of RP?
49	Training Programs for the Diverse Global Faculty Development (DGFD)	Whether the Institute has planned any DGFD?	Whether any DGFD been implemented?	Have you reviewed the working of DGFD?	What are the significant outcomes of the DGFD?	Are there any significant drawbacks to DGFD?
50	Industry-Institute-Government-Community Partnership Unit (IIGCPU)	Whether the Institute planned IIGCPU?	Whether IIGCPU has been implemented?	Have you reviewed the functioning of the IIGCPU?	What are the significant outcomes of the IIGCPU?	Are there any significant drawbacks in the functioning of the IIGCPU?
51	Tracer Studies (TS)	Whether the Institute planning periodical TS?	Whether the feedback has been analyzed and the inferences have been drawn?	Have you implemented the suggestions of the TS?	What are the significant outcomes of the TS studies?	Are there any significant drawbacks in the TS planning?
52	Impact Studies (IS)	Whether the Institution has conducted any IS?	Whether the data have been utilized for improving the functioning?	Whether the Institute redesigned any academic	What are the most significant outcomes of	What are the significant drawbacks of IS?

				activities?	IS?	
53	Return On Investments (ROI)	Whether the Institute has planned a study on ROI?	Whether information on intangible returns has been evaluated?	Whether the institute has incorporated any additional activities due to ROI studies?	What are the most significant outcomes due to ROI?	What are the significant drawbacks of the ROI study?
54	Seminars	Whether the institute planned any seminars?	Have they been implemented?	Whether the Institute improved the courses based on the best practices discussed in the seminar?	What are the most significant outcomes of the seminars?	What are the significant drawbacks of planning and conducting the seminars?
55	Symposia	Do	Do	Do	Do	Do
56	National Conferences	Do	Do	Do	Do	Do
57	International conferences	Do	Do	Do	Do	Do
58	Networking with the International Development Agencies (IDAs)	Whether the Institute planned any network with IDAs?	Have they been implemented?	Whether the Institute has reviewed the networking with IDAs?	What are the most significant outcomes of networking with IDAs?	What are the significant drawbacks of networking with IDAs?
59	Supporting well-performing-faculty teams. (WPFTs)	Have you planned various supports needed for the well-performing faculty teams?	Have you implemented needed supports to plan, undertake, and complete the projects of WPFTs?	Have you reviewed the working of the WPFTs?	What are the most significant outcomes of WPFTs?	What are the most significant drawbacks in planning the projects of WPFTs??
60	Are you forwarding the LOIs to the WPFTs w.r.t projects/ sponsored research projects?	Whether the WPFTs have planned technical and financial proposals and submitted them before the deadlines?	Whether the WPFTs have implemented the projects as per the contracts/agreements?	Have you reviewed the functioning of the WPFTs?	What are the significant achievements of the WPFTs?	What are the significant drawbacks of implementing the projects by WPFTs?
61	Any other issue?					

3.5. Sample internal academic audit by the engineering faculty members

You may constitute an academic audit committee consisting of two or three members, one may be the head of the department, another may an external member from another department and the third may be from another institute. The following issues are suggested to evaluate the planning, implementing, and assessing the outcomes of any undergraduate or postgraduate programs. A questionnaire can be prepared and distributed to the graduates, faculty members, and employers. A questionnaire has been presented in the Annexure. This can be distributed to faculty members and students. A report can be prepared and presented to the Audit Committee. You may include an external member, one senior faculty member from a department of the institution. Their suggestions have to be reviewed by the head of the department, and the chairman of the Academic Audit/ Academic Council.

4. Audit development process

- Develop a questionnaire specific to each branch of engineering
- Administer to the students, alumni, faculty, and employers

- Analyze the feedback and suggestions
- Prepare a report for conducting an academic audit
- Deliberate the proceedings
- Synthesize the suggestions
- Take follow-up action
- Sample questions are presented in Annexure-I.

4.1. The outcome of the academic audit

Curriculum Improvement plans, Improved Instructional Design, Conducting Internal assessments, Faculty Training, Improving the Resources, Campus Placement, Planning and Conducting Dual Programs, Interdisciplinary Postgraduate Programs, Research, Consultancy works, Networked Campus, etc. The outcomes can be assessed through tracer studies and impact studies.

4.2. Institutional evaluation model

The model incorporated all the four key areas, viz, institute, faculty, curriculum, and students. Sixty issues have been considered to identify the performance of an engineering institute. The performance criteria are:

1. Development of high-performing faculty members by nurturing, supporting, and delegating needed authority for planning, undertaking, and implementing new innovative programs at all levels;
2. Offering needed services to various industries, establishing cutting-edge programs that create knowledge capital, and executive development programs for the government engineering departments
3. Creating the need for human capital to support the fast-growing industries
4. To generate sufficient return on investments in engineering education
5. To offer diverse global faculty development

4.3. Academic audit

The major issues in the academic audit center around the curriculum planning based on the needs analysis, identifying needed program educational objectives; generating appropriate course outcomes to create needed attributes in the graduates to perform the tasks; checking the instructional planning and implementation, and ensuring that the best practices are followed. All these issues can be checked through the academic audit. The faculty members perform the major role.

4.4. Return on investment on engineering education

The return on the investment comprises monetary returns and intangible returns like reputation, integrity, and services to diverse global faculty members, creating leadership in the high-performing faculty by supporting their initiatives of them. Most of the institutions are non-profit organizations. Hence, to support the human capital the institutions have to plan industry-specific programs, dual programs, flexible programs, MOOCs, self-directed programs, and interdisciplinary research programs. The institutes have to offer consultancy programs, and executive development programs and are ready to undertake any complex sponsored research projects. All these can be verified by conducting the performance

evaluation of the institutes using the sixty issues listed. It is assumed that the institute enjoys autonomy and possesses all the needed resources. It is also assumed that the government provides needed grants-in-aid and administrative autonomy. The Board of Governors supports all ethical activities and focuses on excellence.

5. Conclusions

The performance audit of an engineering institution has been divided into four components 1). Performance Audit by an External Agency like National Accreditation Body, 2) External Development Agency like World Bank once in six months until project completion, 3). Parliament Standing Members once in ten years, 4). Board of Governors once in a quarter, 5). Through an Academic Council, and, 6). Alumni members, The Ministry of Education has made the accreditation mandatory for funding. The Board has to review the accomplishments every quarter. The quality and accomplishments of an institute depend on carefully watching the progress of all academic activities.

Performance evaluation comprises evaluating the institute policies, recruiting high-performing and qualified faculty members, and developing appropriate curricula which will provide needed attributes, and achievement-oriented students. 60 issues have been identified for evaluating the total performance of the institute. Academic performance is not restricted to student placement alone but covers the institution's contribution to the human capital, knowledge capital, and services to the industry, government, community, and diverse global participants. Also, the return on investments covers not only monetary return but also intangible returns to the society, peace engineering education, and borderless engineers. Well-performing institutions alone sustain and grow. Further, they can get funds for research from various funding agencies. Their graduates will be recruited by various well-paying companies only from high-performing institutes. The graduates can get admission to well-developed national institutes and institutes of national importance. Sustainability demands well-performing institutions.

References

- [1] Illinois Institute of Technology. Performance Evaluations, <https://www.iit.edu/hr/employee-resources/performance-evaluation>
- [2] Nalewalk and A. Mills, "Project performance review- Capturing the value of audit, oversight," First edition, London: Imprint Routledge, (2016), https://www.taylorfrancis.com/books/mono/10.4324/978135602424/project_performance_review_alexie_nalwalk
- [3] S. J. Illmer and D. A. Senik, "Performance evaluation: An introduction," (2015) https://www.cfainstitute.org/-/meta/documents/support/programs/c.PDF_file
- [4] P. M. Sureshkumar, "Academic audit and quality assurance in higher education. International Journal of Management, Technology, and Social Sciences, vol.2, no.2, pp.61-69 DOI:10.5281/zenod.103896
- [5] O. Odumusi, "Employee training and development as a model for organizational success. International Journal of Engineering Technologies and Management Research, vol.5, no.3, pp.181-189 DOI:10.29121/ijetmv.vs.i3.2018.10
- [6] UNEVOC TVETipedia Glossary- Audit-UNESCO-UNEVOC, <http://unevoc.unesco.org/home/TVETipedia+Glossary/fitt=all/id=71>
- [7] J. J. Phillips, "Measuring ROI: The process, current issues, trends," (2017), <https://roinstitute.net/wp-content/uploads/2017/02/Measuring-ROI-Tn.PDF-file>
- [8] Academic Audit: An overview, <https://rocnestate.edu/SMITHCC/academicAudit/AcademicAuditoverviews>

- [9] American University, Washington DC., Alumni and Community Audit, (2021), <https://american.edu/alumni/benefits/alumni.audit>
- [10] Discover Audit, “The skills required for the auditor of the future are always evolving,” (2020), <https://discoveraudit.org/professors/>
- [11] K. Tremblay, D. Lalancette, and D. Roseveare, “Assessment of higher education learning outcomes,” Feasibility Study Report. Volume 1- Design and Implementation. OCED, (2012), <https://oecd.org/skills-beyond-school/AHELOES.ReportVolume1.pdf>
- [12] Lakireddy Balireddy College of Engineering, External Academic and Administrative Audit Report, IQAC- Academic and Administrative Audit (AAA) - A.Y 2017-18, (2017)
- [13] Scientific Advising Board, Report on Academic Audit of AFT Programs in System Engineering, (2004), <https://schola.afit.edu/cgri/viewcontent.cgi?article=1021&content=docs>
- [14] TBR Academic Audit Resources, “What is an Academic Audit?” (2021), <https://tbr.edu/academicAudit/TennesseeBoard>

Annexure: 1

Details of the issues to be considered for the academic audit

Curriculum: Undergraduate/Postgraduate/Dual/Flexible Program

Typical questions to get feedback from the students and the faculty members

- Whether the goals of the program have been stated?
What type of curriculum design process was adopted? Based on the participation of experts in the Board of Studies?
Desired Attributes of the Graduates Students
Whether AICTE approved the curriculum?
Course Schedule
Whether Program Educational Objectives (PEOs) have been stated in the curriculum?
List the Basic Courses, Core Courses, Advanced Courses, Electives, and Dissertation?
Whether any On-the-Job Training has been prescribed?
State Specific Course Objectives (SCOs), Course Outcomes (COs), and the Instructional Design Process adopted?
Whether all the topics presented as per the curriculum?
Whether the Instructional Materials provided at the beginning of the class?
What is the Transformation Process adopted? Participative?
Whether relevant Case Studies given to solve?
Whether the Internal Assessment has been conducted as per the curriculum?
Whether the assignments prescribed as per the course schedule?
Whether the quizzes conducted as per the schedule?
Whether tests are conducted as stated in the course schedule?
What are the average, minimum and maximum scores in the examinations?
What are the feedbacks from the faculty members and students?
Whether any Action Research project has been included?
Information/Data to be collected through tracer studies/ impact studies.
Whether the courses been implemented as per the curriculum?
Whether the internal evaluation has been conducted through tests/quizzes, assignments, projects, or mini research works?
What is the feedback of the students?
What is the feedback of the faculty members?
What are the major deficiencies?

Is the equipment used properly?
Is there any accident in the workshop?
Are there adequate resources as prescribed by AICTE?
Whether the students been placed properly?
What is the feedback of the employers?
Whether a tracer study been completed?
Whether a report been prepared and circulated to the faculty members?
What are the accomplishments of the students?
Strategies to overcome the deficiencies
Interventions like faculty training, procuring additional resources, consumables, etc.?
What is the implementation plan for the next batch?
Do we need to sanction additional funds?
Can we recruit additional faculty members?
Can we employ any adjunct faculty members?
Prepare a course report based on the evidence collected.
Present the accomplishments, achievements, and shortfalls.
Review the achievements and the shortfalls. Suggest an action plan.

Author

Thanikachalam Vedhathiri

B.E., M. Tech., Ph.D., M.S., FIE., FIGS.,
FFIUCEE, Former Professor and Head, Center for International Affairs,
National Institute of Technical Teachers Training and Research, Chennai
India. Former Senior Researcher under the Fulbright Scheme of the USA