

Empowering Communities through Technical Education: A Case Study of the Technical Teachers' Training and Research

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Abstract

Creating social impact by the human resources developing institutes is very much needed to share the expertise and assist other institutes to develop. This qualitative study was conducted to present the social impact created by a national institute of technical teachers' training and research in India. The research has been designed to collect the contributions of the technical teachers' training institute and other services offered. Accomplishments were taken from the Annual Reports of the institute. Most of the respondents of this study are clients of the institute who provided written feedback. The short-term and long-term faculty development programs for the faculty members of technical education were reviewed. As it has grown over three decades, the institute has gained a reputation and its services are utilized by various manufacturing companies, government engineering departments, International Development Agencies (IDAs), and other human resources development units. All these are possible due to approval by the Ministry of Education, the Board of Governors, senior administrators like deans, directors, principals, and the achievement-oriented high-performing faculty teams. Well-accomplished faculty teams have been continuously engaged to establish innovations in creating global social impacts based on timely approval. Considering the fast-growing disruptive technologies, it is suggested to develop professional and interdisciplinary schools with well-accomplished faculty teams, empowering them to undertake radical innovations in creating social impact at a global level. Based on this qualitative study, "Radical Innovation Model to Create Social Impact" has been synthesized for implementation in other teacher training institutes. Further research study on the social impact of technical teachers' training institutes has been suggested.

Keywords: *Prevention of faculty burnout, Social-impact, Rapid development of resources, Well-performing faculty teams*

1. Introduction

After getting Indian independence in 1947, five-year plans have been introduced in India for the development of the economy. Technical education is the backbone of industrial development. Engineering Colleges, Polytechnics, and Industrial Training Institutes have been established throughout the country to create needed industry-specific human resources. Almost all the faculty members of these institutes are specialists in their branch of engineering but they never underwent needed courses in planning industry-specific and

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interdisciplinary curricula, outcome-based instructional planning and delivery, planning diverse global faculty development, offering executive development programs, undertaking institutional development, offering student services, implementing effective higher education administration, developing appreciative leaders, etc. Hence, they need to be exposed to the advances in human resource development theories and models in engineering and technology (www.nitttrc.ac.in).

Faculty development in engineering and technology has become essential to bring improvements in the learners' attributes, establish an interdisciplinary forum for technology development, continuously improve faculty efforts to foster student development, enhance the faculty's ability to prepare industry-specific interdisciplinary curricula, prepare effective instructional design and delivery, create a reflective scientific attitude, facilitate to prepare interdisciplinary research and development projects, bid and undertake research programs under various transnational companies and International Development Agencies (IDAs), to train the faculty in professional, effective and efficient administration, and contribute to the diverse global faculty development. The Ministry of Education, Government of India has established four Technical Teachers Training Institutes in India [1][2][3][4] during 1964-66 in Chennai for the southern region, in Kolkata for the eastern region, in Chandigarh for the northern region, and Bhopal for the western region. These institutes have been upgraded to national institutes in 2004 based on the recommendations of evaluation committees headed by Bhattacharyya [5] and Indiresan [6]. These institutes offered faculty development programs for technician education, engineering education, and executive development programs for the industries. Their vision, mission, and contribution to various sectors and diverse global faculty members have been presented. Further, interdisciplinary research has to be undertaken to facilitate possible rapid growth and undertake the challenges of disruptive technologies, the fast-changing industrial needs of trained engineering graduates, and survive under Volatility, Uncertainty, Complexity, and Ambiguity (VUCA). In this 21st century, global competition has increased under the open economy. Foreign Development Investment (FDI) has increased and the need for world-class quality engineers also increased many folds. The need for closing the gaps between modern industrial practices and engineering institutes has also increased. All the fast developments in human resources have to be studied due to national institutes. Further, they have to be modernized with advanced laboratories and workshops.

2. Literature survey

The literature survey has focused on three distinct areas, viz, faculty development programs, international research, and long-term impact. Significant research articles are presented in this section.

(1) Faculty Development Programs.

Foo, et al. [7] concluded that faculty development programs should assess the actual changes that training has brought about in the workplace. Diane Persellin and Terry Goodrick [8] supported the importance of an interdisciplinary forum for faculty development of teaching. Dee Fink [9] concluded that faculty development should more effectively fulfill the educational mission of the institution and the educational needs of students and society. Yvonne Steinert et al. [9] concluded that faculty development initiatives should be designed to improve teaching effectiveness. According to Dhruva Chak [11], faculty development should identify the training and development needs of faculty to build their skills in technical, behavioural, and research areas. Further, they should develop the faculty to deliver both general and discipline-specific programs to corporate partners. Bilal et al. [12] stated that the

impact and effectiveness of a faculty development program should result in the faculty's knowledge, skills, and professional competence. In engineering education, the faculty members have to create deep social impacts by training the diverse global faculty members, and executives of industries, bidding for complex projects, and adding knowledge and human capital. To accomplish these tasks, continuous faculty development has to be planned and implemented.

(2) International Research

Mary Anne Walker [13] stated that as institutions increasingly invest in international research, one of the most important factors they must consider is how to best strengthen the capacity of faculty in leading global efforts. According to her, worldwide research networks are developed through faculty-driven collaborations that are institutionalized over time with the strategic investment of resources to support their growth. The outcomes of these research collaborations contribute to solving the global challenges of today.

(3) Long-term Impact

According to Peggy Barlett and Ann Rappaport [14], the long-term impacts of faculty development are interdisciplinary grants and publications; expanded knowledge and practical action; and strengthened collegial community connections with the natural world. Mclodie Rowbotham [15] investigated the impact of faculty development on teacher self-efficacy, skills, and retention. He stated that the 2-day workshop gave the most impact and 85% of the faculty changed teaching as a result of a faculty development program due to more active learning and engaging students; more open dialogue and asking questions; a positive learning environment; more aware of the type of learners; and being afraid to try something new. Since the teacher training programs are focusing the faculty's needs, the impact center around facilitating the attributes of the students. A well-developed faculty development institutes are to be established, decentralized, empowered and facilitated. NITTTRs (nitttrc.ac.in, nitttrchd.ac.in, nitttrbpl.ac.in, nitttrk.ac.in) are to be continuously supported to create global impact. Empowerment and decentralization will facilitate social impact. This research study centers on these issues.

The following studies have identified critical factors for the growth of high-performing faculty teams (Thanikachalam. V. 2023) [16][17][18][19][20]:

1. Developing and supporting high-performing faculty teams in engineering institutions (<https://doi.org/10.32388/YYYYDM3>)
2. Role of leadership with equity, integrity, humility, and outstanding culture in the development of engineering institutions (<https://doi.org/10.32388/T4FPD3>)
3. Effective and efficient ways of executive development for corporates in fast-developing countries (<https://doi.org/10.32388/WS8XBS>)
4. A Case Study on Industry-Institute-Cooperation (<https://doi.org/10.32388/9PPL21>)
5. Strategies to resolve toxic leadership actions in engineering institutions which impede faculty performance and innovations (<https://doi.org/10.32388/DD6086>)

All these studies suggested key enabling factors for creating social impact by a technical teachers training institute.

3. Primary objectives

The following are the primary objectives of this research centered on empowering communities through technical education:

1. To assess the progress in creating social impact by the National Institute of Technical Teachers Training and Research, Chennai, India.
2. To identify the further programs needed to be implemented in the next ten years based on the possible demands of fast-growing disruptive digital technology.
3. To suggest desirable innovations in creating programs and projects to effect greater social impact not only in the southern region but also in the developing countries in Asia, Africa, East Asia, South America, and Oceania.
4. To suggest desirable institutional development to implement innovative global programs through decentralized administration and empowered and high-performing faculty teams.

4. Research methodology

The open social system approach suggested by Lincoln and Guba [23][24] has been planned by collecting the data from the Annual Reports of Technical Teachers Training Institute on the programs that created a desirable impact on various stakeholders, client organizations, and diverse global participants who underwent training and development programs, feedback from the administrators of client organizations, evidence on the transfer of skills, competencies, and changes implemented. Further, the shortcomings and the needed changes in the development processes that are identified by the clients will also be analyzed. The significant contributions of this teacher training institute have been listed in the Annual Reports. Based on these, a desirable model of innovative programs has been effectively planned and implemented by the institute. The radical innovations have socially impacted not only the southern region but also many developing countries due to liberal grants from various Ministries of the Government of India, companies, and fees paid by many International Development Agencies IDAs).

4.1. Need for creating the social impact

Considering the needs of various organizations and institutions, the Ministry of Education took the needed policies to extend the services of the well-performing faculty teams. Under the National Education Policy 1984 [22], a separate department for continuing education was established in all NITTTRs which helped the faculty members undertake consultancy projects. The outcomes are presented in this section.

- Sharing the knowledge capital with other institutions and organizations for developing smart human capital
- Assisting social organizations in solving their problems effectively and efficiently
- Assisting to develop quality learning materials
- Adding value to human resources with minimum expenditure
- Effective production of human capital in the client organizations
- Assisting other organizations to create better capacity utilization
- Providing the needed training to adapt better quality improvement in the human resources

- Create linkages in maximizing better efficiency improvement in educational administration through autonomy with accountability, decentralization, and empowerment of the faculty teams
- Eliminating the reinvention of wheels
- Optimizing the investment in the user organizations in the faculty development programs
- Continuously improving their performance
- Reducing the dependence on external organizations
- Improving the Return on Investment (ROI)
- Training and developing the executives of linked organizations in solving their complex problems
- Sharing the process of facilitating the outstanding human resources
- Identifying the root causes, resistance, and bottlenecks in developing solutions for quality improvements and solving them
- Sharing the resources, tools, and equipment
- Improving the regional and national competitiveness

4.2. Factors that enable the social impact

The following factors have been identified which enable the extension of the services of the faculty members and result in the social impact:

- The expertise of the achievement-oriented faculty team members
- Supportive Board of Governors and their timely Approval of the programs and projects
- High-order cognitive abilities with necessary development attitudes of the faculty members in solving the client's problems
- Active linkages with the expert institutions
- Achievement motivation and the willingness of the experts from the interdisciplinary teams
- Abilities of the Project Leadership
- Supportive culture of the institution
- Approval from the Ministry of Education and funding from various ministries and councils
- Empowerment of the high-performing faculty members.
- Formation of interdisciplinary teams.

5. Services to engineering institutions

(Clients: Polytechnic Colleges, Engineering Colleges, State Universities, Deemed Universities, Academic Staff Colleges/Human Resource Developing Units, Vocational Schools) [Mandatory]

The mandated activities center on the quality improvement of human resources. These activities are planned based on the need analyses of the user institutions. Needed linkages were developed between the user institutions and the NITTTR Chennai. They are as follows:

- Continuous Faculty Development.
- Massive Open Online Courses (MOOCs).
- Industry-specific and outcome-oriented Curriculum Development.
- Effective Educational Measurements and Evaluation of Students' Performance.
- Examination Reforms.

- Developing and publishing Instructional Materials through reputed national publishers to meet the needs of students and faculty members.
- Producing and broadcasting Educational Video Programs through dedicated educational channels.
- Preparing innovative Multi-Media Learning Packages (MMLPs).
- Undertaking Interdisciplinary Research based on the grants-in-aid from the Ministry of Education.
- Planning and offering Interdisciplinary Postgraduate Programs in Human Resource Development.
- Conducting Short-term faculty development Programs based on the stated needs of the faculty members.
- Identifying and conducting Finishing School Programs for the students to complement the planned courses.
- Assisting to plan faculty development workshops and conduct In-house Programs.

Tangible Outcomes

Approximately 5000 faculty members have been trained per annum since 1965. All the existing curricula of all southern states have been revised once in five years based on the development and industrial needs. In addition, new diploma programs have been developed in cooperation with the industries, state directorates, and polytechnics to meet the current needs of companies. Around 15 Massive Open Online Courses (MOOCs) have been developed and offered to the faculty members. Necessary textbooks, drawing manuals, laboratory manuals, item banks, and workshop manuals have been prepared in cooperation with the trained faculty members and published through the in-house production unit. Selected textbooks, drawing manuals, and laboratory manuals have been published through reputed all-India publishers. Around 200 educational video programs have been prepared and broadcasted through educational video channels of the Government of India

Intangible Outcomes

Reputation of the institute, the satisfaction of the faculty members, improving the regional competitiveness, and peace engineering education.

5.1. Assistance to Institutional Development of client institutions under various externally funded projects by international development agencies

(World Bank, Asian Development Bank, German International Development Agency (GTZ), United Nations Development Program (UNDP), United States Agency for International Development (USAID), and UNESCO) [Based on the permission of the Ministry of Education]

After the globalization of the Indian economy, the Government of India availed a loan from the World Bank for developing technical education. NITTTRs have been involved as academic consultants in these projects as follows:

- Capacity Development
- Quality Improvement
- Efficiency Improvement

Research [Tracer Studies, Impact Studies, Utilization of Equipment and Space, Sustenance of Project Innovation, Continuing Education, Internal Revenue Generation and Utilization (IRGU), Women Faculty Development, Autonomy, Strategic Planning, Educational Management, Leadership, Student Services, Centers of Excellence, etc.].

Outcomes

With the World Bank's assistance, the Institute has collaborated with the project polytechnics in capacity development, quality improvement, and efficiency improvement. The faculty have been trained and developed as per the needs of the project for the southern and northeastern states of India. Tracer studies on the alumni have been completed and the results have been used to improve the curricula and the instructional delivery in the project polytechnics. As per the World Bank research team, the projects were termed as satisfactory completion. The professional services offered by the Institute have been appreciated by all client states. The southern region has become very competitive and many companies have benefitted by recruiting graduates with the needed industry-specific attributes.

Intangible Outcomes

Self-directed learning of the faculty members, improving the critical thinking and problem-solving abilities of the faculty members, and radical growth of the human resources.

5.2. Establishment of state extension centers [mandatory]

This NITTTR has established extension centers in each state of their region to meet the special needs of the states in developing human resources in technical education as follows:

- State-specific faculty development programs
- Industry-Institute Partnership
- State-specific Curriculum Development
- Developing Instructional Packages
- Developing University Faculty Members to prepare question papers
- Institutional Evaluation and Development

Outcomes

The Institute has proactively collaborated with the states and assisted in developing the faculty members, revised curricula, developed new curricula to meet the emerging needs of the state industries, and assisted in the growth of state technical education.

Intangible Outcomes

Self-supporting institutes, utilization of trained faculty members, and self-defense

5.3. Development of community development through polytechnic colleges [mandatory]

Considering the abundant availability of out-of-school kids in rural areas, the Ministry of Education has established a scheme for training them through non-formal methods. The polytechnics were assisted to offer skill development training programs in and around the polytechnics as follows:

- Non-formal Education for acquiring employable skills
- Technical Support Services
- Extension centers to meet the needs of the rural students
- Skill Development Program for Out-of-School Kids
- Solar Energy for Cooking
- Biogas Utilities for Lighting and Cooking

Outcomes

Around 300 community polytechnics have been facilitated in the southern states and approximately 30,000 rural youth have been trained per year to get employment in various sectors like building construction and micro, small, and medium industries.

Intangible Outcomes

Improving the confidence of out-of-school students, poverty alleviation, the utility of skilled population, satisfied rural population, and improvement in per capita income, self-employment, and engagement of technical support staff for rural population development.

5.4. Services to engineering departments

State Public Works Department, State Electricity Boards, State Water Supply and Drainage Boards, the Cooperative Sugar Manufacturing Companies, State Water Resources Departments [Based on the Permission of the Board of Governors]

All most all government engineering departments in the southern region didn't have any training and development units. When they faced rapid development of technology, they sought the assistance of the NITTTTR Chennai in planning a training unit, offering executive development programs, and conducting them effectively. Some of the programs are presented below:

- Establishing Executive Development Centers for Government Engineering Departments
- Framework for planning needed Employee Training through part-time trainers
- Increasing Productivity, Quality, Safe Work Practices, and Cost Reduction
- Ensuring Environmental Protection
- Research, Development, and Diffusion in Human Resource Development
- Enhancing the Problem-Solving abilities of the executives

Outcomes

Public Works Department, Chennai Metropolitan Water Supply and Sewerage Department, Gujarat Water Supply and Sewerage Board, Tamil Nadu Water Supply and Drainage Board, Tamil Nadu Electricity Board, Irrigation Management and Training Institute, Tamil Nadu, Center for Water Resources Development and Management, Kerala, etc. were assisted in planning needed executive and employees' development programs.

Intangible Outcomes

Satisfaction of the executives, reduction of breakdowns, and continuous services to the population

5.5. Assistance to private companies

Automobile Companies, Wind Energy, Software Companies, etc. [Based on the Permission of the Board of Governors]

After the globalization of the Indian economy, many Indian companies could not meet the competition of the foreign companies established in India under foreign direct investment (FDI). They approached the institute to train their executives and employees. Some of the programs are presented below:

- Modernization of Manufacturing Methods
- Quality Improvement of the Components
- Accident Prevention
- Productivity Improvement
- Quality Circles to solve the problems of the manufacturing
- Conflict Resolution
- Cost Reduction
- Energy Saving

- Mentoring the Employees
- Prevention of Employee Burnouts
- Effective engagement of newly recruited employees and executives
- Total Quality Management (TQM)
- Implementing Japanese Management Principles like “Kaizen”

Outcomes

Most of the companies benefitted through employee development and improved quality and productivity. These companies have become export competitive and become leaders in producing high-quality components.

Intangible Outcomes

Growth of quality components, growth of the economy, export of components to foreign manufacturers, and growth of the foreign exchange.

5.6. Offering diverse global faculty development [based on the permission from the ministry of education and funding from IDAs]

In the late 20th Century, globalization of the economy has been implemented by various developing countries in Asia, Africa, Central, and South America, and Oceania. The Government of India offered funds through many bilateral schemes through funding. Some of the finished projects are presented:

- Faculty Development through the Government of India’s assistance through the Ministry of External Affairs and the Ministry of Finance
- Programs sponsored by International Development Agencies (Asian Development Bank [ADB], Danish International Development Agency [DANIDA], German International Development Agency [GIZ], Swedish International Development Agency [SIDA], UNDP, USAID, UNESCO, and World Bank).
- Under the bilateral agreement
- Foreign Country Sponsored
- Company Sponsored
- Curriculum Development Programs
- Computer Applications
- Print Materials Development
- Teaching-Learning Aids Preparation
- Vocational Education
- Non-formal Education
- Instructional Materials Development
- Educational Media Programs and Learning Aids Preparation
- Educational Management

Outcomes

Nepal and Bhutan benefited largely. They established industry-specific courses and also assisted micro-rural and small enterprises. The graduates have been absorbed by the local enterprises. Bhutan expanded the technical institutions under various international development agencies.

Intangible Outcomes

The increased reputation of educational institutions, better leadership, and added linkages with the IDAs and end users.

5.7. Services to UNESCO's Asia-Pacific educational innovation for development [APEID], Bangkok, Thailand [based on the permission of the ministry of education]

- Peripatetic Programs
- Curriculum Development
- Asia Regional Programs
- In-Country Programs

Outcomes

Most Asian countries benefitted from these programs. In addition, the faculty members have also been admitted into diverse global faculty development programs offered under various bilateral schemes.

Intangible Outcomes

Increase in reputation of the institute, peace engineering, and engineering education without borders.

5.8. Services to Colombo plan Staff College for human resources development, Manila, Philippines [Based on the permission of the ministry of education]

This college has been established through multi-government funding and NITTTR has been invited to conduct many courses with their collaboration. Some of the courses are presented below:

- Research in Technician Education
- Faculty Development
- Faculty Attachment/ Internship
- In-country Courses
- Asian Regional Courses
- International Conferences
- Sponsored Research Projects

Outcomes

The Institute conducted many in-country courses and three faculty members have been seconded to work there.

Intangible Outcomes

Accepted leadership, reliable service provider, and reputation.

5.9. Establishing global networks [Based on the permission of the board of governors]

Under the World Bank projects and UNDP projects, the faculty members of NITTTR have been trained. Further, under many bilateral programs, the faculty members have been offered training, internships, or short-term study visits: Some of them are presented below:

- Joint Programs/Courses
- Faculty Exchange
- Internship
- Long-term Programs
- Conferences
- Faculty Development
- Curriculum Development

Outcomes

During the initial period, many faculty members have undergone faculty development courses at the Huddersfield College of Education, UK. Many faculty members have been sponsored by UNDP and World Bank to undergo a one-semester course and three faculty members have completed the M.S. program in Technical Education at the University of Illinois, Urbana Champaign, and one at Indiana University in the Instruction System Technology, Bloomington, Indiana State, USA.

Intangible outcomes

Reputation for the global programs, recognition for technical services, and growth of partnership institutions.

5.10. Services to Tamil Nadu State Higher Education Council (TANSHE) [Based on the permission of the board of governors][22]

The State Higher Education Councils usually invite a faculty member to plan and offer a development program for the state university faculty members. Some of the programs are presented below:

- University Faculty Development
- Examination Reforms
- Interdisciplinary Research Programs
- Outcome-based Curriculum in Engineering and Technology
- Student Services

Outcome

A few faculty members conducted a series-courses for the university faculty members which are organized by TANSHE.

Intangible Outcome

Reliable human resource developer, improvements in measurement and evaluation of student performance, and undisputed leadership in the institutional developers.

5.11. Academic staff colleges/human resource development units of the University of Madras, Pondicherry Central University, Madurai Kamaraj University [based on the permission of the board of governors]

Academic Staff Colleges were established by the University Grants Commission based on the recommendation of the National Education Policy 1988 in many universities to train newly recruited faculty members. The senior faculty members of NITTTR Chennai assisted them. Some of the activities are presented below:

- Training the Trainers
- Interdisciplinary Research
- Faculty Development
- Examination Reform
- Higher Education Management

Outcomes

Many senior faculty members have been invited to offer lectures on curriculum development, evaluation of students, and institutional development.

Intangible Outcomes

Increase in leadership, self-directed learning abilities, and self-confidence.

5.12. Assistance to professional associations [based on the permission of the board of governors]

Many manufacturing associations have approached the Institute to undertake needed development programs. Some of them are as follows:

- Joint programs: Employee Development
- Training the part-time trainers
- Human Resource Development Policy Formulation
- Establishment of Skill Development Programs

Outcomes

Many professional associations identified the institute and invited it to conduct training and development programs for their executives.

Intangible Outcomes

Improved linkages with the companies, better cooperation with the institution, and reputation.

5.13. Indian council for forest research and education (ICFRE) [based on the permission of the board of governors][23]

This ICFRE got funds through the World Bank. NITTTR has bid and won this project.

- M.Sc. (Forestry) Curriculum Development
- Faculty Development
- Accreditation of Postgraduate Programs

Outcomes

It is a major social impact on the Indian Council for Forestry Research and Education (ICFRE). The systematic approach has been utilized for curriculum development, planning various faculty development programs, and suggesting the process of accreditation of B.Sc. (Forestry), M.Sc. (Forestry) programs, and various postgraduate programs with ICFRE.

Intangible Outcomes

Better linkages with the institution, and the leadership to undertake interdisciplinary skills.

5.14. Broad casting of education television programs [mandatory]

The Ministry of Education has planned to broadcast educational video programs through national television's educational channels. The Institute has supplied around 300 video programs and broadcast them to the public, students, and professionals.

- Technical People
- School Students
- Polytechnic Colleges and Community College Students
- Engineering College Students
- Engineers, Managers, Administrators
- General Public

Outcomes

These educational video programs supplemented the classroom lectures and served as a resource for displaying the field practices. Many newly recruited faculty members and field engineers have also benefitted. The engineering students, faculty members, executives, and

the public have utilized to check the standard practices. Many institutes have purchased video programs for faculty use.

Intangible Outcomes

Skills in planning and developing social impact through educational video programs.

5.15. Conferences/seminars/symposia/ workshops [Based on the permission from the board of governors]

The Institute has conducted many workshops, seminars, symposia, and conferences to disseminate the advances due to research work. Some of the initiatives are:

- Research-Development-Diffusion
- Problem-Solving Activities
- Consultancy Services
- State-specific seminars on the impact of the World Bank project
- Industrial Training of the Faculty Members and Students
- Open house
- Journal in Technical and Vocational Education
- National Conference on Human Resource Development
- International Conference on Globalization of Engineering Education
- International Program on Global Networking

Outcomes

The seminars and conferences assisted to share the advances, possible planning of new courses, and linking many user companies and government engineering departments.

Intangible Outcomes

Improved global networks and development of partnership institutions.

5.16. Programs for armed forces [Based on the permission from the board of governors]

Armed Force Training Units have utilized the services of the Institute. Some of them are:

- Development of training programs for the Armed Forces.
- Development of training modules
- Development of learning aids
- Management of Training Centers
- Academic Audit

Outcomes

The training units of various armed forces have been updated in planning and developing training aids to supplement classroom lectures.

Intangible Outcomes

Networking with the institute and self-defense.

5.17. Individual faculty members' contributions to the society [based on the permission of the dean/director/principal]

Many outstanding faculty members of NITTTR have been invited to conduct training programs and provide many technical services. Some of them are as follows:

- Participation in seminars/conferences/ workshops/ symposia/etc.
- Accepting to be a member of doctoral committees
- Paper publication
- Book Writing
- Accepting to be a member of a governing council of another autonomous institute
- Accepting to evaluate the dissertations/ theses
- Accepting to be a chairperson in a conferences section
- Giving a lecture to any educational institutions
- Social Service

Outcomes

Many senior faculty members have assisted universities and training organizations in planning presentations, providing keynote addresses, and offering advanced lectures to the faculty members.

Intangible Outcomes

Growth of multiskilled faculty teams with higher problem-solving abilities

5.18. Outcomes of creating social impact

- Reputation
- Satisfaction
- Utilization of Resources and Faculty Expertise
- Continuous Faculty Development
- In-house Faculty Development
- Leadership Development
- Human Capital Development
- Organizational Development
- Positive Change in Attitudes
- Meeting the Challenges in the Workplace
- Creation of an interdisciplinary forum for faculty development of curricula and instructional design
- Foster students' development
- Effectively fulfill the educational mission of the institution
- Poverty Alleviation
- Better Return on Investment (ROI)
- Optimization of human resources
- Improvement in the interdisciplinary problem-solving ability
- Skill development of youth and out-of-school kids
- Environmental protection

5.19. Significant Feedback from the diverse global participants

Short questions have been mailed to 250 participants and 121 have given feedback as follows:

- Highly useful course
- Learned to solve our problems due to improved curricula.
- Able to develop appropriate curricula that provided needed attributes to the graduates
- Developed efficient and effective in-house faculty development programs
- Prepared needed learning packages and print materials
- Can develop leadership and program management
- Can prepare strategies for the institutional development
- Can plan training programs for the employees of micro and small enterprises.
- Can develop teacher-made teaching learning aids
- Can plan cooperative courses
- Can prepare periodical improvements in the courses based on the fast growth of the economy

5.20. Feedback from the Indian faculty members who underwent development programs

Questionnaires were sent to about 500 participants and 221 completed the feedback and returned it. The significant outcomes are as follows:

- Prepared industry-specific programs in engineering
- They established a student services unit
- Developed needed self-instructional modules and teaching-learning aids
- Refined evaluation instruments based on the table of specification
- Contributed to the institutional development
- Undertook tracer studies and refined the curricula based on their feedback
- Established an Academic Council and audited the outcomes of the programs every year
- Established a consultancy center and assessed the project outcomes
- Published research papers on curriculum planning and instructional materials development
- Placed the students in various companies through campus placement
- Established skill development programs through Community Development Project

5.21. Feedback from the executives and technical staff who underwent development programs

- Improved the productivity, quality, and cost of manufacturing
- Created quality circles and got good solutions for many manufacturing problems
- Senior executives have undertaken conflict resolution and reduced the number of court cases
- Established in-house training programs for the newly recruited employees
- Effectuated project management
- Need for the implementation of ethics, equity, and better educational culture

5.22. Checking the development policies and the adequacy of the existing human resources available in this institute

The faculty members of the Institute have suggested the following improvements in the organizational structure, delegation, decentralization, etc.:

- Nominate the faculty members to appropriate faculty development programs organized by IDAs, ISTE summer schools, ongoing development projects, and global universities' faculty development programs under the bilateral agreements
- Facilitate the faculty members to present research papers at the international conferences
- Approve the research proposals under various government funding agencies
- Offer dean posts based on the outstanding accomplishments of the faculty members
- Create mentors to encourage the performance and suggest better planning of courses/consultancy projects
- Reward the faculty members as per the Ministry's guidelines for their outstanding accomplishments
- Approve the sabbatical leave for undertaking research in an international university
- Approve the bidding process to undertake development projects under the funding of various government departments
- Create interdisciplinary departments and centers to plan outstanding diverse global faculty development programs
- Increase the faculty member positions based on funds generated through consultancy programs
- Rotate the chairman positions once in three years
- Improve the resources and space
- Create a conducive academic ecosystem for innovation
- Prevent the burnout of the faculty members by safeguarding them from feeling depleted, overextended, and fatigued, compression fatigue, caregiver status, and burnout
- Adapt civility, respect, and engagement at work program
- Create buddy care, peer-to-peer intervention, and address occupational fatigue
- Delegate needed autonomy with the accountability for planning interdisciplinary research and development projects and programs
- Decentralize the academic decision-making process regard to projects
- Fill up all the faculty vacancies
- Develop proper engagement of the newly recruited faculty members through interdisciplinary research programs and complex academic projects

5.23. Need for establishing advanced schools for offering major development programs and undertaking interdisciplinary research projects

As disruptive technologies grow at a fast rate,

- Establish advanced schools for planning needed development of programs
- Reward the faculty members by proportionately sharing the project gains
- Grant vacations as per the norms
- Create centers for developing interdisciplinary research and development programs
- Permit the well-accomplished faculty teams to offer offshore programs under various IDAs.

- Facilitate the conduct of international conferences, seminars, symposia, and workshops
- Support Peripatetic Seminars under various IDAs
- Recognize the knowledge development through MOOCs
- Employ the emeritus professors where ever needed
- Engage project-specific adjunct faculty members from the companies for the industry-specific projects

5.24. Needed empowerment and careful engagement of the faculty members for rapid development of the needed human capital

Well-accomplished faculty members are very much essential for the growth of the institutions. Hence, the authorities should choose them ethically and diligently to undertake many radical innovations in human resource development. They have to be nurtured with ethics and offered equity-based support. The institutional leaders have to focus on the proper engagement of the faculty teams. Teacher burnout should be eliminated. Autonomy with accountability is essential for the dynamic growth of the institution that can create appropriate social impact.

5.25. Desirable Radical Innovative Model to Create Social Impact

Based on the significant outcomes of an Institute of Technical Teachers Training and Research, a Radical and Innovative Model that can effectively create a social impact is presented below:

1. Multidisciplinary Approach in Planning Development Programs.
2. Scaffolding High-Performing Faculty Teams at Every Stage of Performance.
3. Global Vision and Objective-Oriented Development Programs.
4. Mission to Develop Effectively and Efficient Faculty Members, Industrial Executives, Engineering Students, Vocational Teachers, Technical Support Staff, and Out-of-School Rural and Urban Students.
5. Creating Needed Linkages with Organizations, Private Companies, Multinational Companies, Government/Private Engineering Departments, International Development Agencies (IDAs), State Technical Universities, Deemed Universities, Engineering Colleges, Polytechnic Colleges, Vocational Schools, Academic Staff Colleges (Human Resource Development Units), and State Higher Education Councils through Bilateral Agreements, Funding-based on the Effective Service, and Empowering High-Performing Faculty members.
6. Providing Needed Resources to meet the challenges of Volatility, Uncertainty, Complexity, and Ambiguity (VUCA).
7. Supporting Needed Academic Environment Which Eradicates Obstacles and Resistance.
8. High-performing Faculty Members with Intrinsic and Achievement Motivation
9. Leadership with Ethics, Equity, Humility, Toxic Free, and Corruption Free Administration (Thanikachalam, V. 2023) [18].
10. Resolving Conflicts Amicably.
11. Effective Sharing of the Project Gains (Thanikachalam. V. 2023) [16].
12. Periodical Evaluation of Performance and Enabling required Improvements.
13. Outstanding Educational Ecosystem.
14. Rewarding the Outstanding Performers (Thanikachalam. V. 2023) [17].

15. Continuous Improvement in Performance.

This “Fifteen-Point Radical Innovative Model” has been synthesized by observing the performance of a technical teacher training institute. This model can be further improved based on the culture, environment, resources, linkages, leadership, faculty, policies, and funding.

6. Discussion

This model has been synthesized by closely observing the performance of faculty teams who have faced unlimited obstructions, bottlenecks, toxic leaders, poor ecosystems, conflicts, etc. Over time many obstructions were resolved by creating confidence in the administrators. The fifteen factors are synthesized based on the success of various programs and projects over 40 years. The Ministry of Education has empowered the institute to undertake various development programs. These fifteen points can be viewed as essential supporting factors for creating social impact by technical teacher training institutes. Many institutes didn't reach this level of accomplishment due to the absence of many critical factors identified in this study. Supportive culture and leadership have to facilitate all programs and projects. The institute should have a strategic plan and this should be fine-tuned periodically to meet the disruptive technologies. There is no shortcut to achieving excellence.

7. Conclusions

NITTTTR Chennai has taken appropriate steps to establish various short-term and long-term faculty development programs in engineering and technology and served the country very well. Even though it is not mandatory, its contribution to diverse global faculty development, consultancy projects under various international projects, and services rendered to various companies and government engineering departments created a sufficient social impact. This is due to supportive leadership, timely approval, and initiatives taken by the outstanding and intrinsically motivated faculty teams. This institute has paved the way for borderless engineers, and peace engineering since 1964. For the next ten years, this institute has to establish interdisciplinary schools and offer in-country faculty development programs in Asia, Africa, Central, and South America, and Oceania. The well-performing faculty team members are to be facilitated to establish rapid and radical innovations in human resource development.

Limitations of this Study

Even though many such technical teachers' training institutes are there in developed countries, this study is restricted to a case study of one institute. Even though there are many existing models of institutional development, not all of them focused on the factors identified in this paper. This study is based on Lincoln and Guba's model of naturalistic inquiry. An appropriate global model can be developed by a quantitative research study.

Suggestions for Future Study

A large-scale research project on creating Social Impact by Technical Teachers' Training Institutes can be undertaken in different cultures, countries with needed expertise, and supportive policies.

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