Research & Systemic Reforms

NITTTR, Bhopal

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Research & Systemic Reforms at NITTTR, Bhopal

Overview

National Institutes of Technical Teachers' Training and Research Bhopal (previously known as Technical Teachers' Training Institute-TTTI (Bhopal) was established at Bhopal during the mid-1960s by the Ministry of Education, Government of India, as a unique institute of its kind with an aim to improve the quality of Technical Education with focus on Polytechnic Education to undertake activities in the areas of Technical Teacher Training, Curriculum Development, Educational Planning & Management, Education Research and so on. In the report of the Review Committee (GOI, November 2000), in their observation, states in their remark that "during the last 30 years, TTTIs have successfully brought new interventions and implanted many new ideas and innovations in the Polytechnic Education System. Furthermore, the TTTI's experience and skills must be made available to the entire spectrum of technical, vocational, and management education." Therefore, based on the recommendations of the MHRD Review Committees, the Institutes renamed the "National Institute of Technical Teachers' Training and Research" (NITTTRs) in 2003, with a renewed mandate to cater to the training and development needs of Engineering Colleges and allied institutions in addition to Polytechnics. This has resulted in significant expansions of the institute's scope, allowing it to cross-regional boundaries and serve as a resource institution at the national and international levels for the entire range of the Technical Education Sector. NITTTR Bhopal has grown qualitatively and quantitatively over the last five decades to become a one-of-a-kind national institution, offering a wide range of services to Technical Education, Industry, and Field Agencies under one roof. In the current demanding context of teacher shortages and quality development of the Technical Education System, it has been observed that the institute's expert services are also desired by a wide range of clients both nationally and internationally.

With a new mandate and a stronger emphasis on research, the institute was energised to continue M.Tech.Ed. programmes, venture into new educational programmes, and expand research in the technical education sector.

NITTTRs are responsible for conducting researches at two stages, first, for the overall development of the technical education system at the national level, re-engineering and recasting it for making more relevant to the global market needs and technological developments and secondly conducting action researches at micro/ institutional level for creating an environment to promote/ sustain innovations, determining interventional strategies and assessing the impact of such activities / projects, solving problems related to teaching/learning and other areas of professional roles of teachers.

The above two purposes are clearly mentioned in the MOA of NITTTRs.:

A. To undertake systemic research to provide research inputs for the development of technical education training systems and their management.

B. To undertake action research for the development of innovative methods, processes, and practices for the improvement of the teaching-learning environment in technical and vocational education institutions.

Research Contributions

Since acquiring a national identity and the added responsibilities of research, the institute has significantly contributed to doctoral research, master's level research in engineering, technology and management, and markedly undertaken various research studies and sponsored research projects. The contributions in these areas are summarised below.

Doctoral Level Research

Institute faculty has been involved in research and development in content as well as pedagogy areas and have guided various doctoral research studies. Institute has been a research centre in affiliation with RGPV, Bhopal for Engineering discipline and with Barkatullah University, Bhopal for Technical Education. The faculty members are registered as doctoral guide/ supervisor have guided more than ninety doctoral research (Figure 1) during last 25 years. In last 10 years more then 80% of the research contributions have come and gained greater importance in the faculty work.

Years	PhDs
2015-2021	45
2010-2015	29
2005-2010	11
2000-2005	4
1995-2000	2

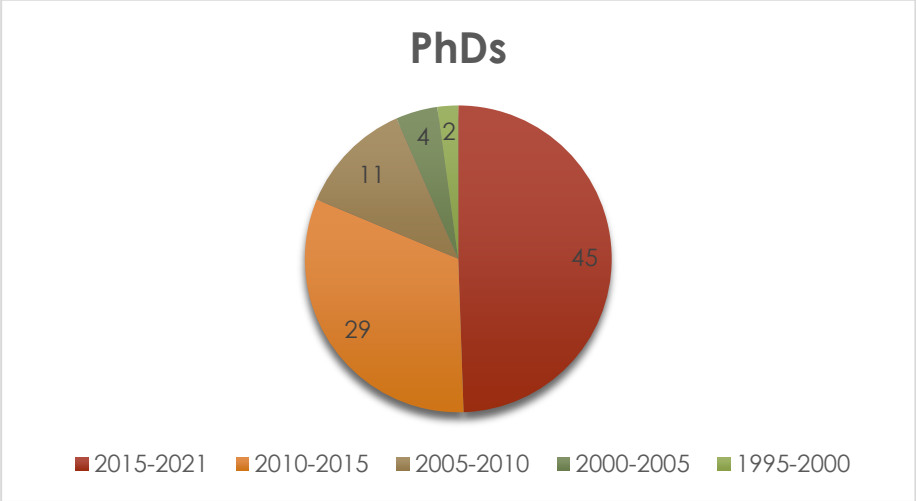

Figure 1: No of PhDs produced in last three decades

Master Level Research

In 1987 the institute started offering M.Tech.Ed. in affiliation with Barkatullah University, Bhopal. Subsequently it got recognized as research centre for Faculty of Technical Education by the university. This provided an added advantage to expand the research in technical education arena and have led to successful completion nearly 200 graduates with M. Tech. Ed. in various areas (Figure 2).

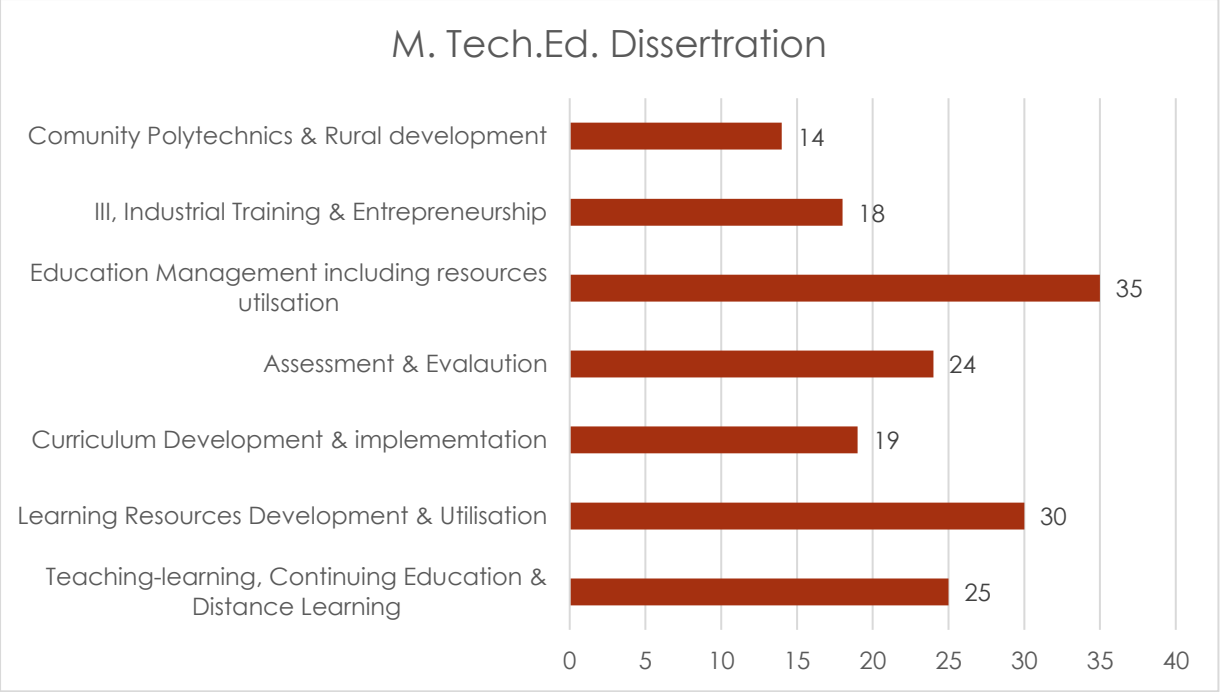

Figure 2: No of M.Tech.Ed. dissertations in various areas of technical education

Research Studies, Projects, and Publications

For dissemination, sharing and knowledge creation the faculty members have contributed to research projects, impact studies, and publications in peer reviewed international and national publications experiences generated faculty members. In last four decades with acquired knowledge and augmented resources institutes has done nearly hundred projects (Figure 3). These projects and institute activities translated in to commissioning of numerous research studies (Figure 4) in form of TNA, Impact Assessment, Action research and resulted in more then one thousand research publications (Figure 5)

Research Projects

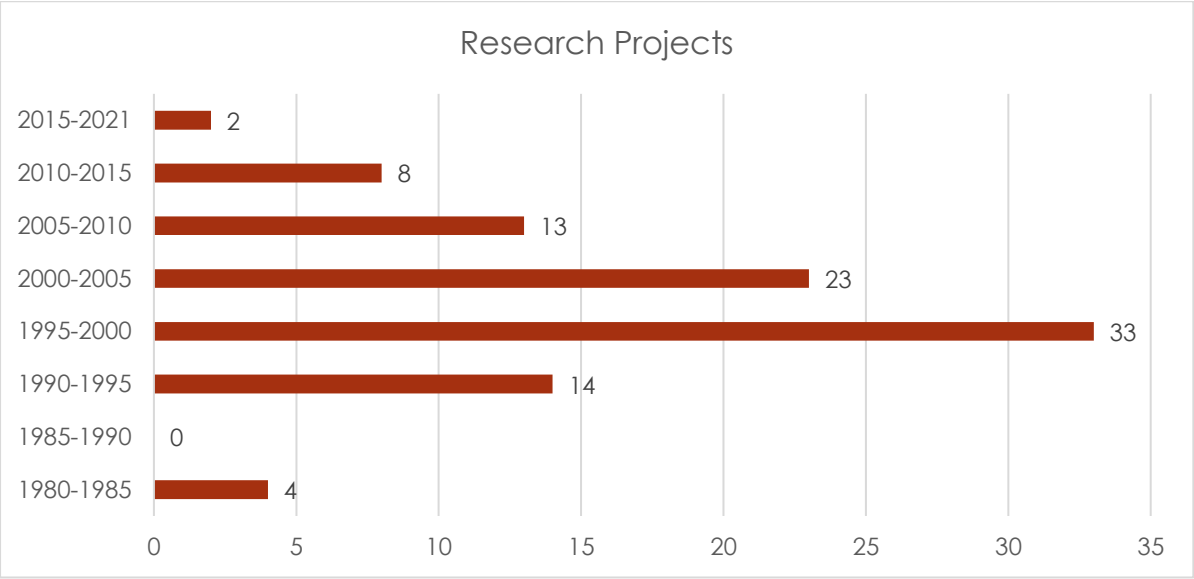

Figure 3: Research Projects undertaken at NITTTR in last four decades

Research Studies

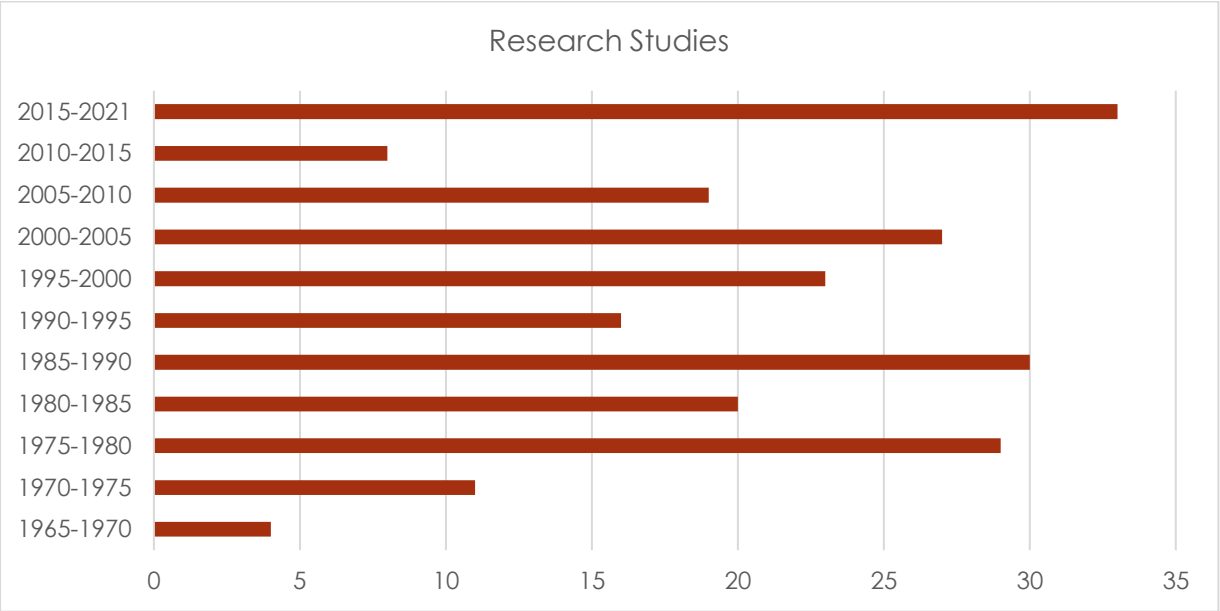

Figure 4: Research studies undertaken at NITTTR, Bhopal since inception

Research Publications

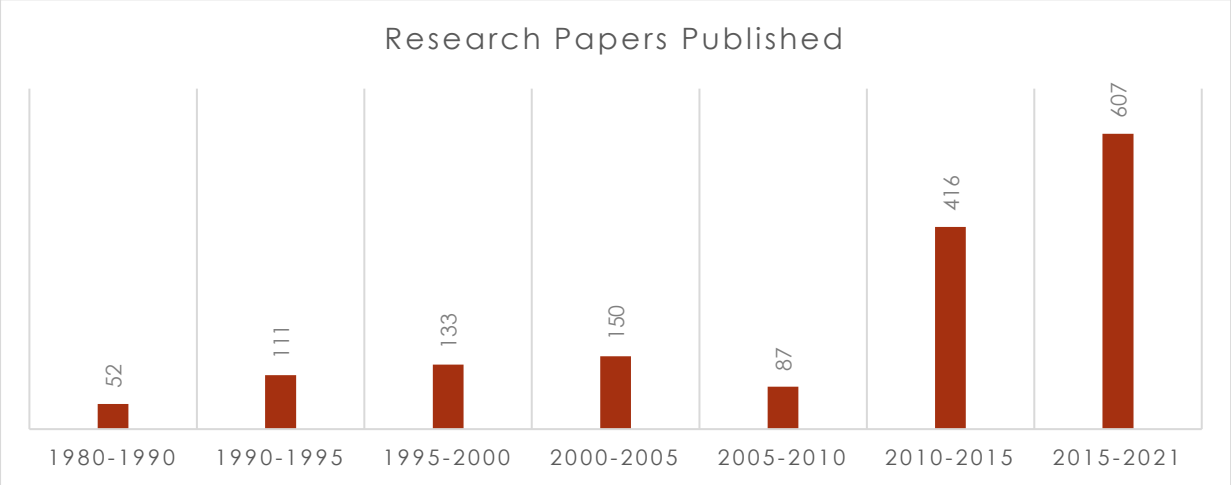

Figure 5: Research Publications at NITTTR, Bhopal in last four decades

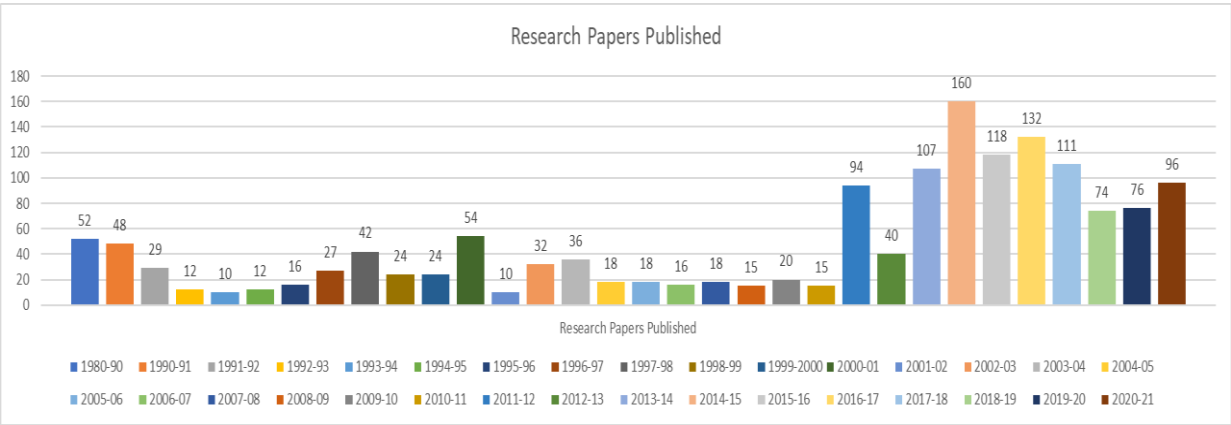

Figure 6: Research publications in last four decades (1980-2021)

Systemic Reforms

With its increasing technological demands and opportunities, technical / engineering education always play a significant role. Preparing Professionals for economic and industrial development is at the core of technical / engineering education. However, over the years, with technology development and changing industrial needs, technical / engineering education has not kept pace with the sweeping changes in engineering practices and, instead, continues to prepare students to be engineers for a world one or two generations past. Hence, this became the key focus area for bringing systemic changes in technical / engineering education. NITTTR Bhopal has mainly worked on systemic reforms for the Indian technical education system to promote discovery, learning, and engagement.

As pointed by Wulf and Fisher that engineering education's challenge cannot be met by simply modifying an outmoded curriculum. Instead, it requires fundamental research that also transforms learning and teaching. NITTTR, Bhopal has initiated and mandated several systemic reforms, interventions and innovation and had successfully implemented in the catering states over the last five decades.

The systemic reforms are clubbed in five major work areas of an institution. The first focus area of this systemic reform endeavour was *curricula revision and development* for new course plans as per the emerging industrial development. Teachers' *capacity* for the new changes was built alongside the curriculum revision. This was followed by the *development and dissemination of learning resources* to help them strengthen their academic resource utilization. The fourth focus area was developing and instilling better *teaching and learning practises* to make the best use of resources. The fifth area of focus was *improving industry interaction and networking* to better prepare students for the workforce.

1. **Developing/Revising Curricula**

   The diploma courses in the polytechnics in the catering States were of the conventional nature and were more or less a duplication of courses existing in other States.

   NITTTR, Bhopal was instrumental in revising all existing curricula and curricula for new courses design in the states of Maharashtra and Gujrat. The key characteristics were.

   i. In the revision and design of curricula, industry involvement was ensured.
   ii. Learning experiences to develop skills needed by technicians to perform in the shop floor or field were included in curricula.
   iii. Soft and general skills like communication, entrepreneurship and managing people at work also found a place in curricula.
   iv. An important innovation in course reform was the introduction of course flexibility through Multi Point Entry and Credit System (MPE&CS). This reform promotes student learning at his/her own pace and the choice of a variety of specialization options.
   v. Making the exam system more valid and reliable with introduction and use of credit based rather than marks based.

2. **Imparting Need-based Faculty and Staff Training**
   To help faculty development Training Need Assessment (TNA) workshops were conducted for all catering States. The TNA workshops findings were useful for the design and implementation of faculty and staff development plan.
3. **Developing Learning Resources and Media**
   NITTTR, Bhopal developed contributed large number of multimedia/CAI packages, OHP transparencies, learning packages, models, laboratory manuals and video programs. Catering to the needs of the resource requirement of polytechnics of the western region the institute has prepared more then five thousand different types of documents on various aspects of technical education and technology.
4. **Inculcating Better Teaching Learning Practices**
   NITTTR, Bhopal, investigated the methods of teaching and learning process and developed various faculty development programmes and induction training for new and in-service technical teachers in pedagogy and content areas based on their research in technical education and identification of best practises. Participating teachers were able to meet and share their experiences, ideas, problems, and strategies through the training programmes. The training was very effective in introducing and instilling the use of modern methods and learning resources such as audio-visual aids, manuals, models, video programmes, and so on, which significantly improved the teaching learning process. Faculty development programmes also enabled institutions to use resources more effectively and efficiently, particularly in the classroom and laboratory.
5. **Promoting Interaction with Industry and Community**
   Even though there were very few industries in the vicinity of many of the institutions, interaction with industry was encouraged through innovative models. One major model entailed utilising the network with other resource institutions to gain academic benefit from industry. The institutions benefited from this in terms of student training and projects, exposure to industrial practises, and interaction with industry experts. This enabled students to be required to participate in industrial training for a period of 4-6 weeks, resulting in increased opportunities for student employment.

Amongst the many successful interventions and innovations a few are enlisted at Annexure-I and Annexure-II.

Recent Research Initiatives

In recent, after enhancement and grant of national status, the institute has divulged and forayed in deep learning and expanded to engineering education. First institute has organized and expanded organizational structure to support and nurture research and innovation and brought in various initiatives. Continuing these systemic reforms and pedagogical innovations in current times and addressing the emerging challenges, in recent, NITTTR, Bhopal have opened new frontiers and working on the cusp of PACT. Institute has created verticals of Teaching Learning Centre (TLC under PMMMNMTT), National Resource Centre (NRC) for Assessment & Evaluation for India, Curriculum Redesign Projects, MOOCs Development, Evidence Based Policy Research with

Institutional financing, and during COVID-19 pandemic organized Webinars and Conferences. Major activates done and work-in-progress are summed-up in Annexure-III. The faculty at NITTR Bhopal is also involved in technological innovations and with support of Department of Science & Technology funded projects is striving hard to bring innovative products, glimpses of such recent research efforts are given in Annexure-IV.

Future Research Plan

National Education Policy 2020 lays a strong emphasis on developing a culture of research and innovation. Some relevant points on research from NEP 2020 is mentioned below.

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*"**17.1.** Knowledge creation and research are critical in growing and sustaining a large and vibrant economy, uplifting society, and continuously inspiring a nation to achieve even greater heights. Indeed, some of the most prosperous civilizations (such as India, Mesopotamia, Egypt, and Greece) to the modern era (such as the United States, Germany, Israel, South Korea, and Japan), were/are strong knowledge societies that attained intellectual and material wealth in large part through celebrated and fundamental contributions to new knowledge in the realm of science as well as art, language, and culture that enhanced and uplifted not only their own civilizations but others around the globe.*

***17.2.** A robust ecosystem of research is perhaps more important than ever with the rapid changes occurring in the world today, e.g., in the realm of climate change, population dynamics and management, biotechnology, an expanding digital marketplace, and the rise of machine learning and artificial intelligence. If India is to become a leader in these disparate areas, and truly achieve the potential of its vast talent pool to again become a leading knowledge society in the coming years and decades, the nation will require a significant expansion of its research capabilities and output across disciplines. Today, the criticality of research is more than ever before, for the economic, intellectual, societal, environmental, and technological health and progress of a nation."*

We face unprecedented economic, environmental, societal, and technological challenges in the twenty-first century. As a result, the engineers we produce are being pushed to new heights to develop long-term, sustainable solutions on a global scale. Given these and other current pressing challenges, our research aims to identify and investigate the curricular, extracurricular, and institutional barriers that students face to create multiple, sustainable pathways to engineering education for all students. In addressing the teaching learning pedagogical dimensions new research plan is to investigate how experts and novices perform engineering designs differently; how self-regulation is essential in problem-solving; and how student experiences, prior knowledge, and cultural backgrounds influence student learning and problem-solving.

Another important dimension which influences the learning system is the rise of educational technologies (ET). The ET has resulted in a multidimensional canvas of learning, particularly online and technology-enabled learning. The online learning environment and emerging technologies entail investigating students' self-efficacy and metacognitive strategies while engaged in interactive learning modules, the role of students' professional experience in online learning, and the effectiveness of students' learning while participating in broadcast delivery instruction. Similarly, significant effort is being expended in developing and implementing a wide range of innovative educational technologies to support teaching and learning in engineering curricula. Research at NITTTR, Bhopal plans to evaluate the effects of computer simulations and animations on student learning and the implications of various classroom management systems (Canvas, Blackboard, MOODLE etc.) and multimedia education systems (computer simulations and animations, virtual reality, and intelligent tutoring systems).

Over a period, since the inception of Washington Accord on Engineering Curriculum, implementing outcome-based accreditation in engineering degree programs has resulted in the emergence of engineering education as a discipline. This requires a comprehensive and research-based framework to continue to evolve and develop. Therefore, the research in technical education must address what content (in terms of knowledge and skills) future engineers must possess, how that content is being learned, and how that learning of the content should be assessed. The research areas identified for future research at NITTTR, Bhopal are classified into four vast thematic areas.

Key Research Areas

- **Engineering epistemologies**
    - research what constitutes engineering thinking and knowledge in current and future social contexts.
- **Engineering learning systems and mechanisms**
    - research on the development of engineering learners' knowledge and competencies in context and engineering educators' instructional culture, institutional infrastructure, and their epistemology.
- **Engineering diversity and inclusiveness**
    - research how diverse human talents solve social and global challenges.
- **Engineering assessment**
    - research into the assessment methods, instruments, and metrics to improve engineering education practice and learning.

A research cell is being setup to coordinate and facilitate the research activities of the institute addressing the needs and support the research activities of departments, COEs, ECs, and faculty and researchers involved.

For superiority of educational management in India, policy-makers and practitioners need to accept set of academic measures for research. This perspective demand research on educational management and role of Leadership as major factors in this context. Information Communication and Technology (ICT) will assist Indian technical teachers to the global requirement to replace traditional teaching methods with a technology-based teaching and learning tools and facilities. In Indian initiative of online courses (SWAYAM), ICT is considered as one of the main elements in transforming the country to

the future development. NITTTR is on the forefront has initiated various MOOCs based programme and shouldering the NITTT project for preparing technical teachers to 'teaching with technology'. Looking at these opportunities, NITTTR Bhopal to focus on employability in curriculum including establishment of pedagogical centres, technology capability development centres forging alliances with industries. This would be further instilled in the short, medium and long terms research and development (Figure 7) with interdisciplinary and evidence-based research activities (Table 1). All departments will undertake different types of research studies like fundamental, experimental, applied, descriptive and action research. These studies will be other than the PhD and PG thesis work.

Perspective Plan 2036 Research Areas and Targets

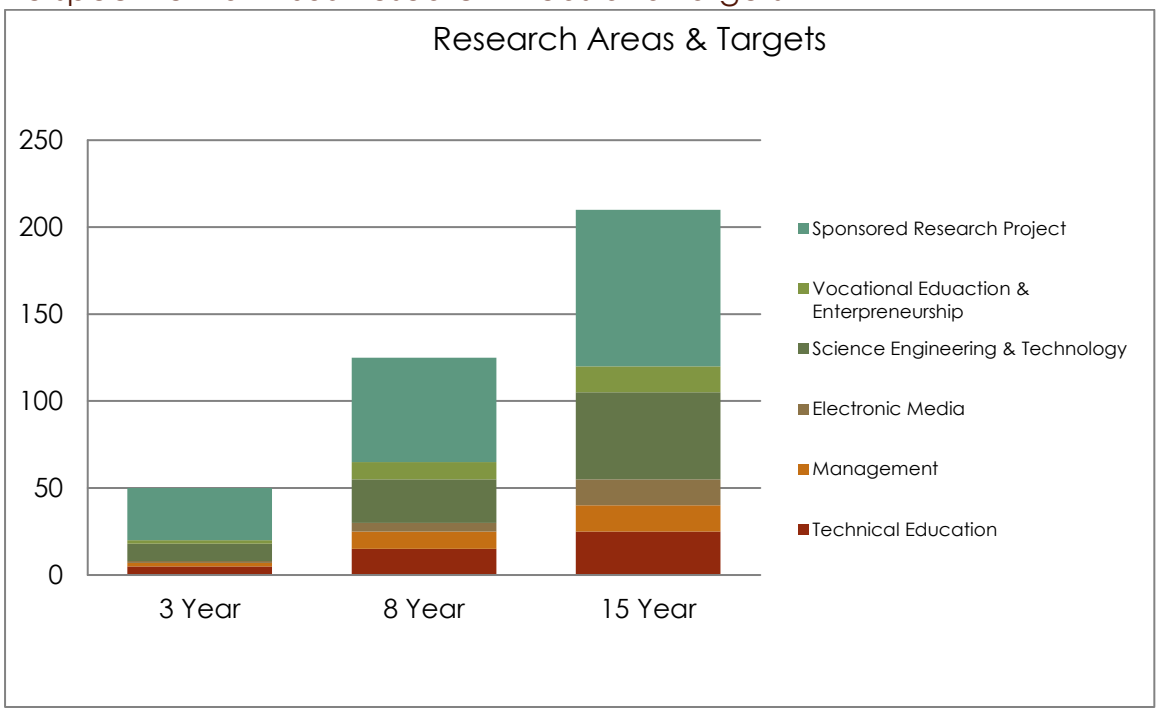

Figure 7: Research Areas and Targets in Perspective Plan 2036

Table 1: Research Areas and targets (in pedagogy) in Perspective Plan 2036

S. No	***Activity/***	***3 Year***	***8 Year***	***15 Year***
1	Technical Education • Need Analysis • SNAP Study • Tracer Studies • Impact Studies • Action Research • Content Analysis	05	15	25
2	Management • Academic Leadership • Institutional Building • Policy Analysis • Governance	02	10	15

S. No	*Activity/*	*3 Year*	*8 Year*	*15 Year*
	• CSR & Sustainable Development			
3	Electronic Media • E-content • Open Source Instructional Mtrls. • Learning Resources	01	05	15
4	Science Engineering & Technology	10	25	50
5	Vocational Education & Entrepreneurship • Start-up Policy Support • Industry Institute Partnership • Impact Study • Need Analysis • Curriculum Development	02	10	15
6	Sponsored Research and Consultancy	30	60	90
	Total	50	125	210

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Annexures

Annexure-I: Research and Innovations in first two decades since inception

In first two decades in evolving technical education in India institute has contributed in big way. Most of these accomplishments indicated here have been through various projects (Source: Marching Towards Excellence- A Sketch, January 1994.

1. Development and implementation of a variety of training programmes of varying durations, modes, and designs (for new recruits, serving teachers and officials of state level infrastructures).
2. Development of models for curriculum development in conventional and emerging (hi-tech) technologies and for reviewing existing curricula at periodic intervals.
3. Design and Implementation of projects on institutional evaluation, planned change, organisation development.
4. Introduction of a Competency Based Teacher Education (CBTE) strategy and an extension of this strategy to cover Training of Trainers in Industry.
5. Development of different types of instructional materials like laboratory manuals, textbooks, workbooks, teacher guides, slides, filmstrips, pictorial manuals transparency sets, multimedia learning packages, Competency modules, video programmes, 16mm films CAI packages.
6. Guidance to the regional states in bringing about reforms in student testing and examinations.
7. Creation of an item bank with about fifteen thousand items and support documents like specification tables, question banks, monographs on testing etc.
8. Establishment of excellent linkages with environmental agencies especially industry for intimate industry/ agency involvement in the various facets of technician education.
9. Design and implementation of Autonomous Polytechnics project.
10. Design and implementation of a master of technical education programme (six batches, fifty students). 11. Guidance to thirty-seven M.Tech.Ed. dissertations.
11. Organisation and conduct of conferences, in-country courses, seminars and workshops on various aspects of technician education.
12. Assistance and consultancy to international organisations like UNESCO, WORLD BANK, ILO, ASIAN DEVELOPMENT BANK, COMMONWEALTH SECRETARIAT.
13. Design and Implementation of projects on Engineering Experimentation Course and Comprehensive Scheme of Assessment.
14. Introduction/Review/Refinement of Flexibility in diploma programmes through Multi Point Entry and Credit Systems (MPECS).
15. Preparation of the project proposal for Strengthening Technician Education in India for submission to World Bank for funding.
16. Preparation of Detailed Project Report (DPR) for TTTI Bhopal, EFC Memo and 'Perspectives for Excellence in TTTIs' for all the TTTIs.

17. Preparation and refinement of DPRs and Implementation Schedules for the World Bank Assisted Project on "Strengthening Technician Education" at state and institutional levels for all the regional states.
18. Preparation of manual and instrument for Performance Appraisal System.
19. Introduction of Quality Circles in technical institutions: Installation of over forty Quality Circles in about twenty-eight polytechnics, Guideline Document for Implementing Quality Circles in technical institutions.
20. Finalised Roles of State Project Implementation Units (SPIUs), Polytechnic Project Implementation Units (PPIUs) and proposed role for TTTIs and Questionnaires (data formats) for academic monitoring of SPIUs and PPIUs.
21. Conduct of technical manpower survey.
22. DPRs for new polytechnics at Dhar, Indore and Gwalior.
23. Action plans for 11 polytechnics for enhancing participation of Women in Technician Education, incorporating new strategies.
24. Industrial training of polytechnic faculty, staff and development of managers, trainers and supervisors from industry (e.g. OPTEL, BHEL, CMA, Defense, Coal India, Jyoti Pumps).
25. Promotion of establishment of Computer Centres and their utilisation through development of resource persons.
26. Facilitation of continuing education projects in the regional states.
27. Production of about fifty modules for continuing education of industry personnel.
28. Conduct of about 60 research investigations on issues and problems related to technician education.
29. Promotion of research in polytechnics through training and guidance.
30. Establishment of computer facilities in computer centre and in other departments/centres of the Institute.
31. Continual modernisation of TTTI laboratories.
32. Equipment lists in Civil Engg., Electrical Engg., Mechanical Engg., Electronics, Computer Science/Applications, Chemical Engg., Plastics, Pharmacy, Instrumentation Control, Textile Technology and Videography.
33. Development of over 70 cases on Management of institutions, Reforms in examinations/Assessment, Innovations etc.
34. Proposals for the establishment of North Eastern Technological Institute, the Boards of Technical Education in M.P. and Maharashtra, residential polytechnics, and autonomous polytechnics.
35. Development of linkages with institutions offering programmes in non-conventional areas like Garment Design, Pharmaceuticals, Hotel Management, Food Processing Technology, Office Management, Architecture and Interior Decoration and Cement technology.

Annexure-II: Research through projects in first two decades since inception

Project based contributions

The project approach emerged at instituted was out of necessity as integrated institutional development. This intervention taken the shape of long-term, contracted development projects polytechnics and state systems with staff development as component of contribution. Other components include assistance in project conception and design, planning, developing project infrastructures, implementation, monitoring and evaluation.

With this intervention philosophy various projects have been carried out in the institute and major projects done during first three decades since inceptions are very briefly described below in select areas.

Major Focus Areas

1. **Performance Appraisal:** The aims of the project are to desi a performance appraisal system leading to identification training needs and staff development and to assist the state of Madhya Pradesh in the implementation of the system. Th was necessary since the current system of appraisal ' found to be inadequate for an effective appraisal polytechnic teachers, especially for identification training needs and subsequent development.

2. **Organisation Development:** The aim here is to enable individual polytechnics to create teams, systems, detail plans and implement the plans for enhancing the performer of identified subcomponents in the World Bank Assist Project on 'Strengthening Technician Education. This being implemented in two polytechnics of Gujarat.

3. **Implementing Quality Circles in polytechnics:** Since that was no effective mechanism in polytechnics to identify a resolve problems, this national project was conceived. polytechnics in 14 states are participating in this project. The aim of the project is to install problem-solving grot and guide and support their activities. Generally, the major foci of the Quality Circles are bringing improvements in classroom instruction and in laboratory instruction.

4. **Development of Models for Centers of Excellence:** Gujar has proposed the establishment of five centers of excellence for five identified engineering disciplines to be cent] for development, use and dissemination of curricula instructional resources. The role of TTTI in this project is to develop models for the establishment of these cent] including infrastructural design, to facilitate the formulation of their operational procedures and to support their activities.

5. **Training of trainers for Cement Manufacturers' Association -Programme Design, Proposal Design, Finalisation of contract**: The project aims at training about 60 trainers through four programmes for Cement Manufacturers' Association in training methodology and use of a variety of instructional techniques and resources. Three programmes have already been successfully

conducted and the remaining programme is scheduled to be conducted during Nov.-Dec. 1993.

6. **Development of Models for Lead Centres:** Six lead centres which have been incorporated by Maharashtra in its WRAP, are expected to 'lead' the other polytechnics in their region in the implementation of institutional project plans. The major facets of Lead Centre performance are training of faculty and staff of its region, preparation, testing and dissemination of instructional resources, curriculum design of new courses, curriculum evaluation and revision of existing courses, promotion of industry involvement in polytechnic education. TTTI Bhopal will provide assistance in deriving the role of lead centres, in the establishment of the necessary infrastructures and in training the personnel of the lead centres. TTTI will also be assisting in establishing LRDCs at Six lead centres and one Media Production Centre.

7. **Role of TTTIs:** The aim of this project is to examine the current role of TTTI Bhopal in relation to,

   a. the restructuring of economic and industrial policies and the consequent gaps,
   b. new expectations of the state technician education systems, allied agencies and industry and
   c. advancements in science, technology and education technology.

8. **Formulation of Strategies for enhancing women's participation in Technician Education:** The National Policy on Education (NPE, 1986) and its Programme of Action placed high emphasis and significance on enhancing participation of Women in Technician Education. As a consequence, TTTI Bhopal took up this long-term project to devise and implement appropriate models and strategies in polytechnics and state system to achieve the directives provided by NPE regarding women's participation in technician education.

9. **Introduction of Cement Technology, Spinning & Weaving, Transportation Engineering Programmes:** The state of Madhya Pradesh intends to start new diploma programmes in the three specified disciplines, as part of its project on Strengthening Technician Education through World Bank assistance. This TTTI project envisages the formulation of programme structures and curriculum design with assistance from selected polytechnic teachers and industry experts.

10. **Restructuring Diploma programmes:** As part of its efforts in making technician education relevant to changing needs and demands of industry, M.P. State desired assistance from the institute to review the curricula in 13 diploma programmes and to provide guidance in restructuring these programmes.

11. **Development of entrepreneurship abilities:** Acting on the guidelines provided by the National Policy on Education (1956), the states have incorporated development of entrepreneurship abilities in the curriculum of the diploma programmes. The project aims at identifying the entrepreneurship skills to be developed in the polytechnic students and develop a need-based, relevant

curriculum in this subject. Also included in the project would be training of polytechnic faculty to ensure the effective offering of the subject.

12. **Production of video programmes:** A project for producing more than forty video programmes in areas like welding, workshop practice, NDT, NC-CNC machine tools and soil engineering has been undertaken by the institute. The aims of the project are twofold. One to make available video programmes to polytechnics to enhance the effectiveness of classroom instruction and the second, to provide for continuing education of industry personnel. This project has incorporated intimate involvement of industry in the production process. Indian Society of Technical Education has given responsibility to produce motivational video-lectures pertaining to about 300 modules developed for continuing engineering education.

13. **Identifying technician skills for new technology areas:** The rapid developments in the industry scenarios have made it imperative for the technician education systems to incorporate in polytechnic instruction the acquisition of new skills by students. The aim of the project is to identify the sets of technician skills required of the polytechnic pass outs by, industry in the new technology areas like information technology, communication technology, computer hardware maintenance and chemical technology.

14. **Development of textbook, Laboratory Manuals, Workbooks for Communication Skills:** The need for revamping the current text book, manuals, and. workbooks has. arisen because the entry qualifications for. the diploma programmes were changed by the states from -11+ to 10+ and the consequent difficulties experienced by the students. The aim of the project is to revise and update these learning resources for effective acquisition of communication skills.

15. **Introduction of flexibility in polytechnics through Multi Point Entry and Credit Systems (MPECS):** This project has been ongoing for over 6 years in Gujarat. TTTI Bhopal assisted the state in introducing flexibility in diploma programmes through Multi Point Entry Credit Systems (MPECS). Revision of curriculum is being carried out at this time. This project has now been extended to the other three states in the region. This involves the development of new models appropriate to the situations existing in these states and the design of curriculum as well the development of support systems like assessment schemes, guidance and counselling.

16. **Introducing Continuing Education in a state:** Gujarat has, under the continuing education subcomponent of the WBAP, introduced diploma programmes through correspondence mode for, the acquisition of diplomas by industry workers and by students in remote areas. The TTTI is (a) assisting polytechnic teachers in preparing instructional material, (b) preparing operational manuals, teacher and student guidebooks and (c) training faculty to counsel students and to conduct contact sessions.

17. **Setting up a Learning Resource Development Centre (LRDC):** This project is being taken in Gujarat. The aims of the project are (a) to provide specifications required for the LRDC, (b) to get the equipment installed, tested and made operational (c) to conduct staff development training programmes to ensure the availability of necessary skills in the centre.

18. **Assisting 18 polytechnics in a state to initiate Learning Resources Utilisation (LRUCs):** This project has been taken up to provide assistance to 18 polytechnics so that Learning Resources Utilisation occurs. The project aims are: (a) to promote utilisation of learning resources both by teachers and students, (b) to assist in the training of resource persons for development of learning resources.

19. **Facilitating Staff Development Planning in states:** One crucial aspect of the implementation of the World Bank Assisted Project is Staff Development Planning, keeping in mind the needs of the institution and the strengths and weaknesses of the faculty and staff, especially in areas like management skills, induction of new and hi-tech technologies. TTTI Bhopal is assisting the regional states in developing teacher profiles, preparing need-based staff development plans for the faculty and staff of polytechnics and officials of state level infrastructures.

20. **Autonomous Polytechnics:** Two of the regional states have included accord of autonomy to selected institutions and requested TTTI assistance in formulating guidelines, preparing operational documents, providing training related to the dimensions of autonomy and generally assisting the institutions in using the autonomy to the utmost.

21. **Appropriate Technology design and transfer:** As part of the national community development thrust, the states have designated several polytechnics as community polytechnics. One of the functions of these institutions 1 is the design and transfer of Appropriate Technology. The project envisages the provision of required assistance and guidance by TTTI to these community polytechnics.

22. **Curriculum Development of Appropriate Technology - Design:** A ne',4 master's degree in Appropriate Technology is to be launched by the institute in 1994. In this context, under this project, the programme design, structure and operational details are being detailed out. The curriculum would be need-based, inter-disciplinary and would train polytechnic teachers in developing and transferring Appropriate Technology to the rural masses.

23. **Multipurpose Worker Development:** Industrial restructuring has become inevitable in the context of new economic and industrial policies of the country and the induction of new (hi-tech) technologies. The implication here is the need for developing capabilities among industry manpower to operate, use and maintain new technologies. This requires the transfer of advanced skills in new and emerging technologies, supervision and management of appropriate levels of personnel to suit structural changes envisaged by the industry.

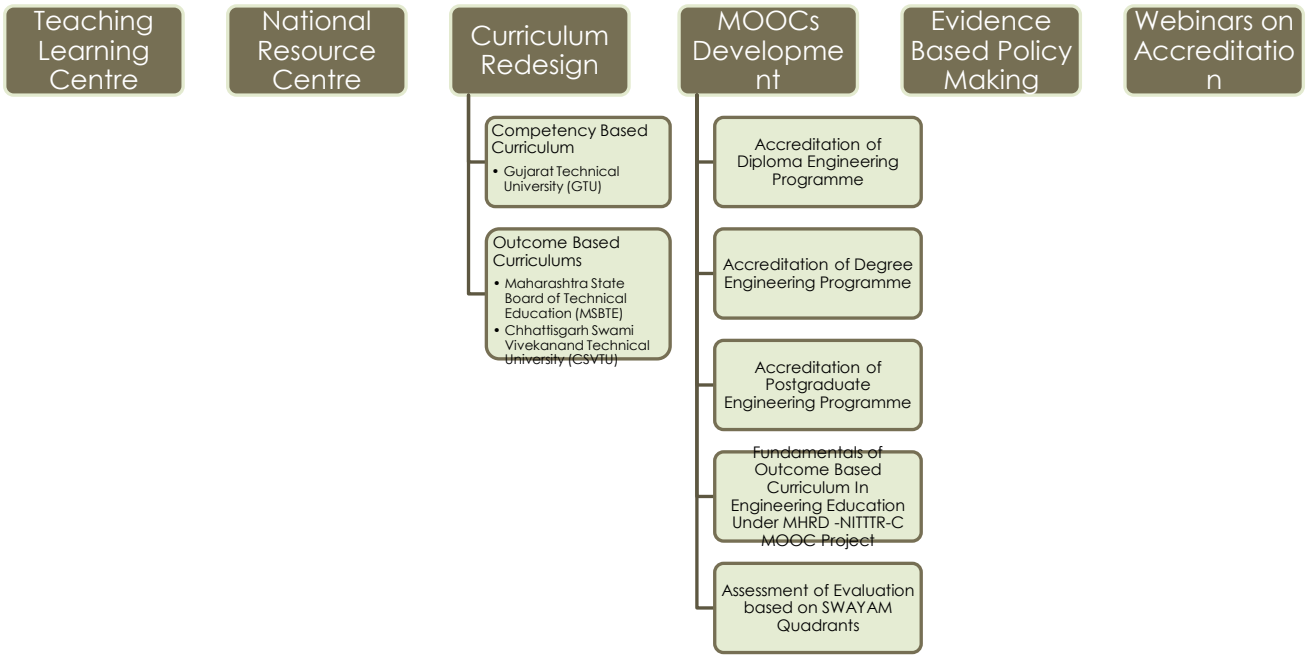
Annexure-III: Recent Initiatives and Pedagogical Innovations

Since inception institute has been on forefront of evidence-based research and pedagogical innovations for the technical education system in India. In its more than fifty years of existence, central agencies and affiliated state governments have benefitted with models, curriculum design and innovation, implementation frameworks and policy designs.

During seventies "Bhopal Model of Curriculum" was developed and implemented in all the polytechnics (around 90) of Western regional states. NITTTR also developed and introduced competency-based curriculum following the Bhopal Model. Next reform came as development and implementation of "Job based" curriculum in the polytechnic system.

Systemic research in curriculum development and implementation laid the path of laboratory innovations. New laboratory experimentations and laboratory manuals were developed in large numbers and implemented in Western regional polytechnics through a Lab Manual Development Project. Curriculum redesign projects were undertaken for the state of Maharashtra, Gujarat, Madhya Pradesh and Chhattisgarh centered on outcome-based model of curriculum development. Under the National Skill Development Mission of GOI, Skill Based Curriculum have been designed and developed (Approx. 95 nos.) with the help of industry and field experts. During implementation of National Vocational Educational Qualification and Certification Framework (NVEQCF) Project (2003-2006) NITTTR, Bhopal designed and developed curriculum (60 Nos.), self-learning material (101 Nos.), trainer guide and trainee guide (9 Nos), assessment guideline (9 Nos.) under NVEQCF project. NITTTR introduced technical education qualification to bring changes in implementation of reforms and innovations in technician education. Certificate Course in Technical Teachers' Training was initiated in early seventies. The certificate course was specifically designed to provide inputs related to curriculum implementation, design of instructional strategies, develop appropriate learning resources and assessment of learning. In late eighties, Master in Technical Education was introduced. The masters programme was specifically designed for academic administrators. The course was offered for more than two decades.

Continuing these pedagogical innovations in current times and emerging challenges, in recent, NITTTR, Bhopal have opened up new frontiers and working on the cusp of PACT. Major activates done and work-in-progress are summed-up in the following projects and initiatives.


Teaching Learning Centre
National Resource Centre
Curriculum Redesign
Competency Based Curriculum
• Gujarat Technical University (GTU)
Outcome Based Curriculums
• Maharashtra State Board of Technical Education (MSBTE)
• Chhattisgarh Swami Vivekanand Technical University (CSVTU)
MOOCs Development
Accreditation of Diploma Engineering Programme
Accreditation of Degree Engineering Programme
Accreditation of Postgraduate Engineering Programme
Fundamentals of Outcome Based Curriculum In Engineering Education Under MHRD -NITTTR-C MOOC Project
Assessment of Evaluation based on SWAYAM Quadrants
Evidence Based Policy Making
Webinars on Accreditation

I. Teaching Learning Center (TLC)

Teaching Learning Centre (TLC)

Make in India, Skilling India and Digital India are most ambitious initiatives of Govt of India which will change the face and future of our country through proper entrepreneurial efforts and vocationalisation. India has to take proactive steps to convert its youth into demographic dividend so as to be included in leading economies of the world. These interventions require massive efforts with right spirit and result oriented plans and their effective implementation for the designed outcomes. Make in India initiative was launched with the primary goal of making India a global manufacturing hub, by encouraging both multinational as well as domestic companies to manufacture their products within the country. This requires subtle entrepreneurial and vocational education inputs at the grass root level. Skilling India initiative requires people need to be "rightfully skilled" so that they can effectively participate in this phase of economic growth. Thus, skill development in India goes beyond the transactional view of balancing the emerging labour demand-supply gap and envelops inclusion of new entrepreneurs and "right kind of vocatonalisation for skilling".

The Pandit Madan Mohan Malaviya National Mission on Teachers and Teaching (PMMMNMTT) is a Central Sector Scheme with All- India coverage. This scheme was launched in 2014-15 for a period of three years i.e. from 2014-15 to 2016-17 during XII Plan. The Mission is envisaged to address comprehensively all issues related to teachers, teaching, teacher preparation and professional development. The Mission addresses, on the one hand, current and urgent issues such as supply of qualified teachers, attracting talent into teaching profession and raising the quality of teaching in schools and colleges. On the other, it is also envisaged that the Teacher Mission would pursue long term goal of building a strong professional cadre of teachers by setting performance standards and creating top class institutional facilities for innovative teaching and professional development of teachers.

With the above in mind, Centres of Excellence for Curriculum and Pedagogy were created throughout the country with primary mandate of teachers' development. These Centre were established with specific purposes,

- It is mandated to ensure a coordinated approach so as to holistically address the various shortcomings relating to teachers and teaching across the educational spectrum ranging from school education to higher education including technical education; using the best international practices for excellence.
- It will also empower teachers and faculty through training, re-training, refresher and orientation programmes in generic skills, pedagogic skills, discipline specific content upgradation, ICT and technology enabled training and other appropriate interventions.

The Mission would focus in a holistic manner dealing with the whole sector of education without fragmenting the programmes based on levels and sectors as school, higher, technical etc. It is considered that programmes dealing with teachers in all sectors and levels of education should grow and function in a mutually supportive manner. It will try to bridge the gap between teachers and teacher educators and provide opportunities for teachers to become teacher educators.

The MHRD approved the Teaching Learning Centre (TLC) in Vocational Education Training & Entrepreneurship Development to be established under PMMMNMTT at NITTTR, Bhopal in January 2018.

VOCATIONALISATION OF HIGHER EDUCATION

The TLC Project of NITTTR, Bhopal focuses on improved teaching- learning process that focuses the students' concern, their purposeful engagement within and outside the classroom, attention on learning and developing interest for gainful employment including self-employment to make the educational offerings more meaningful and socially relevant.

TLC in Vocational Education Training & Entrepreneurship Development assumes importance in the context of ambitious initiatives of Govt of India such as Make in India, Skilling India and Digital India through proper entrepreneurial efforts and designed inputs on vocational education in our technical education institutions. Vocationalisation of higher education is the need of the hour and solution to many challenges that the technical education faces today. Until recently, vocational courses were referred to jobs like mechanic, welder and other such menial employments, thus the stigma attached to it. However, due to the changing economies of the world into more knowledge based economies, the world now requires an individual to be "holistically trained" with specialised knowledge of work-life balance. "Vocationalisation with reference to technical education means "providing vocation specific references" and transforming the students' caliber and learning competence through "persistent exposure to realities of work life and environment" during Teaching-Learning". "Vocationalisation thus, is the key to metamorphose the students' calibre through consistent exposure to realities of work life during education". It develops insight into work-life balance by inculcating elements of joy for work. An ardent and passionate drive is created during the years of education, make-up students' life fulfilling and highly enabling. The resilience in them need to be cultivated with immense efforts while journey of learning become livelier and life-oriented. Just having an outcome-based curriculum does not create purposeful learning, its implementation needs to be concerted, planned and focused towards gainful engagement of students.

NITTTR, Bhopal is adopting multi-pronged strategies to find a viable solution to meet challenges of "Vocationalisation" technical education through the TLC project;

i. Identify "vocation specific gaps" in the content taught in the technical institutions through need analysis.

ii. Creating a pool of trainer-educators (TEs) among the selected Training Institutions (TIs) in its regional states.

iii. Use Vocation specific gaps to develop "purposeful, innovative and usable learning resources (LRs)" through "trained Trainer Educators"

iv. Disseminate learning resources to students and teachers through a viable "Learning & Content Management System".

The TEs will be thoroughly trained to develop relevant LRs modules, video films and all such instructional material that can become substantial interface between education and work-life and those can help the students and teachers as well in their overall growth, development and guidance. The TEs will be constantly supported during the Project period of three years and they would be strengthened in such a way that project activities operated in the TIs become self-sustaining at later stage.

VISION OF THE TLC:

To become a Centre of Research & Innovations to proliferate Vocationalisation of Technical Education.

MISSION OF TLC:

The mission of TLC Project encompasses all the mission statement of NITTTR, Bhopal and focuses itself to the following;

i. To commit ourselves to promote research and innovations for effective implementation of vocationalisation of technical education.

ii. To work relentlessly to maintain a platform of Learning & Content Management System for purposeful engagement of teachers and industry experts to develop and disseminate usable learning resources for technical education system.

iii. To engage ourselves in capacity building and efficiency improvement of our own teams in order to transform technical education system by adapting best practices from around the world and transacting through seminars, workshops, training and conferences.

OBJECTIVES OF THE TLC:

To translate the vision and mission of the TLC, the objectives have been carved to achieve the desired outcomes in the given time frame. The objectives derived for the Teaching-Learning Centre are:

i. To provide training, research and experimentation platform to faculty of AICTE approved institutions to become passionate trainer educators and researchers to develop sustainable environment for vocational education & training (VET) and entrepreneurship development.

ii. To catalyse the networking with institutions/organisations, alumni and industries in carrying out training, research and entrepreneurship development.

iii. To conduct purposeful and relevant researches on existing policies, implementation of GOI initiatives with reference to entrepreneurship & VET.

iv. To develop adequate and appropriate learning resources using applied knowledge and skills for upscaling their capacity to perform effectively.

v. To develop clearing house of requisite learning resources including video films for provision of such modular programmes courses in higher education TLC.

vi. To establish an eco-system for fostering and scaling of social and grass root innovations.

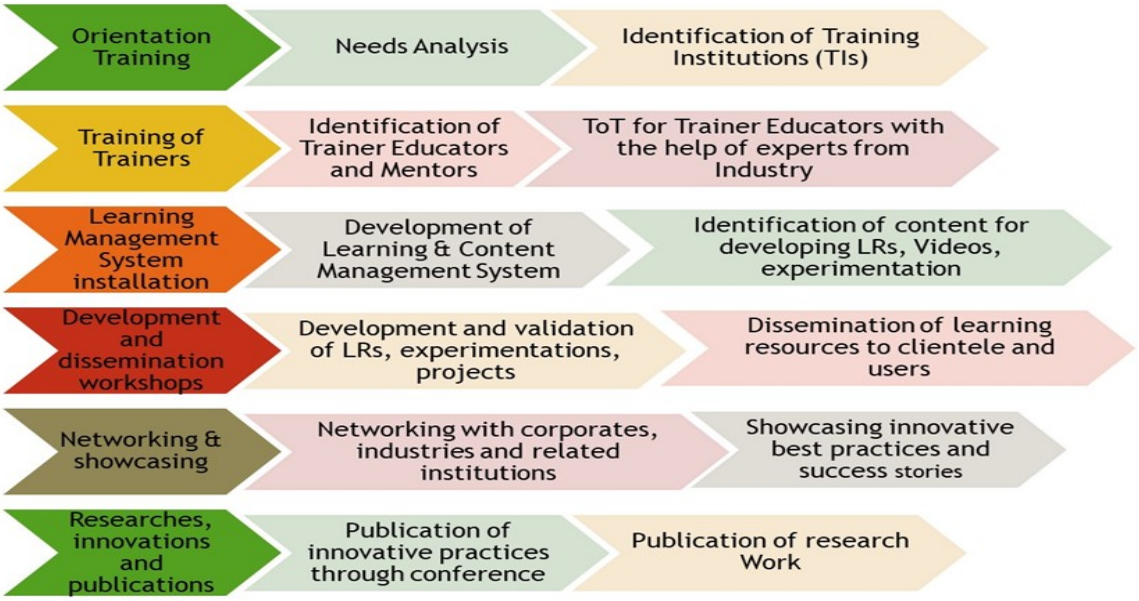
vii. To make use of intellectual and other resources developed at TLC to contribute in the ecosystem to bring sustainable change through Skill Development, Start-ups, Social Innovation, Incubation and VET,

viii. To disseminate and share various research findings among planners, policy-makers, trainer educators, entrepreneurs and similar institutions.

ix. To provide mentor support and hand-holding to budding entrepreneurs through an innovation cum incubation centre.

IMPLEMENTATION STRATEGY OF TLC PROJECT:

The plan period of the TLC Project is three years. The implementation strategy of TLC includes the following stages;



IMPORTANT MILESTONES:

The following are the important milestones of the TLC Project;

1.1. Collaboration with AICTE and Skill University

The TLC collaborated with AICTE to conduct four national workshop to launch Bachelor of Vocation and Diploma of Vocation in 13 identified vocations. These workshops were conducted in Bhuvneshwar, Bangalore, New Delhi and Bhopal during April-May 2018. About 450 institutions offering B.Voc and D. Voc Programmes in the country participated in these four workshops. TLC is further collaborating with Haryana Vishwkarma Skill University, Sonipat to conduct TOT of those teachers who are engaged to teach D.Voc and B.Voc students. This TOT will be conducted in Nov. 2018.

1.2. Need analysis and orientation programmes:

Orientation and need analysis of teachers of polytechnics and engineering colleges has already been initiated and data of 600+ participants have been collected till 15th Sept 2018. Process of identification of Training Institutions (TIS) is in place and three Training Institutions have already been identified so far, namely;

i. Bhilai Institute of Technology, Durg
ii. PSG Institute of Technology, Coimbatore
iii. SGIST, Indore

These TIs will be hub for operationalizing activities in the specified region. MOU will be signed with the identified TIs to fulfil the objectives of the TLC.

1.3. Identification of visible gaps and analysis of data:

Analysis of the collected data has been done with reference to disciplines, topics where learning gap exist and relevant Learning Resources have been specified. Five major disciplines have been selected to initiate the work of LRs development which include Civil, Mechanical, Electrical, Electronics and Computer engineering. Total of 328 topics have been identified in the 38 courses of five disciplines. These topics are being correlated with appropriate course outcomes of related courses so that the developed learning resources will find better linkages with course contents.

1.4. Identification of potential Trainer Educators & Mentors:

Identification of potential trainer educator was carried out along with data collection of need analysis. 158 technical teachers have been identified so far to be selected among them as potential trainer educators. Separate orientation workshop is planned in III week of sept for identifying mentors among the industry experts. Industry experts and alumni have also been identified with the selected TIs.

1.5. Website of TLC

To promote various activities of the TLC Project a separate web site is being developed. The website will be in place in II week of Oct 2018. The website will inform in general about the activities carried out at TLC and also attract the target audience as well as users to provide relevant feedback at appropriate point in time.

1.6. Conduct TOT of TEs:

The TOT is planned to be conducted during December 2018. The potential TEs will be trained to develop relevant LRs. The TOTs have been based on the following premise that they will use the visible gaps and relate them with the suitable real life examples. TOTs will provide them opportunities to learn to develop different LRs as shown in the flow chart;

1.7. Installation of advanced labs:

The installation of two advanced lab has been proposed to support design and development of creative and innovative learning experiences. These labs will have state of the art technology and resources to inculcate culture of innovations among the

teachers and particularly trained TEs. A proposal for furnishing the labs has already been in place in Aug 2018. CPWD has been approached to develop detailed drawings based on the requirements. These two advanced labs will be the "Centre of Innovations & Creativity" for the teachers as well as budding entrepreneurs.

The details of two labs are as follows;

6.7.1 Next Generation e-Learning Lab (NxGeL Lab)

The lab aims at creating learning environment for the Trainer Educators and teachers who will be using and developing these learning resources and ICT enhanced artefacts in sustaining learning environments. Focus is on providing a dynamic, authentic and interactive learning environment with multimedia resources. All the activities carried out by learner during the learning process will be registered in the data base created for the purpose. The objectives of setting up the proposed lab are;

i. To design simple and efficient user Interfaces and user experience (UIUX).

ii. To develop LCMS for dynamic learning ecosystem

iii. To develop strategies for integrating reflective practices in LRs.

6.7.2 Creative & Immersive Learning e-Lab (CreatE Lab)

CreatE Lab will provide learners an environment which is highly interactive both virtually and physically. This helps in replicating possible scenario and in teaching specific technique. Immersive learning is the process of learning with the usage of a simulated or artificial environment. The environment enables the learners to completely get immersed in the learning and in way that feel like experiencing an actual learning environment.

The objectives of setting up of CreatE Lab are

i. To develop concepts for meaningful learning experiences and explore the mind sets, environments, artefacts and technologies that enhances immersion, creative learning and mindful awareness.

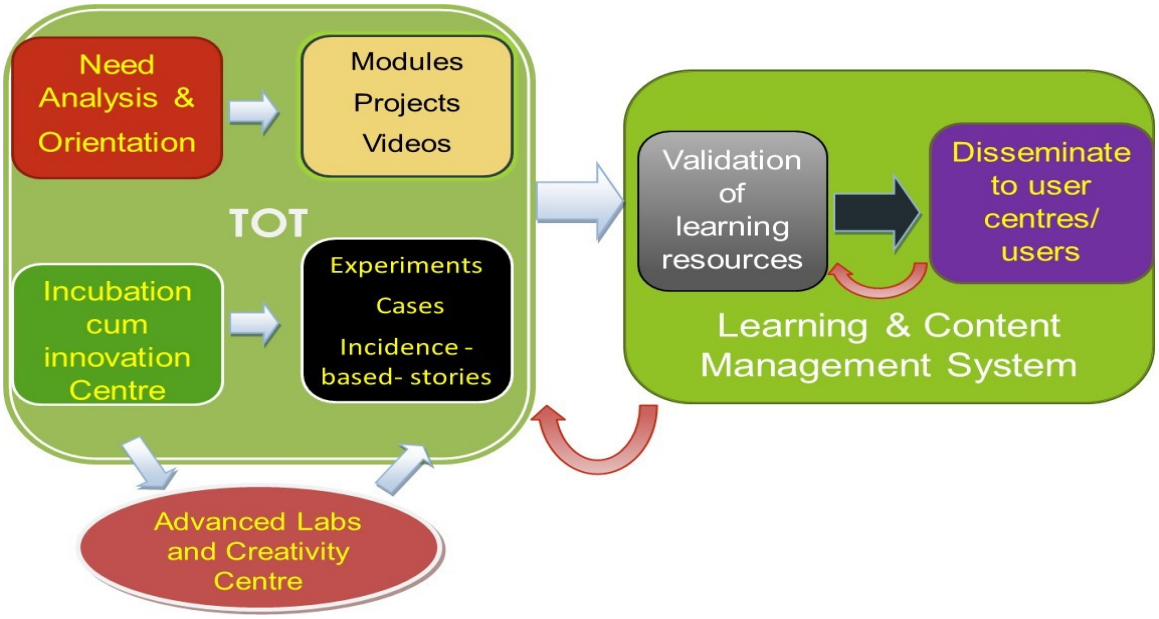
ii. To investigate playful, creative and embodied learning in hybrid and physical learning environment.

1.8. Installation of Learning & Content Management System (LCMS):

The installation of proposed LCMS will be completed by Dec 2018. The trained TEs will use LCMS platform to develop the LRs. Mentors will also use the LCMS platform for validating the LRs. The validated LRs will be made available to the users. It is also proposed to conduct researches in the installation, use and effectiveness of LCMS. Showcases have been planned at the identified TIs to disseminate the products to the users of different institutions.

VISION REACH STRATEGIES

The vision reach strategy to reach the important milestones is shown graphically and the following activities are planned to be implemented in phased manner;



PLANNED DELIVERABLES OF THE TLC PROJECT

The planned deliverables of the TLC Project are given here;

i. Infrastructure and facilities to conduct training, workshops, basic and experimental research for proto-type development, software development and testing.

ii. 300+ Trainer Educators (TE) of 10 identified Training Institutions (TI) in addition to alumni and industry experts trained through deeper training and research in applications of Learning Resources development.

iii. Researches during the project period on the identified themes of implementation of PMMMNMTT TLC Project and also GOI initiatives like Make in India, Skilling India and Digital India, etc.

iv. Learning resources like modules, cases, incidence based success stories, anecdotes, picture stories, videos, animations, etc. developed by the TEs.

v. Documented success stories, evidences based practices and case studies of successful practices drawn from real life situations.

vi. Showcases to exhibit innovative practices, publications, researches through the TE and TLC researchers.

vii. Active network of institutions, industries, corporate and organisations for conducting and disseminating intellectual work of the centre through trained trainer educators and researchers.

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II. National Resource Centre (NRC) - Assessment and Evaluation

National Resource Centre (NRC) - Assessment and Evaluation

The Ministry of Human Resource Development has launched a major and unique initiative of online professional development of 1.5 million higher education faculty using the MOOCs platform SWAYAM. In the first phase, 75 discipline-specific National Resource Centres have been identified which are tasked to prepare online training material with focus on latest developments in the discipline, new & emerging trends, pedagogical improvements and methodologies for transacting revised curriculum.

Under this initiative, all in-service teachers, irrespective of their subject and seniority will have an enabling opportunity to keep abreast of the latest developments in their disciplines through the technology based online refresher course. The NRCs are developing the Refresher Module which includes the latest trends in their earmarked discipline. The training materials is uploaded and made available through SWAYAM to all the teachers and based on the response, the course is being repeated. NRCs have published the list of the faculty who have been certified and UGC has issues order/regulations for the purpose of Career Progression and APIs.

Faculty can benefit from this initiative as it is highly flexible and can be done at one's own pace and time. The NRCs are revolutionized professional development of faculty by catering to massive numbers by leveraging ICT and online technology platform of SWAYAM.

The NITTTR, Bhopal has established the NRC for Assessment & Evaluation and has been selected second time as National Resource Centre (NRC) for Assessment of Practical and Social Skills in Higher Education (NRC-2 in ARPIT) Scheme - A unique initiative of online professional development of in-service teachers of higher education, using MOOCs platform. Under this, various themes related to NRC-2 on Assessment of Practical and social skills in Higher Education have been developed by the NRC team members. Feedback on this MOOC course is highly encouraging and appreciated by the SWAYAM Management team, MHRD and course participants. The details of the major achievements and future plans are as under:

Year 2019-20

Major Achievements	1. 2497 participants were enrolled in the programme. 2. Prepared E-content, video script, assignments etc for the identified course on Assessment of Practical and Social Skills in Higher Education. 3. successfully uploaded all the course material on SWAYAM platform as per the given guidelines (between Nov 2019 to Feb 2020) 4. Assessed and gave feedback online on the submitted assignments. 5. Tackled participants problems and queries during the course period

<table>
<tr><td></td><td>6. Design and Developed final exam paper and forwarded to Testing Agency (NTA).
<table>
<tr><th>Parameters</th><th>Progress made in the past one year</th><th>Progress made since the launch of the scheme</th></tr>
<tr><td>Total number of Courses run on SWAYAM under ARPIT</td><td>01</td><td>02</td></tr>
<tr><td>Total number of Enrolments</td><td>2497</td><td>3680</td></tr>
<tr><td>Number of Faculty Trained</td><td>2460</td><td>3420</td></tr>
<tr><td>Number of E-module developed</td><td>14</td><td>32</td></tr>
<tr><td>Number of videos developed</td><td>12</td><td>30</td></tr>
</table></td></tr>
<tr><td>Future Plans</td><td>Based on the feedback of Participants MOE has asked NITTTR Bhopal to rerun the course for 2020-2021. The e-content and videos have been uploaded and the course will start from 1st December 2020 and will run up to end of January 2021. Offer courses to develop the competencies required to assess students in the psychomotor and affective domain of learning at higher education level.</td></tr>
<tr><td>Major Achievements (2018-19)</td><td>1. 785 teachers registered from universities, engineering and polytechnic colleges
2. 180 registered for online examination, about 50% passed the examination for certificate
3. Designed 18 e-contents, 20 videos, 10 assignments, and two MCQ based Test papers</td></tr>
</table>

Year 2018-19

National Resource Centre (NRC) For Student Assessment and Evaluation under ARPIT Scheme at NITTTR Bhopal- A unique initiative of online professional development of in-service teachers of higher education, using MOOCs platform SWAYAM -Annual Refresher Programme in teaching (ARPIT) was launched by MHRD in October 2018. NITTTR Bhopal has been identified as one among the 75 discipline - specific National Resource Centres (NRCs) under Pandit Madan Mohan Malviya National Mission on Teachers' and Teaching (PMMMNMTT) Scheme for conducting online refresher courses for all faculties under

SWAYAM Scheme. NITTTR Bhopal had launched first MOOC programme on Student Assessment and Evaluation under this scheme using SWAYAM platform in the month of Nov., 2018. The details of the major achievements and future plans are as under: -

Major Achievements	1. 785 teachers registered from universities, engineering and polytechnic colleges 2. 180 registered for online examination, about 50% passed the examination for certificate 3. Designed 18 e-contents, 20 videos, 10 assignments, and two MCQ based Test papers
Future Plans	Offer courses to develop the competencies required to assess students in the psychomotor and affective domain of learning at higher education level.

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III. Curriculum Redesign & Development

Curriculum Redesign & Development

Curriculum development in emerging & diversified areas of engineering & technology and revision of existing programmes is a continuous process, to be responsive to market needs of technical manpower. NITTTR, Bhopal has been rendering assistance to its clients in the Western Region and other parts of India in training faculty in the scientific way of undertaking curriculum development in different ways by identifying curricular needs, developing curriculum programme structures, curriculum presentation and in delivery approaches. Developing curricula is the joint effort and responsibility of NITTTR, Bhopal and client system ensuring training-cum-development workshops with teachers at all stages of development. The most recent one has been the state level outcome-based curriculum re-designing projects - one for MSBTE, Mumbai and another for CSVTU, Bhilai.

The institute has completed the project of developing the curricula of the Seventeen Diploma Programmes (32 courses in each) of Maharashtra State Board of Technical Education (MSBTE) including Civil, Electrical, Mechanical, Electronics & Telecommunication, Instrumentation, Computer, Chemical, Automobile, Plastic Engineering, Digital & Industrial Electronics, Information Technology, Production Technology, Medical Electronics, Textile Technology, Textile Manufacturing & Fashion and Clothing Technology. This NITTTR-MSBTE Model is based on competency-focused Outcome Based Curriculum using the participative approach from stakeholders. This project was started in October 2016 and concluded during the year 2018-19. Similarly, curriculum redesign project was undertaken for Chhattisgarh Swami Vivekanand Technical University (CSVTU). During 2018-19 Curricula of 129 courses for Diploma Programmes of 15 disciplines for Semester – III and IV were developed (Computer Science & Engineering, Information Technology, Electrical, Electrical & Electronics, Electronics & Telecommunication, Instrumentation, Mechanical, Metallurgical, Civil, Mining, Chemical Engineering, Architecture, Interior Design and Decoration, Modern Office Management, Costume Design &Dress Making Technology).

i. Competency based Curriculum

For Gujarat State: For Gujarat Technological University (GTU) which is the State University of Gujarat, NITTTR Bhopal completed the development of the research based curricula for 24 branches of Diploma Engineering Programmes in 2015. GTU has more than 100 polytechnics affiliated to it and total intake of students is about 40,000 altogether in these institutes.

Various researches were undertaken to redesign and redevelopment of this curriculum in which large number of Industries were surveyed to identify the competency requirements of the industry for 24 different branches of the Diploma Engineering Programme in the state of Gujarat. Large, medium and small were selected from all the sectors of economy spread across different regions of the State. Based on this survey the essential and desirable competencies required in diploma engineers (in different branches of engineering) were identified and competency bank was prepared to help in development of curricula. Implementation training programmes are also being carried for effective implementation continuously.

GTU

Curriculum Re-design project for GTU

Duration of the Project: 2015-2018

Total number of courses developed: 600

Consultancy amount – XXXX

Net IRG: Rs 20 Lakh

ii. Outcome based Curriculum

For Maharashtra State: Maharashtra State Board of Technical Education (MSBTE), a State Board of Maharashtra which has about 558 polytechnics affiliated with it and total sanctioned intake of students is about 1,60,734 in these institutes. NITTTR Bhopal started the development of the research based curricula for 18 branches of Diploma Engineering Programmes in 2015. A large number of small, medium and large scale industries were surveyed to identify the technician/technologist related competencies, which were prioritized to develop Outcome Based Curriculum. As on today, work till the third semester is complete and this outcome-based curriculum has been launched in July 2017.

MSBTE

Curriculum re-design project for MSBTE

Duration of the Project: 2016- 2020

Total number of programmes re-design: 17

Consultancy amount – Approx. -25.00 Lakhs

Net IRG Generated- Approx.- 5.0 Lakhs

For Chhattisgarh State: Chhattisgarh state curriculum Redesign / revision project (CRP) of diploma programmes under Chhattisgarh Swami Vivekanand Technical University (CSVTU), Bhilai commenced in November, 2016. Under this, SWOT analysis and need analysis for Curriculum Redesign / Revision Project of 15 diploma programmes have been conducted along with orientation training cum workshop of core teams of CRP, CSVTU, Bhilai for 15 diploma programmes. A large number of medium and small scale industries and alumni were surveyed to identify performance based outcomes in different disciplines.

CSVTU

Curriculum re-design project for CSVTU Bhilai

Duration of the Project: 2017-2020

Total number of programmes re-design: 15

Consultancy amount – 52.5 Lakhs

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IV. Massive Open Online Course (MOOCs)

MOOCs

National Institute of Technical Teachers Training and Research is involved in the prestigious flagship online programme of Ministry of Education, Government of India since 2018. In total 50,861nos of teachers have been trained through different online MOOCs offered by NITTTR Bhopal. The detail are as follows:

1. SWAYAM MOOC for in-service and aspiring teachers of technical education system of India. In all six courses has been launched and in all 36,482nos of teachers have been trained.
2. NITTTR Bhopal as National Resource Centre (NRC) to offer ARPIT programmes and 3680 nos. of teachers have been trained.
3. AICTE – NITTT Modules (Module-2 and Module-4) offered to newly recruited teachers of technical education system having less than 5 years of experience. In all 10,699nos of technical teachers have been trained.
4. SWAYAM MOOCs course on 'ICT in Teaching and Learning' is also selected by Ministry of External Affair and offered to students in the country Ghana (vide email dt4May2020).

SNo.	Name of MOOC	Faculty members Involved	No. of Participation			
			(Jan 2018-19)	(Jan 2020)	(July 2020 Semester)	Total Trained
1.	ICT in Teaching and Learning Dr.K.J.Mathai-PI	3nos.	8255	4083	3122	15,460
2.	Accreditation for PG Engineering Programmes Dr.D.S.Karaulia- PI	4nos	1546	0	0	1546
3.	Accreditation of UG Programmes Dr.R.K.Dixit -PI	4nos.	2096	3108	1752	6,956
4.	Accreditation of Diploma Programmes Dr.B.L.Gupta-PI	3 nos.	961	2577	1010	4,548
5.	Fundamentals of Outcome-based Curriculum	2nos	1795	1421	1061	4,277

	in Engineering Education Dr.Joshua Earnest-PI					
6.	Learning and Instruction Dr.K.Saksena-PI	3nos	2900	0	795	3,695
7.	Assessment and Evaluation (NRC: Refresher Course) Dr.KKJain-PI	3nos	1183 (NRC-1)	2497 (NRC-1)	0	3,680
8.	ACITE-NITTT Module-2: Professional Ethics & Sustainable Development Dr.S.K.Gupta-PI	14nos	0	5432	1705	7,137
9.	ACITE-NITTT Module-4: Instructional Planning and Delivery Dr.S.S.Kedar-PI	15nos.	0	2622	940	3,562
	TOTAL		18736nos	21740nos	10385nos.	50,861.00

V. Webinar Series on Accreditation

Webinar Series on Accreditation

The National Board of Accreditation (NBA), over the years, has made many quality paradigm changes including the change of model of accreditation. The 'input-process-output model' of assessment was replaced with the outcome-based model, aligning its methodology with international benchmarks, since 2009. NBA, India has become the permanent signatory member of the Washington Accord on 13th June 2014, thereby getting international recognition for graduates passing out of the accredited programs of Indian institutions. It has also been a member of the NABEEA (Network of Accreditation Bodies for Engineering Education in Asia), since 2011.

NITTTR Bhopal, an institution of MHRD, mandated for technical teachers training, has been in the forefront for promotion of accreditation of technical institutions across the country. Apart from regular calendar training programmes, it has designed and offers through SWAYAM portal, three MOOC programmes on accreditation of diploma, degree and Post Graduate level programmes. Though, there has been many activities in the front of accreditation, so far, there has been no formal large-scale exercise of documenting the experience of accreditation and promotion of accreditation. In this regard, NITTTR Bhopal has taken an initiative to reach out to maximum number of stakeholders in the system to document their experience and also to reach out to the faculty of institutions that have not gone through the process of accreditation.

It is in this context NITTTR Bhopal had started this series of 12 webinars on different criterion prescribed by National Board of Accreditation to bring quality in technical education system of the country. The online webinar series comprising of twelve webinars on different aspects and criteria of NBA accreditation had been launched from 7th July to 27 August 2020 by NITTTR Bhopal to create awareness about different dimensions and aspects of NBA accreditation and trained almost 9000 participants with following details:

i. Objectives of the Webinar Series

The participants will be able to-

- Apply different aspects of Outcome Based NBA accreditation
- Assess requirements of different criteria of NBA SAR
- Follow processes and procedure of NBA accreditation
- Facilitate activities of visiting team for assessment
- Prepare for NBA accreditation

ii. Webinar Statistics

S. No.	Title	Date	Coordinator	Faculty	Expert	No. of Attendee
W1	Vision, Mission and PEOs for technical institutions	7th July 2020	BLG	DSK, PD, CSR	Dr. A.G. Kokade	507
W2	Evolving and aligning teaching learning process for implementing engineering curriculum	9th July 2020	SP	MAR, SR, ASW, RKK	Dr. M.T.Beg	601
W3	Course outcomes and domains of learning	14th July 2020	SA	SP, AAK, CM, MAR	Dr. K.M.Babu	844

W4	Assessment of COs-POs-PSOs	14th July 2020	RKD	SA, AR, SKG, HJK	Dr. R.V. Ranganath	697
W5	Prepare Course & Programme Articulation Matrix	23rd July 2020	DSK	SA, ND, SSK	Dr. R.V. Ranganath	581
W6	Development and use of rubric for effective assessment	28th July 2020	SP	SR, AR, RKK, ASW	Dr. P. K. Tulsi	795
W7	Information required for Student performance	6th August 2020	SR	SP, AR, BS	Dr. A.G. Keskar	643
W8	Compiling Faculty information and contribution	13th August 2020	SR	DSK, AAK, SSK	Dr. A. K. Nassa	613
W9	Continuous Improvement, Institutional governance and support system	18th August 2020	RKD	BLG, CM, RP	Dr. Chittaranjan Mandal	675
W10	Applying for Accreditation	20th August 2020	SA	RKD, HJK, BS	Dr. A. K. Nassa	932
W11	Planning required during the visit and Post-visit activities	25th August 2020	DSK	SA, BLG, ND, CSR	Dr. B. B. Ahuja	797
W12	Action plan to prepare Institute for accreditation	27th August 2020	BLG	RKD, SA, PD, RP	Dr. K.M.Babu Dr. R.K.Jain Dr. V.R.Rao Prof. F.A.Khan	687

iii. Learning Analytics

Webinar	Average Attentiveness	Average Interest Rating
W1	84.07	84
W2	83.96	80
W3	84.45	82
W4	82.38	80
W5	81.12	79
W6	80.48	79
W7	79.29	77
W8	79.48	84
W9	81.08	77
W10	84.62	81
W11	81.78	79
W12	79.88	81

To complete this task in structured and effective way Director NITTTR Bhopal has constituted a team of 18 faculty members along with the mentioned experts to execute all the 12 webinars. The Accreditation Webinar series was inaugurated with best wishes of Dr. Anil Kumar Nassa, Member Secretary National Board of Accreditation (NBA) and the series ended with the enlightening words of Chairman NBA Prof. K.K. Aggarwal in which he emphasised that looking to the accreditation work volume and the expertise available at NITTTR Bhopal, both NBA and NITTTR Bhopal can work together to prepare NBA evaluator, faculty and institute ready for accreditation in a mission mode without diluting the quality standards.

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VI. Evidence Based Policy Making in Education Sector

Evidence Based Policy Making in Education Sector

No.	Project Investigators	Title of the Project	Objectives of the Project	Outcomes Expected
PROJECT GROUP 1: NATIONAL EDUCATIONAL POLICIES: PROGRAMMATIC INTERVENTIONS AND SYSTEMIC PROGRESSION				
1	Prof. D. Singh Karaulia and Prof. Sanjay Agrawal	Comparative Analysis of ICT Adoption in Higher Education and its status in Engineering Institutions in Western India	• Analyze Education and ICT Policies of selected countries of Asia. • Assess extent of adoption of ICT in terms of organizational maturity, adoption, effectiveness and impact in teaching & learning. in higher technical education. • Identify supporting & impeding factors in adoption thereof.	Report on: • Comparative analysis of ICT Policies in Higher Education of selected Asian countries and its extent of adoption • Assessment of effectiveness & impact of ICT promotion provisions in teaching & learning. • Policy implications and recommendations.
2	Prof. R. K. Dixit and Prof. D. Singh Karaulia	Comparative Analysis of Engineering Education: Policy Implications for India	• To analyze policy, regulations, and structures of engineering education in different countries. • To analyze input, process and output parameters of engineering education. • To draw policy implications from the above for Indian Engineering Education.	Report on policy implications with respect to following: • Size of Institution, size of batch, inclusiveness and infrastructure • Ideal number of graduates with respect to population and GDP • Incentives for R&D, patents and research publications • Strategies for enhancing quality of education
3	Dr Deepak Singh, and Dr Roli Pradhan	FacultyDevelopment Program in Technical Education.	• Analyze the relationship of self-efficacy on faculty teaching effectiveness . • Study the influence of FDP on self-efficacy, teaching competencies, and teaching perspectives. • Analyze the impact of outcome for improving the quality of teachers through FDP	• Programmes for cultivating highly efficacious teachers to cope with the needs of students. • Report on pedagogical and curricular implications of Faculty Development Program in India. • Best instructional practices and the strategies that develop effective teaching behaviors and skills.
4	Dr Roli Pradhan &	Effect of Private Players' Investment in Technical Education	• Identify the key changes & pattern of technical education expansion in India in last three decades,	• Policy reforms and private sector investment pattern in last three decades

No.	Project Investigators	Title of the Project	Objectives of the Project	Outcomes Expected
	Dr Deepak Singh	in India: An Impact Analysis.	• Analyze the impact of participation of private players in terms of Expansion, Equity & Excellence • Strategy for private players' investment and future directions.	• Report on the impact of private sector investment on expansion, equity and excellence • Suggestions /insights and directions for future policy initiatives.
Project Group 2: Curriculum Models: Progressions towards Green Curriculum				
5	Prof. Joshua Earnest, Dr.(Mrs.) Vandana Somkuwar, and Dr.P.K Purohit	Outcome-based Green Curriculum Model for Undergraduate Engineering Programmes	• Evolve outcome-based green curriculum model for UG engineering programmes. • Identify the industry-relevant green technology related competencies required by the industries employing the graduates with respect to any three-core engineering degree programmes. • Develop detailed outcome-basedgreen UG curriculum for an engineering programme, based on the evolved model.	• Outcome-based green curriculum model for UG engineering programmes. • List of green technology related UG level competencies of three major programmes. • Detailed outcome-basedgreen UG curriculum for one major engineering programme based on the evolved model.
6	Prof.(Mrs.) Susan S. Mathew, Dr. A.S Walkey andDr.Bashirulla Shaik	Outcome-based Green Curriculum for Engineering Diploma Programmes and Implementation Strategies	• Evolve outcome-based green curriculum model and identify the related competencies required by the industries with respect to any three-core engineering diploma programmes. • Develop detailed outcome-basedgreen engineering diploma curriculum for an engineering programe, based on the evolved model. • Evolve the strategies to incorporate green technologies in the identified competencies and skill sets to be developed in the students of any one of the core engineering diploma programmes.	• Outcome-based green curriculum model for engineering diploma programmes. • List of green technology related engineering diploma level competencies of three major programmes. • Detailed outcome-basedgreen engineering diploma curriculum for one majorprogramme based on the evolved model. • Strategies to incorporate the identified competencies and skill sets.
Project Group 3 Technical Teacher's Training –An Impact Analysis				
7	Dr. Kiran Saksena and Dr. V. D. Patil	Impact of Faculty Development Programmes (FDPs) on Performance of Teachers of Technical Institutions in India	• To analyze existing practices of FDPof teachers of technical institutions in India and abroad. • To assess the impact of FDPs offered through different modes of delivery • To suggest a viable and economical model of FDP for technical teachers in Indian context.	• Different types of FDPs being offered in India and Abroad • Viable and economical model of FDP • Projected action plan to train existing technical teachers.

No.	Project Investigators	Title of the Project	Objectives of the Project	Outcomes Expected
8	Dr. S. S. Kedar	Effectiveness of a proposed "outcome based" technical teacher training offered through blended mode	• Design and develop an outcome-based training programme based on the identified competencies. • Develop implementation plan, learning resources and assessment scheme for identified module. • Implement the module through blended mode and ascertain its effectiveness.	• Competency profile of technical teachers. • Design of a proposed "outcome based" training programme. • Strategies for certificate programme through blended mode.
9	Prof. M. A. Rizvi	Big Data Analytics in Assessment and Impact Studies of Technical Teachers Training Programs	• To prepare a comprehensive database on Trainers, Trainees and Training Programs • To design predictions, models and assessment of future options using Big Data Analytics • To support evidence-based decision making using Big Data Analytics and Map Reduce for training effectiveness	• Comprehensive Database of Trainers, Trainees and Training Programs • An analytic framework for creation of evidence on various training programs • Decision support system for training policy design
10	Prof. Shailendra Singh	Design and Development of Web Automation Framework for Needs Analysis, Design of Training Programs and Efficiency improvement	To design a Web Interface to automate: • Data collection, communication and management • Training need analysis and Training programs • Institutionalized Feedback and respond mechanism and • Design of templates	• Web Automation Framework Software tool for web design and data gathering • Generic e-Form Engine, Web Database Interface & GUI Relational Mapping, e-Form Templates, User Management System, Web Personalization and Automation Framework etc.
PROJECT GROUP 4- Teacher Proficiency: Levels, Training and Certification				
11	Prof. Mrs.ChanchalMehra and Prof. Prabhakar Singh	Study of proficient teachers' attributes serving in diploma level technical institutes in India	• Identify attributes of proficient teachers of diploma level technical institutes • Develop Professional Standards for Teachers that describe the professional knowledge, professional skill and practices of competent teachers. • Evolve a system of accreditation for teachers of diploma level technical institutes	• Attributes of proficient teachers in diploma level technical institutes in India. • Professional Standards for Teachers of diploma technical institutes. • System of accreditation for teachers of diploma level technical institutes.
12	Prof. Mrs.AnjuRawlleyand	Evolving and accrediting proficient teachers' attributes required in degree	• Identify attributes of proficient teachers of degree level technical institutes	• Attributes of proficient teachers in degree level technical institutes in India

No.	Project Investigators	Title of the Project	Objectives of the Project	Outcomes Expected
	Prof. Sharad Pradhan	level technical institutes of India.	• Develop Professional Standards for Teachers that describe the professional knowledge, professional skills and practices of competent teachers. • Evolve a system of accreditation for teachers of degree level technical institutes	• Professional Standards for Teachers of degree technical institutes • System of accreditation for teachers of degree level technical institutes
Project Group : 5 Structure and assessment schemes of UG and Diploma programmes:-A Topical Analysis				
13	Dr. S. K Gupta, Dr J.PTegar, Dr C.S. Rajeshwari, Dr. Alan Rocha, Dr S.Singh, Dr S Roy and Dr. Hussain	A critical study of UG curriculum of main branches of engineering offered at major universities and institutions	• Analysis of design and philosophy of credit based UG Engineering program w r to. program structure, content, weight-age to basic, core and elective subjects including mode of offering elective subjects, extent of emerging technology, repetition of contents, degree of obsolescence and trivial contents in the courses. • Analyze the emphasis given to laboratory instruction, mini, minor and major projects including industrial training. • Design and develop suggestive model programme structures for curriculum of programmes in main branches of engineering.	• Report/guideline documents: • A report on prevailing status of UG curriculum of main branches of engineering in major state Universities and prominent Deemed Universities (including NITs but excluding IITs) in India. • A suggestive model curriculum structure validated for UG programmes of main engineering branches. • A report on prevailing status of curriculum of main branches of diploma engineering programmers in major state Universities and prominent Technical Exmaination Boards in India. • A suggestive model curriculum structure validated for Diploma programmes of main engineering branches.
14	Dr C.S. Rajeshwari, Dr. S. K Gupta, Dr J.PTegar, Dr. Alan Rocha, Dr S.Singh, Dr S Roy and Dr. Hussain	A critical study of Diploma curriculum of main branches of engineering offered at major universities and prominent Boards of Technical Examination in India.		
15	Dr J.PTegar, Dr. S. K Gupta, Dr. Alan Rocha, Dr C.S. Rajeshwari ,Dr S.Singh, Dr S Roy andDr. Hussain	A critical study of assessment schemes in main branches of UG engineering programmes in premier institutions in India.	• Analysis of assessment of Learning Out Comes and Distribution of marks in Progressive Assessment (mid-term exam, mini projects, assignments, attendance etc.), • Approach of Assessment of Performance in practical experiments/ lab work, project work, industrial training etc, Extent of Self-Assessment.	• Prevailing status of assessment in UG engineering curriculum in selected state Universities and prominent Deemed Universities • A model assessment scheme for UG Programmes to enhance employability. • Prevailing status of assessment in diploma engineering curriculum in selected state Universities and Board of Technical Educations in India

No.	Project Investigators	Title of the Project	Objectives of the Project	Outcomes Expected
16	Dr. Alan Rocha,Dr. S. K Gupta, Dr J.PTegar, Dr C.S. Rajeshwari, Dr S.Singh, Dr S Roy and Dr. Hussain	A critical study of assessment schemes of main branches of diploma engineering programmes in premier institutions in India.	• Design and develop a suggestive model for assessment of students for assessment of outcomes with an emphasis on assessment of performance	• A model for performance-centric assessment scheme for diploma Programmes to enhance employability.
Project Group 6: Service Conditions and Productivity: A Comparative Analysis				
17	Prof. K. K. Jain and Prof. M. C. Paliwal	A Comparative Study of Service Conditions and its Impact on Teacher Productivity in Accredited and Non-accredited Technical Institutions	• Assess the present status of service conditions of teachers in technical institutions • Identify factors affecting the service condition and analyze its impact on teachers working in technical institutions. • Evolve strategies for providing better service condition to teachers for productivity improvement.	• List of significant factors of service condition of teachers working in technical institutions • Strategies for providing better service condition to teachers in technical institutions for improving their performance.
18	Prof. K. James Mathai	The Impact of Digital Technology on Productivity of Technical Teachers in Teaching and Learning Process	• Analyze the present studies on impact of digital technology in all its forms on productivity of teachers' in the technical institutions • Synthesis the evidence from survey and meta-analysis of above studies about the impact of use of digital technology in all its forms on various educational parameters in technical institutions. • Evolve learning models and strategies to leverage the use of digital technology in all its forms for increasing the productivity of technical teacher's.	• Current status of Impact of technology in all its forms in technical institutions • Evolve Learning Models and strategies to leverage the use of digital technology in all its forms for increasing the productivity of teachers of technical institutions.
19	Prof. M. A. Rizvi	Analysis of Job Stress Affecting the Performance of Technical Teachers.	• Analyze the extent to which job stress affect the performance of technical teachers in their places of work.	• Trends and insights on impact on quality of education with respect to service conditions of teacher • Evolve Strategies for quality improvement in Technical education

No.	Project Investigators	Title of the Project	Objectives of the Project	Outcomes Expected
			• Develop strategies for avoiding technical teachers' job stress	
Project Group 6: Service Conditions and Productivity: A Comparative Analysis				
17	Prof. K. K. Jain and Prof. M. C. Paliwal	A Comparative Study of Service Conditions and its Impact on Teacher Productivity in Accredited and Non-accredited Technical Institutions	• Assess the present status of service conditions of teachers in technical institutions • Identify factors affecting the service condition and analyze its impact on teachers working in technical institutions. • Evolve strategies for providing better service condition to teachers for productivity improvement.	• List of significant factors of service condition of teachers working in technical institutions • Strategies for providing better service condition to teachers in technical institutions for improving their performance.
18	Prof. K. James Mathai	The Impact of Digital Technology on Productivity of Technical Teachers in Teaching and Learning Process	• Analyze the present studies on impact of digital technology in all its forms on productivity of teachers' in the technical institutions • Synthesis the evidence from survey and meta-analysis of above studies about the impact of use of digital technology in all its forms on various educational parameters in technical institutions. • Evolve learning models and strategies to leverage the use of digital technology in all its forms for increasing the productivity of technical teacher's.	• Current status of Impact of technology in all its forms in technical institutions • Evolve Learning Models and strategies to leverage the use of digital technology in all its forms for increasing the productivity of teachers of technical institutions.
19	Prof. M. A. Rizvi	Analysis of Job Stress Affecting the Performance of Technical Teachers.	• Analyze the extent to which job stress affect the performance of technical teachers in their places of work. • Develop strategies for avoiding technical teachers' job stress	• Trends and insights on impact on quality of education with respect to service conditions of teacher • Evolve Strategies for quality improvement in Technical education
PROJECT GROUP 7: SKILL INDIA MISSION: IMPACT ON EMPLOYABILITY AND SOCIAL EQUITY				

No.	Project Investigators	Title of the Project	Objectives of the Project	Outcomes Expected
20	Prof. Nishith Dubey	Study of Implementation of Prime Minister Kaushal Vikas Yojna (PMKVY) in Technical Institutions	• To identify the local needs and curriculum of training programmes. • To critically examine the implementation & effectiveness of the training programmes. • To ascertain the effect on employability and social equity due to training programmes.	• Local need-based training programmes will be identified. • Sample competency & outcome-based curriculum of training programmes • Effect of training on employability and social equity.
21	Dr. Nishith Dubey and Dr. Atul Mishra	Study of problems related to infrastructure and pedagogy in implementation of Community Colleges scheme under AICTE.	• Identify infrastructure related problems in effective implementation of Community Colleges scheme • Identify pedagogical related problems in its effective implementation • Create solutions for the identified problems in effective implementation of the scheme.	• Infrastructural problems in effective implementation of Community Colleges scheme under AICTE • Pedagogical related problems in effective implementation of Community Colleges scheme • Solutions for Infrastructural and pedagogical problems in effective implementation of the scheme.
22	Prof. Anjana Tiwari and Dr. Atul Mishra	Impact on employability of technical graduates through development of communication skills	• To evaluate the effectiveness of the use of Language lab in teaching communication skills, on employability. • To assess the effect of training through language lab on employability of technical graduates • To identify teaching competencies of language teachers	• Modification in the style of teaching in Language lab. • Enrichment of communication skills of faculty. • Guidelines for designing more effective teaching-learning sessions in future.
23	Prof. A. K. Jain & Dr. R.B.Shivgunde	Impact of Scheme of CDTP on Employment and Social Equity	• To determine the employment status of trained persons viz -a- viz social equity in identified areas • To find out enhancement of earnings • To ascertain the needs for further training programmes for all groups.	• Major areas & Vocational trades in which vocational training was imparted. • The status of self & wage employment • Trades in which further training is required to the employed persons. • Policy support to the Government
Group 8: Institutional Autonomy: Models and Impact Analysis				

No.	Project Investigators	Title of the Project	Objectives of the Project	Outcomes Expected
24	Dr. V. H. Radhakrishnan and Dr. B. L. Gupta	Critical examination in polytechnics and engineering colleges with respect to academic, financial, administrative and managerial aspects.	• To ascertain the current status of autonomy in terms of fulfilment of the objectives • To identify the facilitating and impeding factors for sustenance of autonomy. • To evolve mechanism and strategies for long-term sustenance of autonomy.	• Status of autonomy in polytechnics & engineering colleges, including facilitating and impeding factors towards sustenance/ non-sustenance. • Mechanism and strategies for long term sustenance of autonomy in technical Institutions.
25.	Dr. B. L. Gupta and Dr. V. H. Radhakrishnan	A study on problems and challenges of affiliating Polytechnics	• To assess current performance of affiliating polytechnics • To determine problems and challenges of affiliating polytechnics. • To devise strategies to overcome problems and challenges and enhance performance of affiliating polytechnics	• Current performance of affiliating polytechnics • Problems and challenges of affiliating polytechnics. • Strategies to overcome problems, challenges and enhance performance of affiliating polytechnics.
26	Prof. A. A. Khajanchee and Dr. R. K. Kapoor	A critical study of academic, financial, administrative and managerial autonomy of polytechnics vis a vis state boards of technical education (BTE)/ technical university and DTE	• To ascertain the current status of autonomy • To assess the effect of "autonomy "or "no autonomy" of Boards and DTE on the performance of polytechnics • To compare the performance of autonomous and non-autonomous BTEs • To suggest strategies for maximizing the benefits of "autonomy" or "no autonomy" on the performance of the BTE, DTE vis-a- vis performance of polytechnics.	• Effect of "autonomy "or "no autonomy" of Boards and DTE on the performance of polytechnics. • Current status of autonomy in Polytechnics and Impact of autonomy on performance of the institute. • Strategies for maximizing the benefits of "autonomy" or "no autonomy" on the performance of the BTE, DTE vis-a- vis performance of polytechnics. • Comparative performance of autonomous and non-autonomous BTEs.
27	Dr. R. K. Kapoor and Dr. A. K. Sarathe	Impact of autonomy on performance of the Engineering colleges with respect to academic, financial, administrative and managerial aspects	• To ascertain the current status of autonomy in engineering colleges with respect to academic, financial, administrative and managerial aspects and factors for implementation of autonomy. • To assess the impact of autonomy on performance of the institute and external primary stakeholders.	• Current status of autonomy in engineering colleges and factors for implementation of autonomy. • Impact of autonomy on performance of the institute and external primary stakeholders. • Mechanism and strategies for maximizing the benefits of autonomy.

No.	Project Investigators	Title of the Project	Objectives of the Project	Outcomes Expected
			• To devise mechanism and strategies for maximizing the benefits of autonomy.	
Project Group 9: Accreditation: Process Design and Impact-An International Comparison				
28	Dr. B. L. Gupta Dr. Sanjay Agrawal Dr. D.S.Karaulia Dr. R.K. Dixit Dr. Sharad Pradhan	Comparative study of accreditation criteria and processes in selected Washington accord signatories and India	• To compare accreditation criteria in selected Washington accord signatory countries and India • To compare accreditation processes in selected Washington accord signatory countries and India	• Implications and recommendations on accreditation criteria and ocesses
29	Dr. B. L. Gupta Dr. Sanjay Agrawal Dr. D.S.Karaulia Dr. R.K. Dixit Dr. Sharad Pradhan	Impact of accreditation on organisational governance in engineering programmes	• To ascertain the impact of accreditation in institute planning • To ascertain the impact of accreditation in institute management • To ascertain the impact of accreditation in monitoring, control of the institute	• Impact of accreditation in leadership and organisational management of the institute • Influence of accreditation in policy making of the institute • Impact of accreditation on systematic reforms in the institute.
30	Dr. B. L. Gupta Dr. Sanjay Agrawal Dr. D.S.Karaulia Dr. R.K. Dixit Dr. Sharad Pradhan	Impact of accreditation on faculty and student experiences	• To ascertain impact of accreditation on student experiences in curricular activities • To ascertain the impact of accreditation on Student outcome • To ascertain impact of accreditation on faculty preparedness and experiences for implementation of curriculum and measuring student outcome	• Impact of accreditation on student experiences in curricular activities • Measure the impact of accreditation on student outcome • Impact of accreditation on faculty preparedness for implementation of curriculum • Impact of accreditation on faculty experiences in measuring student outcome
30	Dr. B. L. Gupta Dr. Sanjay Agrawal Dr. D.S.Karaulia Dr. R.K. Dixit Dr. Sharad Pradhan	Analyze influence of accreditation on curriculum reforms in Tier – I institutions	• To ascertain impact of accreditation on curriculum reforms to establish correlation between student outcome and curricular innovations • To ascertain impact of accreditation on convergence of POs and PSOs against curriculum design • To ascertain relevance of COs with curriculum, POs, PSOs and student outcome	• Assess curriculum reforms to establish correlation between student outcome and curricular innovations • Assess the convergence of POs and PSOs against curriculum design • Assess relevance of COs with curriculum, POs, PSOs and attainment of student outcome
Group 10: Economics of Education				
31	Prof. Aashish Deshpande	Expansion of Technical Education in India and the Task	• Identify the key changes and pattern of engineering education expansion in India in last three decades. • Examine the inter-relationship of technical education financing and economic development in India.	• Trends and insights on technical education in India and its contribution in India's economic development.

No.	Project Investigators	Title of the Project	Objectives of the Project	Outcomes Expected
		of Inclusive Economic Growth	• Develop a model to explore the relationships between the technical education and economic development using the human capital theory and Keynesian economic principle.	• Policy options and strategies to further enhance investment in technical education sector in India. • Support study for augmenting and enhancement of plan allocation in technical education sector.
32	Dr C Thanagaraj and Dr Roli Pradhan	Technical Manpower Demand Projection- A Modeling approach	• Identify major influencing factors of technical manpower demand • Formulation and validation of model using regression and evolutionary methods • Projection of technical manpower for the future	A systemic framework and validated models for futuristic projections of technical manpower in the country
33	Dr C Thangaraj and Dr.Aasish Deshpande	Capacity Expansion of Technical Education System Under Conflicting Policy Objectives	• To translate policy initiatives into tangible objectives • Design a model for expansion of supply subject to resources and demand constraints and conflicting policy objectives • Design of a Decision Support System for future expansion of technical education system	• Standardized modeling method for optimal capacity expansion under conflicting policy objectives • A Decision Support System for policy design for alternative Scenarios

Annexure-IV: Recent Technological Innovations

NITTTR Bhopal, an institution of MHRD, mandated for technical teachers training, has been in the forefront for bringing quality in technical education through its pedagogical and technological interventions.

The faculty at NITTR Bhopal is striving hard to bring innovative products, following are the glimpses of such recent research efforts:

1. Road cum Rail Track Garbage Cleaning and Slurry Suction Vehicle
2. Automatic Public Ration Distribution Machine
3. Design and Development of Compact Magnetic Thermal Decomposition Unit for Mixed Municipal Solid Waste Management (Submitted)
4. Low Cost 3D-Printer

1. Road cum Rail Track Garbage Cleaning and Slurry Suction Vehicle

Through this endeavor our aim is to extent our service to the nation by providing a 'Road cum Rail Track Garbage Cleaning Vehicle' thereby minimizing manual cleaning and realizing improved health and hygiene of commuters and to meaningfully contribute towards **'Swachh Rail Swachh Bharat'**.

Concise Description

Indian Railways is one of the world's largest railway networks comprising of 115000 km of track and 7172 railway stations. Indian Railways runs 12,617 passenger trains and 7421 freight trains daily. Sanitation is indeed a major and critical challenge faced by IR as effective management of disposal of dry and wet garbage throughout the length and breadth of the country. Despite having a large force to deal with its waste problem, the railway stations are largely dependent on rag pickers and manual cleaning through metal plates, brooms and high pressure water jets. The Hose pipes supplying water often leaks and the pressure generated are not sufficient for cleaning operations. In the end, the workers have to use brooms and metal plates for scraping the dirt. Even the channels conducting waste into the drains are not well-dug and water mixed with excreta stagnates in them. The workers have to drag their brooms along the channels/trench to clear them.

The developed railway track cleaning is a self-propelled vehicle which can move on rail as well as road in both the directions equipped with Road cum rail attachment, dry and wet suction units, water spraying unit, insecticide spraying unit, display unit, control system, Auxiliary engine, driver cabin and a noise insulated back cabin. The vehicle is multifunctional and easy to operate. It requires two persons to perform automatic cleaning of the railway track. The cleaning action is achieved by the combination of a dry suction unit and a wet suction unit. It is designed for quick and effective pick-up of all

litters ranging from plastic bags, waste papers, crushed plastic bottles, beverage cans, plastic plates, plastic pouches and other wastes. Garbage which is sticky in nature or residuals can be pushed towards the drains running along the tracks by the high pressure water jets. To clear the slurry from the trench (parallel to the track), the suction pipe can easily be placed at appropriate position in the side trench to suck the sewage slurry. An insecticide/sanitization unit is placed at the back of the vehicle with spraying nozzles to kill insects, cockroaches and rats. Both dry and wet garbage are collected in different tanks and once filled it can be decanted at appropriate local municipal garbage collection point. Being rail cum road vehicle, it can be used as material/ garbage transport vehicle/ maintenance/inspection/carrier vehicle from track to road and vice-versa by Indian railways.

Objectives

- ✓ To replace the manual cleaning of railway track completely.
- ✓ To develop a prototype of 'Road cum Rail Track Garbage Cleaning Vehicle' with following features:
    - Road cum rail attachment for making it capable to move on rails and toad both.
    - Suction unit for dry garbage cleaning
    - Suction unit for wet garbage cleaning
    - Water nozzle bank to clean the residual wet garbage and push it towards the side trench
    - Telescopic arm to suck slurry from Trench and for selective picking
    - As a disinfectant spraying vehicle
    - Being rail cum road vehicle, it will be used as material/ garbage transport vehicle from track to road by Indian railways. As a garbage/material transportation vehicle from rail to road
    - As maintenance/inspection vehicle between stations as it is a rail cum road vehicle with max speed on track as 40 km/hr .

Originality/novelty of the invention

The developed vehicle has following salient features that make it better and effective as compared to existing research endeavors:

- It is a self-propelled road cum rail vehicle.
- Can switch between Rails and Road with minimum efforts.
- It has got two engines. One to propel the vehicle and other to drive all other subsystems.
- Only two persons are required to drive, position and control the vehicle.

- A display unit is provided for real time control of the cleaning under drastically changing environment.
- A dry suction unit is implemented for dry waste which could be easily collected by suction.
- A wet suction unit used for cleaning of wet garbage.
- Water jets completely removes the human waste and other wet garbage from the inter rail space zone.
- A flexible suction pipe can easily be placed at appropriate position in the side trench to suck the sewage slurry.
- Insecticide spraying unit for complete sanitization of the track.
- Compact in size.
- Cost efficient.
- Minimum manual efforts.
- Easy training for operator.
- Reverse and Forward movement is possible.

Project details

Funding Department: Department of Science and Technology (**DST**), Ministry of Science and Technology, Government of India,

Scheme:	Technology Systems Development Programme (TSDP)
Reference Number:	DST/TSG/AMT/2015/369/G
Amount funded:	51,51,600/- (INR)
Duration:	2 Years (Dec. 2017-Dec. 2019)
Status:	Completed 07.12.2019

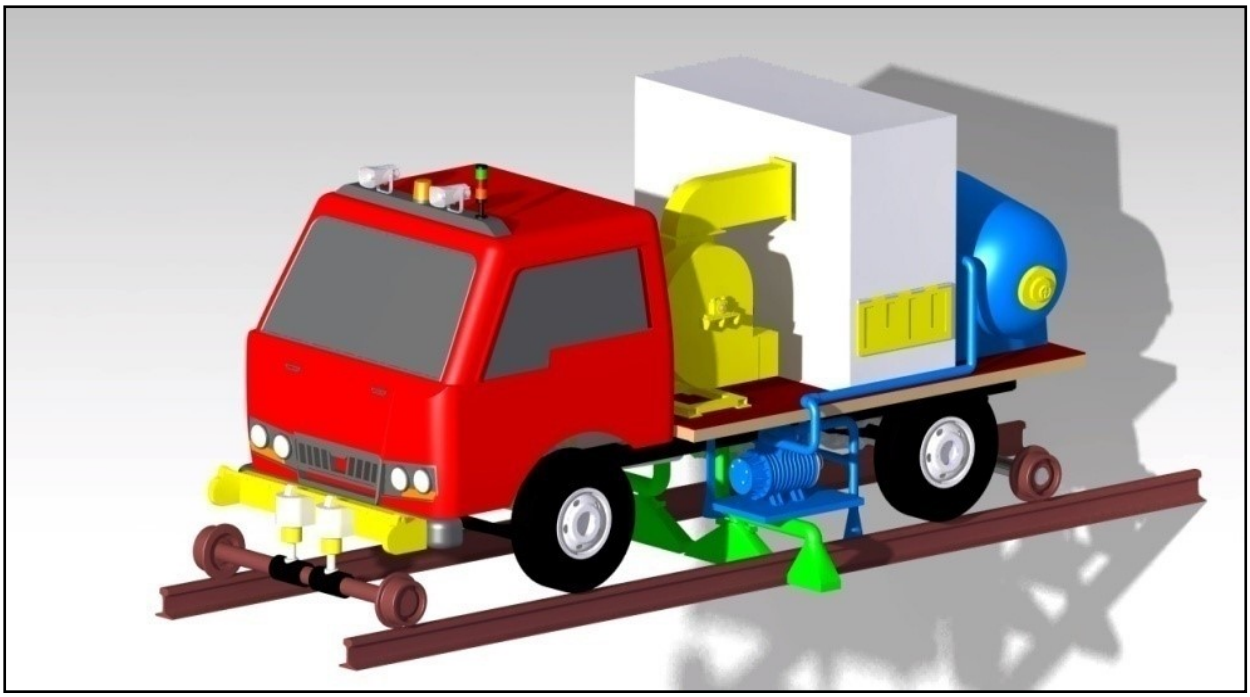

Figure 1: Solid Model of Multifunctional Railway Track Scavenging Vehicle without Back Cabin

Figure 2: Isometric View of the developed Vehicle

Figure 3: Back View of the developed Vehicle

Potential Impact

By incorporating this vehicle in India for railway track cleaning the society would be benefitted in following ways:

- Service to the society by minimizing manual cleaning.
- Improved health and hygiene of commuters.
- Reducing the overall maintenance cost of the Indian Railway tracks indeed boosting the G.D.P.
- Swachh Rail Swachh Bharat
- Expanding the tourism scenario in India

The overall face lifting of Indian Railways

Commercialization

As far as commercialization of the developed vehicle is concerned following two major steps are required:

1. The developed vehicle should be adopted by Indian railways as a cleaning and sanitizing vehicle for all of its stations through Directorate of Environment and Housekeeping, Railway board, Ministry of Railways, Rail Bhavan, New Delhi.
2. Identified manufacturing industry along with the Principal Investigator of the project can be associated to produce its commercial version on mass scale.

Video Link

https://youtu.be/8xd6ncPUrXc

2. *Automatic Public Ration Distribution Machine*

Through this research effort we would like to propose and develop an automatic multifunctional Public Ration Distribution Machine to replace all the manual activities performed at existing Ration shops for distribution of Ration and to meaningfully contribute towards **'Digital India'** drive.

Objectives

✓ To automate current ration distribution system.

Potential Impact

By incorporating this machine at state level for automatic for automatic distribution of subsidized ration, the society would be benefitted in following ways:

- It will prevent public for taking undue advantage of current system loop holes and will save the poor from disgrace of the ration shop owners.
- It will reduce the long queues out the current Ration shops,
- It will reduce other human efforts in terms of tenders, shop manager/workers,
- It will reduce money trafficking,
- It will reduce non-poor taking advantage,
- It will reduce paper work and time to serve to public (24 x 7).
- It will also enhance data security with encryption, biometrics and pin. Linking of 'Ration card' with 'Aadhar card' will also help in easy implementation, easy data maintenance, better record keeping and direct benefit to the targeted public.
- It possess Automatic metering and distribution of ration items like rice, wheat, sugar, salt, kerosene based on the eligibility of the person.
- It has automatic handling and updating the database of eligible persons.
- It supports automatic (preferable digital) money transaction facility as per subsidized rates.
- It has got automatic record keeping facility.
- It enables Digital Ration card reading and linking facility.
- User friendly and very easy to understand interactive panel like EVMs and ATMs.
- Onboard power generation unit and battery support.

Commercialization

As far as commercialization of the developed vehicle is concerned following major steps are required:

2. The developed vehicle should be adopted by state and central Ministry of Food & Public Distribution to automate the complete process of ration distribution.

3. The machine can also be used to distribute ration/other commodities in case of any pandemic/emergency.
4. Identified manufacturing industry along with the Principal Investigator of the project can be associated to produce its commercial version on mass scale.

Employment Generation:

5. Approximately 30 persons at different level ranging from Manager works, Design Engineer, Maintenance supervisor, Production supervisors, Purchase officer, Account officer, Fitters, Welders, Painters, Plumbers, Machinist, Casting experts, Hydraulic automation expert, Workers etc. can get employment in the manufacturing unit.

- Once it is adopted by state and central Ministry of Food & Public Distribution and deployed at localities for automatic distribution of ration at subsidized rates or MRP, the complete supply chain management and maintenance contracts related to this machine and associated system can be given to the identified private service providers which in turn generate huge scope of further employment.

Video Link

https://www.youtube.com/watch?v=gxVe22t-WPo&feature=youtu.be

https://www.youtube.com/watch?v=CyDDpxc1Sek&feature=youtu.be

Figure 3: Photograph (front view) of Full Machine

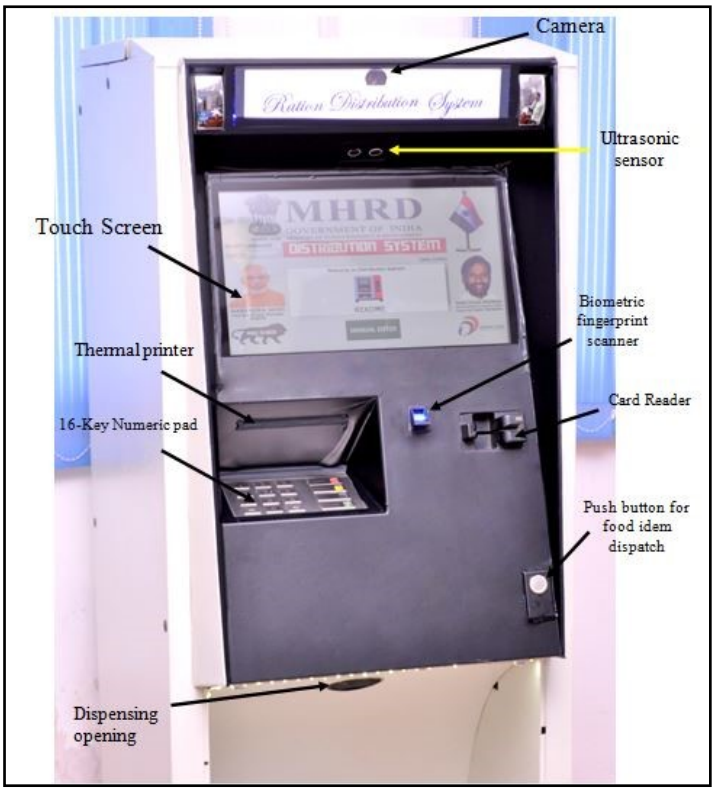

Figure 4: Close up view of machine with component details

3. *Design and Development of Compact Magnetic Thermal Decomposition Unit for Mixed Municipal Solid Waste Management (Submitted)*

Through this endeavor our aim is to extent our service to the nation by providing a 'Compact Magnetic Thermal Decomposition Unit for Mixed Municipal Solid Waste Management' thereby minimizing land filling, primary and secondary transport of MSW and to meaningfully contribute towards **'Swachh Bharat'** mission.

The proposed unit is a compact unit for Magnetic Thermal decomposition of Mixed MSW. These compact units can be installed at different locations in each municipal locality/society/colony thereby completely avoiding any primary and secondary transport of the garbage. This machine will decompose the Mixed MSW thermally at the point of generation of garbage itself. This unit has capacity to decompose one ton Mixed MSW to 3-5 Kg of ash per day. The ash so produced can be further used by the Municipal corporation for Road pothole filling, making bricks and as other civil construction activities. The Syn gases generated due to controlled magnetic thermal decomposition of mixed MSW will be reused to run the unit in practically perpetual mode. After decomposition of the mixed garbage, the unit will produce practically zero pollution and there is practically no requirement of any external fuel/power to run the proposed unit.

Major applications of the proposed technology

1. To thermally decompose Mixed MSW at the point of generation itself.
2. Proposed compact unit for magnetic thermal decomposition of Mixed MSW can be installed at different locations in each municipal

locality/society thereby completely avoiding any primary and secondary transport of the garbage to either the land fill location or remotely placed Waste to Energy plant.

3. It is targeted that this unit will decompose one ton Mixed MSW to 5 Kg of ash which can be further used by the Municipal corporation for Road potholes filling and as civil construction material.

4. The Syn gases generated due to magnetic thermal decomposition of Mixed MSW will be reused to rum the unit in practically perpetual mode. Thriugh this decomposition the unit will produce almost zero pollution and there is practically no requirement of any external fuel/power. It is a self sustained unit which will thermally decompose the garbage there itself.

Target Beneficiaries & Expected Impact

The proposed Compact Mixed MSW unit is a de-centralized and scientific method of thermal decomposition which avoids costly logistics to transport the waste to either landfill locations or to Waste to Energy plants and segregation of garbage. The beneficiaries are:

1. General public with improved health and hygiene.
2. Waste-picker and families
3. Local Municipal Corporation: for getting rid of primary and secondary transport of mixed MSW, separation, land filling and associated operations.
4. Industry: going to be benefited by taking up the production of proposed compact unit on mass scale, thereby generating more employment.
5. The poorest who often live near waste dumps and power their city's recycling system through waste picking, leaving them susceptible to serious health repercussions.
6. No air, water, noise, environment and soil pollution due to primary and secondary transport and land filling of mixed MSW.
7. No uncontrolled or nonscientific burning of garbage (the third biggest cause of greenhouse emission in India).
8. No landfills hence:

- No landslides of the waste dumps which can bury homes and people under piles of waste.
- No emission of the methane, that is approximately 21 times as potent as carbon dioxide (OECD).

- No flow of the toxic leachate, which otherwise continuously flows out, making dump-yards susceptible to natural and artificially caused fires, hence putting the lives of waste-picker families at risk..
- No land area will be occupied by the dump yard which causes, air pollution, soil toxicity, water pollution and never the less bad smell right in the middle of the city or may be nearby outskirts. Acres and acres of land has been wasted, which instead can be used for developing infrastructure (like schools college hospitals township etc) will be add-on to the society and the city.

Future commercial exploitation of technology

Once the design and development of proposed unit is completed than following steps are required to commercialize it:

1. As a pilot testing of the project at least two to three prototypes should be developed and installed in different localities with varied quantity of garbage, people literacy, high and low population etc to test the performance of the developed unit.
2. Once the testing is over then the technology can be transferred to identified industry with PI as technical partner to produce these units at mass scale.
3. The Municipal Corporation should be contacted to adopt this technology and unit in all their colonies and localities.

Development status at the participating agencies

1. Completed comprehensive study and survey of existing approaches and plants related to Municipal Solid Waste Management.
2. Developed a small lab level unit to perform experiments related to Mixed Municipal Solid Waste (MMSW) magnetic thermal decomposition and got reasonably good response. (Few photographs attached)
3. Completed preliminary simulated study using ANSYS software based on Computational Fluid Dynamics approach related to Thermal decomposition of Mixed MSW and production of the Syn gases. (Post processing results of 2D CFD are attached)
4. Developed solid model of the proposed Compact Magnetic Thermal Decomposition Unit for Mixed MSW Management. (Few figures attached)
5. Established linkages (letter of consent attached) with following industries for future technical support and their experience related to Thermal decomposition of Mixed Municipal Solid Waste:
    - Trimuti Production,

Plot A2 Sector E, Sanwer Road, Industrial Area, Indore (MP) India

Mr. Tribhuvan Yadav (Proprietor) (Contact No. 9893775322)

https://www.trimurtiproduction.com/

- Naghul Techindus

No. 41, Ameer Street, Om Sakthi Nagar, Kaveripakkam, Vellore District, Vellore-632508, Tamil Nadu, India

Selva Kumar (Proprietor) (Contact No. 8220878537)

https://www.indiamart.com/naghul-techindus/

A scale down lab demonstration model of the same has been developed at NITTTR Bhopal. Initial performance testing has already been completed on this scale down model. The computer aided design and analyses of different subassemblies associated with the proposed vehicle have been completed and following sections show the proof of concept through solid models prepared, experimentation model developed and analyses done for the proposed unit.

Solid Models developed

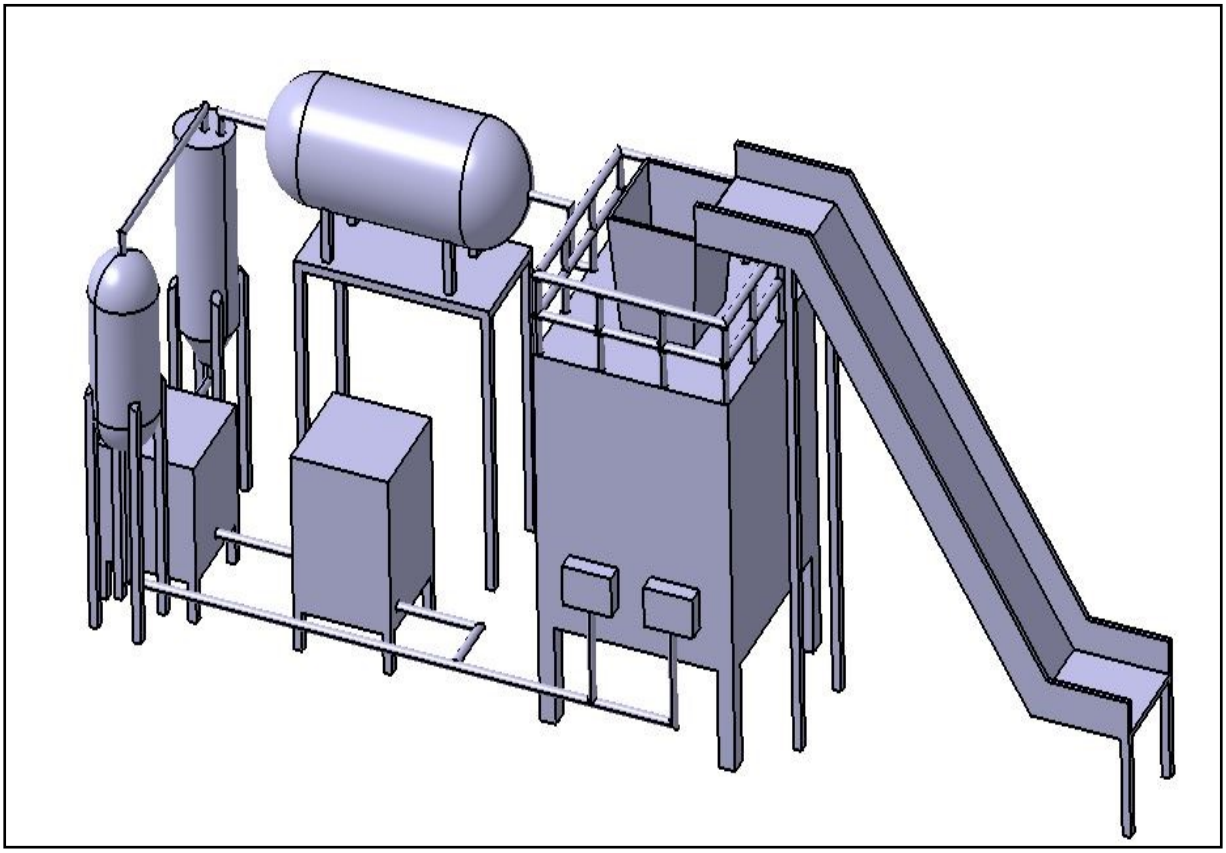

Figure 1 – Conceptual Model of the Proposed Unit

Experimental unit developed

Figure 3 – Experimental Setup-1 developed to measure the process and performance parameters

Figure 4 – Details of Experimental Setup-1 developed to measure the process and performance parameters

Figure 6 – Details of Experimental Setup-2 developed to measure the process and performance parameters

4. *Low-Cost 3D Printer*

Fused deposition modeling fabricates a 3D model from CAD data using a heated tip to extrude thermoplastic material onto a surface layer-by-layer. At present, there are number of commercial 3D printers' manufacturers who have improvised on number of process parameters, functionalities and aesthetics of this process.

Owing to the high cost, material restrictions and difficulty to study process parameters of commercial 3D printers an open source 3D printer is designed and developed taking into consideration the cost analysis as well. A comparison of similar attributes of commercial and open source 3D printers is done to study and shortlist the specifications in general based on which a low-cost 3D printer is designed and developed.

The selected components are designed, printed and purchased to develop the basic framework and structure of the 3D printer. Once the process is finished Marlin firmware is uploaded through Arduino software onto the Arduino ATMEGA 2560 AVR microcontroller that governs the movement of actuators through RAMPS 1.4 board shield and gets feedback through closed loop control via sensors. Open source software for CAD (OpenSCAD) and printing (Repetier-Host) are installed on the computer to finalize the printing setup. The last step in assembly is the calibration where the tip of the nozzle from the heated bed is adjusted to 0.4 mm i.e. the diameter of the orifice to ascertain proper adhesion of first layer with the bed. Under the printing setup of the Repetier-Host the baud rate is adjusted as per the programming code in the Marlin firmware for printer computer communication. A CAD model (.stl file) is downloaded from *www.thingiverse.com* and uploaded after connecting the computer with printer via USB port. The model is sliced to get auto-generated report on Slic3r program like estimated time to print, number of layers, length and volume of the filament used. The path adopted is depicted through figure 1.

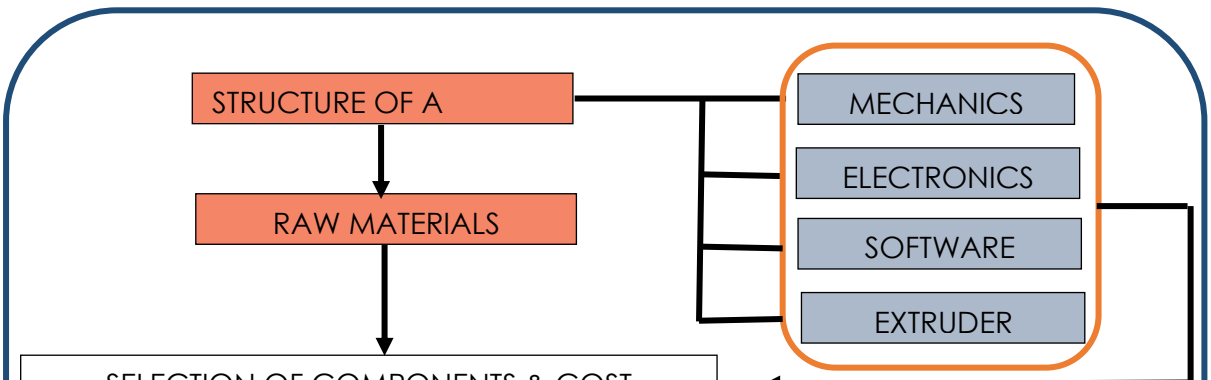

Figure 1 – Design-Development-Calibration of Open-Source 3D Printer Format

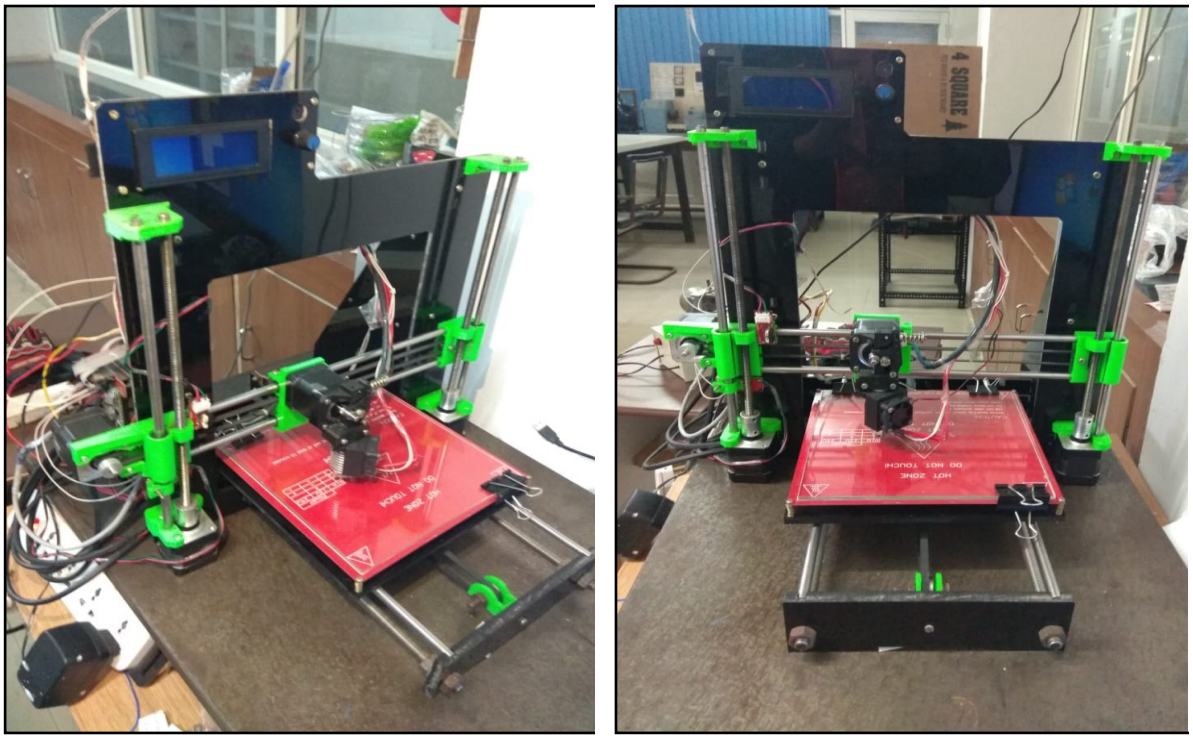

Figure 2– Developed 3D Printer

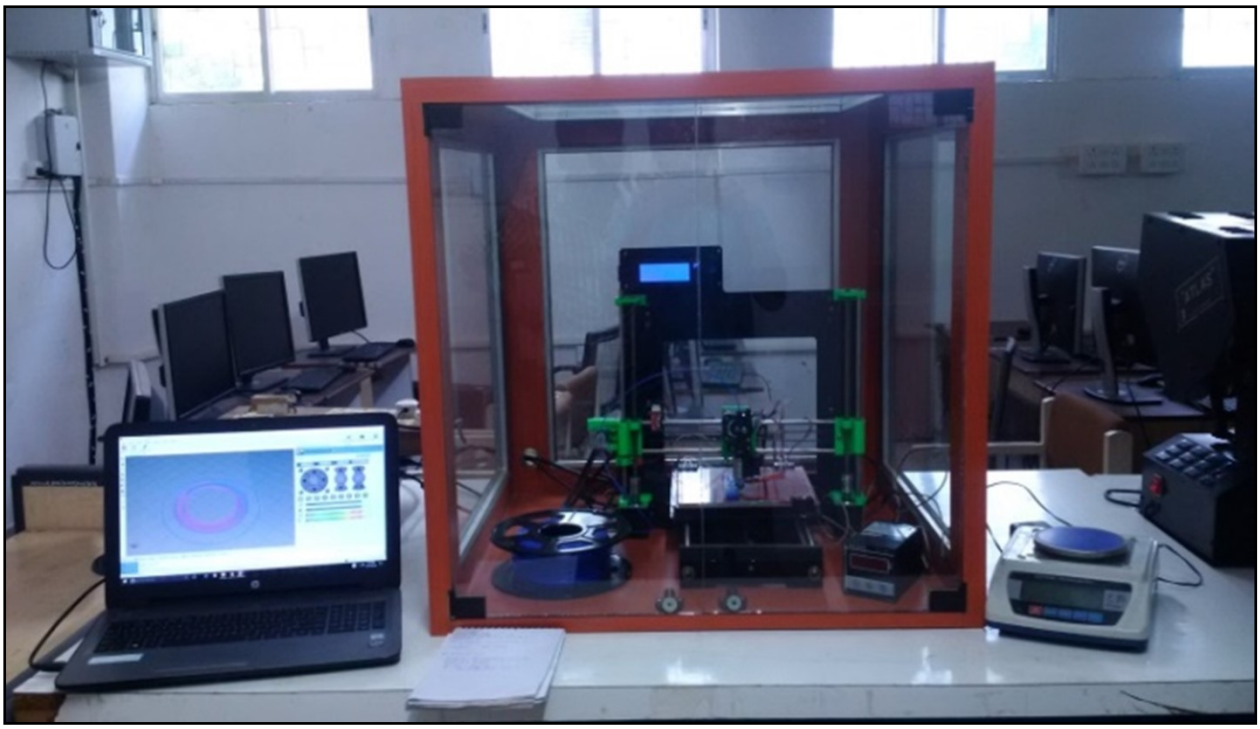

Figure 3 – 3D printer in an enclosure connected to the Laptop

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References

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2. NITTTR, Bhopal Perspective Plan 2036, 2021
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4. National Education Policy (NEP) 2020