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Intrapreneurship and Innovation in Engineering Education

V.Thanikachalam
Executive Consultant in Engineering Education and HRD, Chennai-600041
vthani2025@gmail.com

Abstract: It is observed that around 1- 2 % of the faculty membersin autonomous institutes usually take risk in developing many innovative projects and programs for corporates and International Development Agencies (IDAs) by responding to letters of invitation or advertisements through bidding process. They utilize their talents, expertise and prepare high quality and cost effective projects which meet the stringent terms of references (TORs). These faculty need empowerment, and delegation from administrators of the institutes but they are usually neglected in many institutes. Usually there is an inordinate delay in forwarding thebid documents and providing with sufficient technical staff even though the revenue generated would meet all expenditures. Most of the innovations are due to intrapreneuers who are risk taking faculty members, and also think out of box and provide creative solutions.

There is a need for supporting policy from the Chief Executing Officers (CEOs),Board of Governors, and government to encourage such outstanding ventures. Even though these institutes enjoy all types of autonomy but it is not passed on to the departments and to the faculty members. Institutes have to plan project specific policies, maintain separate accounts and distribute the gains as per the approved norms. Also the fear of failing has to be removed from other faculty members besides giving the needed resources. Such initiatives would encourage more risk takers to undertake development activities, outreach programs and sponsored projects. Since, the institutes have to contribute to the economy through providing conducive environment for creating new and innovative products; the management has to take a lead.

Keywords: Intrapreneurship -Development Policies-Internal Revenue Generation and Utilization.

1. Introduction

Well performing Indian engineering institutes like autonomous colleges, deemed to be universities, national institutes and Indian Institutes of Technologies are substantially contributing by undertaking many development projects for industries, governments and International Development Agencies (IDAs). With high quality faculty members with creative thinking, risk taking

V.Thanikachalam
Executive Consultant in Engineering Education
and HRD, Chennai-600041
vthani2025@gmail.com

capability, they contributed to the development of improved industrial processes, produced new products and trained the executives of the industries. They also generated sufficient revenue through these activities. Most of the well performing engineering institutes have established consultancy centers in 1960s and nurtured the growth of these centers. However, the full potential of high performing faculty has not been put into action in many institutes which have been established by the governments or private edupreneurs.

2. Objectives

The following are the objectives of this paper to investigate the success factors, problems faced by the intrapreneurs, and the needed managerial changes in the institutes.

- To assess the potential of well trained and educated engineering faculty in engineering institutes.

- To identify the difficulties faced by the outstanding faculty members in undertaking externally funded projects from government departments, industries, and IDAs.

- To suggest remedial measures and interventions this could be approved by the Board of Governors of the engineering institutes.

3. Who are the Intrapreneurs?

The well qualified faculty members who evaluate their strengths, institutional resources, infrastructure, and the terms of reference for the projects offered by multinational corporations (MNCs) or International Development Agencies (IDAs) or Government Departments or National Project Executing Organizations and prepare technical or development proposals, and financial proposals. They send the bids through the institutes. Based on the CEOs approval, they negotiate with the external agencies who advertised the projects or who sent the letters of invitation and win the project. They systematically follow the rules and think out of box and present the best and cost effective solutions. Primarily they are risk takers. They also co-opt other competent faculty members and share all the documents but the funds are received by the institutes and remitted to the project account but they prepare total estimates, get the advances for execution and follow the norms and rules for spending the amount. They also complete the project as per the agreed terms and bring success and reputation to the institutes. The growth of excellence in industry-institute -partnership centers on such high performing faculty.

4. Consultancy Centers

Most of the institutes allow the Heads of the Departments to use the workshop and laboratory resources for testing and providing consultancy to the public, government departments and industries. There are standards and norms for various testing services.

In some institutes, there would be a separate Consultancy Center which will coordinate between external organizations and the departments. The head of the consultancy center would receive enquiries and he will forward them to the concerned departments and the reply would be sent by him. Also, this consultancy center alone is authorised by the institute to correspond with the clients.

In some institutes the Head of the consultancy post would be rotated among the senior professors. It is also designated as "Dean-Consultacy Works". The tenuremay vary from three years to five years.

Normally the deans would not directly repond to adverticements for undertaking consultancy works. Many governments provided guidelines for utilizing the gains of the consultancy works. AICTE has bought out separate guidelines for calculating the fees and utilizing the gains in 2000 and the same was published in the Indian Soceity for Technical Education's Newsletter.

Innovation CentersInnovation centers established by the engineering institutes would invite the national industries, and MNCs for utilizing the research findings, the patended processes and various innovations in planninng, designing, manufacturinng and maintainng the products. They also call for collaborative research on the industrial problems. Through out the western world university inovation centers could permit the industries to bring their employees and conduct their own confidential research and pay the rent to the university. The industry employees have greater contact with university researchers. The researchers are permitted to publish their research works without any restriction. Most of the large scale industry sponsored projects provide five years funding which attracts many faculty members. University of California,

Berkely permitted their faculty to have more freedom for publication.

5. State of the Art

Emily Abbott et al (2011) have brought out five essential elements of succesful twenty-first century university corporate relation program.Since the intrapreneurship is well built into American educational system, there is no specific mention about this. Julio Pertuze et al (2010) listed best practices for industry-university collaboration. However, here also no mention about the university based intrapreneurs. Katherine Chudoba, Mary Beth Watson and Kevin Crowston (2012) listed innovation in academy-industry partnerships and measuring challenges to effective performance. Mark Gorden has recommended the comercialization university owned technology. If the intrapreneurs are assisted by universities, then they would get more technology which can commercialized. NACRO Writing Team and Benchmarkking Committee (2011) listed five essential elements of a successful twenty-first century university corporate relationships which are applicable to Indian engineering institutes also. Renu Khater(2013) described a case study on forging strategic business partnership to develop the 21st century workforce through an undergraduate petroleum engineering program at the University of Houston. Roger Geiger described the successful process of corporate sponsored research at Penn State. U. S Senate Task Force emphasized university-industry partnnerships and brought out the desirable principles for large-scale collaborations. The Task Force suggests the freedom to the researchers and autonomy to the institutions. UIDP Projects (2013) brought out 10 case studies of high-return university-industry collaborations. U. S Department of Commerce (2013) studied the process of creating the innovative and entrepreneural university. All these indirectly focus on the competent and high performing intrapreneurs whose creative thinking brings full success in sustaining effective industry - university partnership which really give rise to industrial leadership in USA. In Texas, the University of Texas has fixed that about 25% of research expenditure has to be generated through industry sponsored research. Further the institutions should enhance the ranks of the faculty so that they can undertake industry sponsored research projects. Universities have to develop collaboration with the Regional innovation centers. The contribution of Bergquist and Pawlak (2008) in engaging six cultures and Hower A Mark (2012) in guidelines for deeping department's collaboration are presented in the next section.

6 Research Methodology

The research methodology centers on naturalistic evaluation. Four national institutes of technology, four national institutes of technical teachers training and research, four autonomous engineering colleges, and four deemed to be universities were considered. 16 senior faculty members have been selected to respond to the questionnaire. Questions were developed to assess the enabling factors and difficulties faced by the faculty members. Based on the feedback, the positive institutional factors are synthesized and presented below:

Institutional Factors that Enable Risk Taking Key Performers (Intrapreneurs)

The following factors enable the intrapreneurs:

- Vision of the institute which deliberately provide direction for taking many innovative programs and projects
- Freedom to use the institutional resources for externally funded projects
- Unrestricted distribution of letters of invitation (LOI) from the external agencies
- Freedom to respond to advertisements connected with development projects under various external agencies
- Empowerment based on the recognition of high performers/ intrapreneurs
- Standard norms for estimating the cost of the projects/ financial proposals
- Well-developed laboratories and workshops
- Availability of master craftsmen
- Internet facilities and modern library resources
- Encouragement for high achievement
- Delegation of authority to design the technical and financial proposals
- Conducive academic environment to form project based interdisciplinary teams of associates
- Excellent leadership at department and at institute levels
- Flexible norms for execution
- Evaluation of achievements of the team and recognition for the same

Letters of Invitation has been transmitted to the unqualified external agency.	Again a few corrupt CEOs do this intentionally for their benefit. Only Board can rectify these acts by constituting standing committees. Such practices are there in many American Universities.
The CEOs ordered the project leaders to stop responding to the external requests.	Again this relates to the unacceptable views of incompetent CEOs. Only the Board can take action.
The technical and financial proposals were withheld by Administrative Officers or the project documents are untraceable.	This may be due to the unethical instructions from the CEOs only.
The Ministry official insists that he has to be included in the project team as an expert.	This is a strange way of constraining the Institutes and get unethical financial gains. Such interventions are more common in many developing nations. Only government can constrain such actors.
The project gains were not distributed to the project team.	The CEOs would delay the distribution and later unethically withdraw the amount and distribute among certain office staff.

Barriers to Faculty Collaboration

There are numerous barriers to form high performing teams and collaboration. Kezar and Lester (2009) identified the following factors:

- Professionalism of the faculty members
- Disciplines and departments of the proposed team members
- Paradigmatic differences among them
- Training underwent and socialization
- Tenure of the faculty
- Reward system
- Bureaucratic and hierarchical administrative structures
- Clash between academic and administrative structures

Many such barriers could be eliminated by proper discussion and structured participation, well designed roles and proper distribution of the gains. The project leader has to respect the professional contribution of the diverse faculty members and eliminate conflicts.

Hower A Mark (2012) provided the following guidelines for deepening department collaboration:

- Promote a culture of shared leadership and responsibility for institutional goals.
- Develop a shared vision of the institute, and seek to build it in every moment and interaction.
- Actively reduce barriers to collaboration, and integrate of collaborative practices, into all important academic tasks and responsibilities.
- Create professional development opportunities, related to collaboration, including: retreats, workshops, teaching circles, sabbaticals etc.
- Develop institutional rewards and recognition processes that support collaboration and individual initiative.
- Invite and support scholarship, exploring, documenting, and involving collaborative practices.
- Actively seek to expand the diversity of faculty mentors with a record of collaboration to support to new faculty members.
- Reflect periodically as an institute of the systems, processes and relationships of the faculty members in the projects.

All these guidelines could be utilized to create more active faculty members who could become intrapreneurs.

Bergquist and Pawlak (2008) have brought the following six cultures of academy (Table.2).

Table- 2

Culture	Focus of the culture
Collegial	Emphasized developing the values and quality of character of society's future leaders.
Managerial	Shares a commitment to serve the needs of local commitment especially providing access to education to underserved populations.
Developmental	Finds meaning primarily in the creation of programs and activities furthering the personal and professional growth of all members of higher education culture.
Advocacy	Finds meaning primarily in the establishment of equitable and egalitarian policies and procedures for the distribution of resources and benefits in the institution.
Virtual	Answering the knowledge generation and dissemination capacity of the postmodern world. The virtual culture values open, shared, responsive educational systems and conceives of the institution's purpose as connecting to global and technological advances of recent decades and responds to the challenges facing higher education including economic constraints and declining public supports.
Tangible	Finds meaning in its roots, its community, and its spiritual grounding.

Intraperuneurs need more support which can be synthesized from the above six cultures. The CEOs have to nurture appropriate supporting culture for extending the expertise of the faculty.

Statewide Governing Boards

Paul Lingenfelter, Richard Novak, and Richard Legon (2008) described the statewide governing boards and coordinating boards in 20 states of USA which are designed to be a 'built-in' connection of business and civic leaders to the higher education public policy dialogue, and to provide a permanent forum for higher education policy that is partially insulated from the give and take and discontinuities of the partisan political process. They provide a single, authoritative 'chain of command' from the board to the chief executive of every university in the state system. This formal power is its strength from the public accountability perspective; the ability to hire and fire can be an asset when seeking to make broad scale improvements. This method evaluates the actions of CEOs. The boards successfully balance institutional priorities with the public good, show a willingness to help lead and support strategic change by engaging in statewide, systemwide, at institutional planning, establishes expectations for accountability, assumes responsibility for results in the academic affairs of the university, and show the ability in balance engagement with an appropriate degree of detachment. Such statewide boards would bring success in all planning processes of the state engineering universities and state engineering colleges.

Leadership challenges

According to Paul Lingenfelter, Richard Novak and Richard Legon (2008) leadership challenge arises from uneven attention to board selection process. Appointing board members is the most direct way elected leaders can influence higher education governance. Paying more careful attention to selection is necessary for improving board capacity and performance. Board members can also become pawns in a high stake game between the legislature and the governor. Board seats can be doled out to less deserving executives on the basis of political connections or contributions. Building greater merit into the appointment process would minimize politics and help secure stronger and more effective boards. Hence, more care could be exercised in the selection of CEOs for the engineering institutes in India which will ensure more delegation to the intraperuneuers and enabling them to achieve more contribution to the consultancy.

State Engineering Education Council

Many states have recently established State Engineering Education Councils in India which will provide policy guidance to the engineering institutes. Also this council can provide assistance in planning and implementing industry focused services.

Suggestions for corrections and improvements

The Board of Governors could form standing committees on the industrial collaborations, assist the Intrapreneurs to bring more internal revenue. They can fix goals for sponsored research projects, new interdisciplinary graduate and postgraduate programs, quantum of internal revenue, patents, publications, industry specific students assistanceships, internships, and employment. Reputation of the institutes couldbe built easily through intrapreneurs and hence, they have to be encouraged but they have to be protected from harassment. Many CEOs do not even circulate the enquiries received from corporates governments. There should be an annual evaluation of the academic environment in the institutes and remedial measures could be taken. The CEOs could be trained on the motivational techniques and institutional development methods. It is essential to establish Industry-Institute-Partnership Centers with more freedom to take steps for bidding the development programs not only from the state and central governments but also from IDAs.

Spin Off Benefits

The Intrapreneuers usually develop industry relevant interdisciplinary and multidisciplinary graduate programs based on their expertise. Also the engineering students would get industry specific skills and competencies and get excellent jobs. They are key performers in this area also. If the colleges do not establish interdisciplinary departments, it would be very difficult to implement such programs.

Also the Intrapreneurs could bring more Industry Sponsored Dissertation and Research Works which could support many graduate students through assistantships and future employment. They could easily get very good exposure to the current industrial

process. They could get very good training on the jobs. Many patents and publications could be developed through this process.

The well performing institutes could network with other institutes and develop the faculty and utilize the resources and infrastructures. This would improve the regional competitiveness.

7. Conclusions

Under various institutional development and quality improvement programs, the faculties of engineering colleges have been trained in many cutting edge and emerging technologies. The project institutes have been designed to extend the expertise to the industries which would impact on the economy. The intraperuneurs could achieve very much under the knowledge based economy only when they are provided with the needed delegation, and empowerment. The Boards of Governors could take steps to improve the academic environment of the institutes by continuous improvement process.

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