

# Institution-Industry Linkages (IIL): A Value Addition Route for Academic Entrepreneurship

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A significant body of work already highlights the relevance of curriculum, internships, trainings, Soft skills, collaborative research and informal relationships, to university–institution linkages. This study identifies relevant sources and applications of university-institution linkages which leads to entrepreneurial skills. The impacts of sources are systematically reviewed to examine their relevance to entrepreneurial formation. We present a conceptual model developed through systematic review of exploratory researches by academic and industry researchers. We considered research work conducted after the year 2000 which contributed to the development of university-entrepreneurial frameworks in WOS and SCOPUS. Each identified source and application is validated by two significant reviews. This study concludes by identifying future research needs and gaps for imparting entrepreneurial skills, in all educational institutions. The theme of ‘Structured Entrepreneurial Course’ is to be amalgamated into the course structure, depending on the course outcome of academic programmes.

**Key words:** *Industry-Institution Linkages, Curriculum, Internship training, Soft skills, Spin-off, Entrepreneurship.*

**JEL Classification:** I23, O32, O34

## Introduction

Entrepreneurship is believed to catalyse economic progress, multiply employment opportunities, and be critical for innovations and social wellness (Bjornskov et. al, 2016;

Bylund et al., 2017). Academic entrepreneurship is believed to be an individual or collaborative company spin-off, through inputs of educational institutional personnel (Rothaermel et al., 2007). Haytor et al. (2018) argued a need for entrepreneurial ecosystems to be fully leveraged, to adopt policy changes from regulatory institutions. The conceptions of employability have broadened in recent years, from a focus on mostly technical skills and attributes required by ‘work-ready’ graduates, to a wider notion encompassing non-technical areas such as networking (Bridgstock, 2017). In the educational environment view, it is widely recognised that universities and other public research institutions play a central role within systems of innovation for basic research generation, technology transfer and knowledge diffusion to firms (Hall et al., 2000; Mowery et al., 2002; Mowery et al., 2005; Bercovitz et al., 2006; Thursby et al., 2011; Filippetti et al., 2018).

‘Industry Linkage’ expresses the relationship between manufacturing / service industry and higher educational institutions. There are expectations of industry regarding the right employee for the right job, to be fulfilled by educational institutions. Teaching and training are two sides of the education ‘coin’, as proposed in the helix model of actors, organisational structures, rules and regulations (Tolbert et al., 2011). In this model the actors are Educational Institutions, Industry and Government. Educational Institutions make teaching space available. Industrial units facilitate on-the-job training. Teaching and training must be interlinked to the desired output. Students should learn theoretical concepts in class rooms, and learn and practice the applications of such concepts in industrial units. This type of learning environment must be made available to students, for the benefit of both students themselves, and industrial units which face a shortage of skilled employees. Work-integrated learning (WIL) is a key strategy for promoting graduate employability (Rowe et al., 2017).

### **Institution-Industry Linkage - The bridge!**

Many studies have landed upon the relationships between Educational and Research Institutions, and Industry. Some believe that information flows from Institutions to Industry (Thursby et al., 2005; Bercovitz et al., 2008) Few groups believe vice versa; i.e. industry is thirsty for research and development (R&D) and innovations through knowledge flows from the universities (Lim et al. 2006). The source or channel of Institution- Industry linkages (Cohen et al., 2002; Colyvas et al., 2002; Shane 2002; Perkmann et al., 2007) is the movement of knowledge or information from Educational or Research Institutions, to Industry (sometimes via intermediary). The source of this flow is to evolve from the Institution, which will lead to its destination or application in Industry (Varghese, 2016). Table 1 shows the sources and applications of Industry Institution Linkages.

**Table 1:** Sources and Applications of Institution- Industry linkages

Author, Year	Source	Author, Year	Application
Liebeskind et al., 1996; McPherson 2010	Personal Networks of Academic Staff	Ashraf et al. 2018; Cohen et. al. 2002	Internships, Industrial training
Cohen et. al. 2002; Mendoza et al., 2008	Publications, Public meetings & Conferences	Stuart et al., 2002; D'Este et al., 2010	Spin-offs of new firms
Fontana et. al., 2006; Lee et al., 2010	Collaborative Research & Informal Contacts	Van Hemert et al., 2012; Joseph et al., 2009	Industrial Innovation, Indigenous Knowledge System
Hall et. al. 2011; Owen-Smith et al., 2004	Funded research & Research partnerships	Lili et al., 2012; Varga, 2000	Employable graduates to Industry
Etkowitz 2003; Slaughter et al., 2012	Incubators, Technology transfer offices	Schiller et al., 2009, Edison et al., 2013	Fertilisation of ideas, Transfer to private sector
Jessop 2017; Mendoza 2012;	Value-based research	Colaghirou et al., 2004; Hoye et al., 2009	Advancement in new product sales, Repeat Commercialisers
Zhimin et al., 2016; Gonzales et al., 2014	Scholarships and government support	Rooksby et al., 2014; Plewa et al., 2013	Intellectual property practices, Inventions & Commercialisation
Vick et al., 2018; D'Este et al., 2010	Patenting of research and Industry grants	Kauppinen 2013; Holahan et al., 2013	Commodification of knowledge

**Source:** Review of Literature

### **Curriculum! The backbone of Entrepreneurial Sprouting**

Curriculum design has become a challenge for the survival of educational institutions in the competitive world of work. The ultimate aim of (re)designing a curriculum is to equip students with industry mandated potentials. Institution-Industry Linkages provide students with practical experience, which cannot be fully simulated in the classroom (Elarde et al., 2012). Engineering, arts and science students get degrees for the years they spend in college.

But degrees and high marks do not provide employment, even self-employment becomes difficult. Basic subject knowledge and its expression is an essential academic requirement. A student can learn it from a classroom and library. If as a student one fails to attend regular classes, one cannot acquire subject knowledge. These processes are ensured by university–industry (UI) interactions, in their various modes (i.e. joint publications; joint research projects; co-patenting; spin-off), and both researchers and policy makers are recognising their crucial role (Scott, 2005; Protogerou et al., 2011; Perkmann et al., 2013). Participation in seminars, group discussions, competitions, cultural programs will help students to express their learning in the class room and other related aspects. Classrooms alone cannot create a versatile student become employable in the future. Knowledge as it prevails outside the classroom (employment opportunities and skills needed to get employment) contributes a major part to career determination and graduates’ success. Moreover, it provides students with the opportunity to apply the skills that they learn in classroom settings, to the world of work (Green et al., 2011). What distinguishes linkages from other forms of active learning is a degree of supervision and self-study that allows students to ‘learn by practice’, and to reflect upon that learning in a way they wish, to achieve set targets and goals. The level of learning separates a student from a volunteer, in terms of achievement, motive and perfection (McPherson et al., 2010).

In 2004 a large research university in the US Midwest created an industry programme, to enhance both the entrepreneurial skills of undergraduate STEM or businesses students, and their motivation to work for small businesses or start their own enterprises (Donnellon et al., 2014). That relates to graduates currently finding difficulties in obtaining employment in government departments, public sector enterprises, and private sector enterprises and in entering into entrepreneurship. Of late, students learn the art of getting employment and entering entrepreneurship, only after completing colleges / university. What is the reason? The rate of educated youth is increasing daily. Similarly the rate of educated, unemployed youth is also increasing day-by-day. Why? In educational institutions academicians teach and publish. Industrialists focus on production, productivity and profit. Their works are isolated and unrelated to each other. It must now be related and linked.

Linkage between educational institutions and industry will solve this isolation. The academic curriculum of educational institutions plays a vital role in linking higher educational institutions and industry. Perception of teachers and students will add to that linkage. Industry should come forward to utilise the laboratory and human resources available in educational institutions. Industry should sponsor research in educational institutions, and in turn their findings will help industry enhance productivity, reduce costs, and increase workforce efficiency. Industrial units are expected to establish their own units in the educational institutions, and provide such internship to students. This linkage will help both educational institutions and industry. Students will be trained in a particular industrial unit and acquire

skills needed for their employment, and industry can get the right employees for their activities. If research students work in industrial units, it will help industry innovate the manufacturing and the distribution of goods and services. To understand student learning in an entrepreneurial internship programme, the cognitive apprenticeship model is proposed (Donnellon et al., 2014). Cognitive apprenticeship (CA) is a model or conceptual framework that explains how experts transfer knowledge to students, as well as how students acquire knowledge through practising authentic activities in a particular profession (Donnellon et al., 2014). Table 2 shows curriculum as a source which leads to Entrepreneurial Innovation.

**Table 2:** Curriculum on Institution-Industry Linkages

Author, Year	Source	Application
Tran, 2015; Rowe et al., 2017	Curriculum (re)design and pedagogical interventions	Work Integrated learning (WIL) experiences in curriculum supports employability outcomes
Sachs et. al, 2017; Britton et al., 2019	Institution and Course design	Skills significantly affected by the institution and course taken
Lili et al., 2012; Perkmann et al., 2013;	Faculty Norms, Academic Engagement, External lecturers	Enhancement of collaborative research, patenting, licensing contract research & consulting etc
Mowery et al., 2002; Gonzales, 2014	University entrepreneurship, Technology transfer	Technology transfer through licensing and university start-ups
Filippetti et al., 2017; Zhai et al., 2019	Individual academic entrepreneurs v/s Non-academic	Enlargement of academic engagement for commercialisation and patenting of Innovations, start-ups, consulting
Perkmann et al., 2013; Clarke 2017	Individual attributes	Sex, age, seniority and academic standing found relevant
Lili et al., 2012; Abreu et al., 2013	Gender and personal traits	Women Academics disclose less on inventions, patents, creation of new start-ups based on academic research
Hamdan et al., 2011; Abreu et al., 2016	Entrepreneurial graduates	Instils entrepreneurship values for generating income for university

**Source:** Review of literature



### **How Far Industry Institution Linkages Inculcate Entrepreneurial Abilities?**

Strategic relations with industrial units create advanced modes of values creation in the academic arena. Student visits to the organisations / institutions with linkages, as a part of curriculum for internship and project work, provide access to advanced technologies and this helps them in improving their knowledge and skills (Moller et al., 2007). Internships enable students to acquire skills which cannot be learned in the classroom environment, while employers obtain access to low-cost labour and reduced recruitment costs (Galloway et al., 2014; Holyoak, 2013; Maertz et al., 2014). Interns develop interpersonal skills, team-working skills, professionalism and customer management experience. Students also improve their communication, confidence and self-efficacy. Those with internship experience are more likely to find jobs and earn more (Saniter et al., 2016). In the information technology (IT) sector, internships provide valuable on-the-job training that helps develop entrepreneurial skills and prepares students for self-employment in this sector (Donnellon et al., 2014). Moreover, internships provide students with the opportunity to apply the skills that they learn in classroom settings in the world of work (Green et al., 2011). Industrial training / internship / summer placement training / apprenticeship students obtain opportunities to communicate and convince a large number of people. Table 3 shows internship programs as a source which leads to Soft skills development.

**Table 3:** Institution-Industry Linkage on Entrepreneurial skill

Author, Year	Source	Application
Holyoak, 2013; Gabrielle, 2018	Soft skills & Interpersonal Skills	Less need for socialisation of learning
Bridgstock, 2009; Galloway et al., 2014	Technical & problem solving skills	Relevance of institution and practical work
Galloway et al., 2014; Tiit et al., 2019	Communication, team work, customer service skills & creativity	Enhancement of skills for work ready
Velez et al., 2015; Saniter et al., 2016	Employment skills	Increased employment through Internship experience
Gault et al., 2010; Cardon et al., 2017	Management skills & Passion	Positive impact on earnings and productivity though academic exposure
Lambe et al., 2002; Holyoak, 2013	Trust & knowledge-sharing skills	Relevance of being in professional communities
Morris et al., 2012; Neumann et al., 2012	Supervision skills & industry partnering	Extra reporting, embargoes on publication and extra training
Rip, 2004; Manathunga et al., 2009	Strategic research skills	Amalgamation and conglomerate formation

**Source:** Review of literature

### Student-Entrepreneur or Entrepreneur-Student?

Whoever, and under various circumstances, grasps ideal opportunities, still lacks clarity in present entrepreneurial processes (Canales, 2017). Students gain valuable real-world experience and this reduces the requisite adjustment period when starting employment. Employers can assess the likelihood of a fit between a prospective employee and the organisation (Dobratz et al., 2014). Internships should be a requirement for entrepreneurship students, because it connects their studies and real world experience, in addition to benefitting both the academic institution and the employer (Dobratz et al., 2014). Educational institutions should offer academic programs on Entrepreneurship. Curriculums should be related totally to entrepreneurship. Seventy percent of the curriculum should be practical. Academic Internships enhance the reputation and visibility of academic institutions, and also enhance their potential for recruiting students (Velez et al., 2015). A minimum of ten entrepreneurial activities should be included in the curriculum. Choice should be given to students to select one entrepreneurial activity on their own decision. Arrangements for

practical classes in the specified industrial units should follow, and teachers should monitor the academic - industrial link. The classroom should not be syllabus-oriented. It should be skill learning-oriented. Skills will stay in the minds of students forever throughout their life. Table 4 shows Industry Institution Linkages on Entrepreneurship programs as a source which leads to Soft skills development.

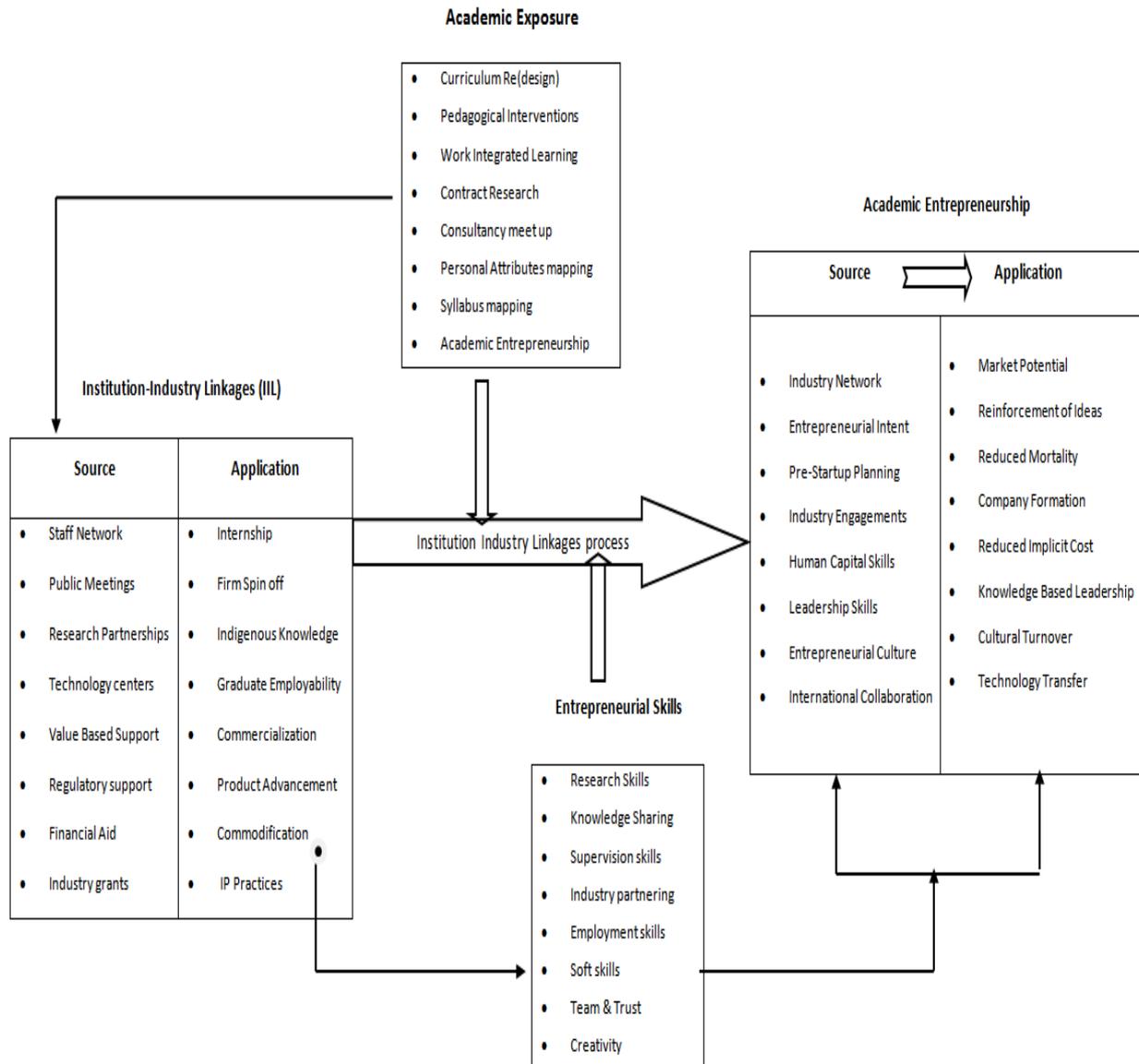
**Table 4:** Academic Entrepreneurship through Institution-Industry linkages

Author, Year	Source	Application
D'Este et al., 2010; Green et al., 2011	Patenting and company formation	Monetary incentives for industry engagements
Maertz et al., 2014; Groh et al., 2015	Labour cost	Minimising of labour cost to employer
Dobratz et al., 2014; Ostergaard et al., 2018	Human Capital Skills	Reduction in implicit cost to employer
Holyoak, 2013; Dobratz et al., 2014	Industry Networks	Knowledge sharing & market potential depth
Shoenfelt et al., 2013; Ashraf et al., 2018	Self-efficacy & entrepreneurial intent	Reinforcement of skill sets & experiences
Mendoza et al., 2005; Zhai et al., 2019	Pre-startup Planning	Reduction of high mortality of new small business
Maertz et al., 2014; Guemes-Castorena et al., 2019	Culture	Promotion of entrepreneurial culture
Osborn et al., 2009; Tiit et al., 2019	Leadership skills	Alliance innovations, strategic contributions & knowledge-based leadership
D'Este et al., 2010; Salazar et al., 2013	International collaboration	Technology projects, Entrepreneurial culture & creation of incentive system

**Source:** Review of literature

Attention should centre on the transferability of skills and potential across contexts and disciplines, and on proactive, entrepreneurial, innovative individuals capable of managing their own careers through creating, constructing, designing, and identifying employment opportunities, rather than training for a particular profession (Benneworth et al. 2016; Trede et al., 2016).

## Conceptual Model



## Model Discussion

Presently, Institution-Industry linkage vitally enhances Academic-Entrepreneurship competencies, resulting in company spin-off or spin-out. The linkage can be categorised through an Input-Output model (Soto, 2009) i.e. the source – application of IIL.

The source of IIL sprouts from the networks of educational institution personnel. These networking practices and inputs help generate Internship training/On-Job training/Work integrated learning opportunities (WIL) for students, as well as academic staff. Public meeting facilitates another forum of discussion. Academic beneficiaries can share ideas on



company spin-off or spin-out. Research partnerships across business labs, R&D Centres, Incubation Centres, Technology Centres etc will enhance indigenous knowledge on business viability. Technology Centres and Research Labs add practical expertise and experience to curriculum-designed theory delivery. As per Michael Porter's Five Forces model, competition has led to a massive need for value-added products, rather than a basic product to satisfy needs. Injection of value-based support systems will not only inculcate ethical value systems, but also enable commercialisation through high moral and societal values. The primary face of partnering with industry should start from regulatory support, failing which will increase the new business mortality rate. Product and services commoditisation requires a large piece of funding, in the form of government financial aids or industry grants.

Academic exposure is integral to the successful implementation of IIL. Traditional "Theory only" curriculums should be redesigned to equip students with recent industrial exposures. Pedagogical Intervention is a new methodology to be incorporated into the curriculum, which should be imparted through industry enabled/experiences, by faculty teams. Collaborative teaching of a course by more than one faculty can add more depth to the existing knowledge base of theory subjects. Grouping courses with a similar nature can generate industry-oriented learning programs, with more specialised or interest-oriented Internship programs/on-the-job training programs. Curriculums should have facilities for students to take up contractual projects on terms and conditions validated in collaboration with institutional norms. Educational institutions should have mandatory consultancy tie-ups or meetings for students who desire to subsequently implement their business ideas or plans. During any academic program, a proper mapping of student's personal attributes, traits and tastes needs to be monitored. Throughout the academic program, every course should link collaboratively, in terms of direct or parallel course behaviour. A proper channelling of existing academic curriculums, to the above, redesigned course structure, will enable more successful academic entrepreneurs.

The proposed curriculum redesign, along with inbuilt entrepreneurial skills, will promote successful academic entrepreneurial action. Academic beneficiaries of IIL will develop industry networking skills enabling them to target and acquire market potential. This will create Entrepreneurial Intentions which will reinforce strategies for productive implementation of their projects. Academic entrepreneurship will enable a better structure for planned outcomes, minimising the mortality of start-up firms. Company formation will have a better organisational structure, with active industry engagement practices. These linkages will help develop Human Management skills, minimising the implicit costs of employee turnover policies. In the long run, an entrepreneur will fail, if one is not a Role Model for one's entire employee base. Academic Entrepreneurship will facilitate the clubbing of learned and inbuilt culture, to a new entrepreneurial culture for their organisation. International



exposure through academic inputs is a predominant factor, leading to knowledge of technical advancements among domestic entrepreneurs.

### **Conclusion and Collaborative Discussion**

There is dynamism in labour requirements among industrial units, whereas there is static in academic curriculums taught in educational institutions to students. It is a mismatch and does not meet the labour requirements of industrial units. It makes a research question.

What are the plans needed to make higher education students employable in industrial units matching employment requirements, and entrepreneurs on their own? A study is needed to answer this question. It is presumed that industrial linkage will create employment competencies and entrepreneurial competencies among higher education students. Land, labour, capital and organisation are four factors of production. It is the responsibility of higher educational institutions to teach, train and practice their students in acquiring the four factors of production, to develop a country's industries.

Industry should communicate its manpower / skill shortage to educational institutions. Educational institutions should take immediate steps to fulfil the requirements or demands of industrial units related to manpower requirements. Grooming of students for employment should match industrial demands. The educational institutions and industrial units are not mutually exclusive, but supplement each other. This behaviour will enhance entrepreneurship and proceed there by economic development. Another important part of industrial linkage is that the teachers should work for a period of three months in industrial units, and industrial experts should work for a similar period in educational institutions. It must be an Institution-Industry knowledge transfer. The research of educational institutions should be application-oriented, that is applied research to solve the problems of industrial units and enhance the efficiency of such units.

Industrial Linkage can play a vital role in developing the following skills that are essential for students to enter into and survive in entrepreneurship and succeed in business. These skills include Communication, Teamwork, Analytical & problem solving skill, Personal Management skill, Interpersonal skill, Computer Literacy, Leadership skill, Learning skill, Ethics and work values.

In this process students can learn the intricacies or nuances of communication and convincing others. They have to work with a team. Such abilities enable them to move with a team, learn compromises, adjustability and achievement. Material, manpower, money, machines, management, are basic ingredients of business. If a problem arises in one ingredient, that will affect other ingredients. Sometimes trainees may create operational problems due to their



lack of learning. During internship, students can learn causes for problems and analyse ways and means to solve such problems. Knowledge is medicine for all illness of business, and such knowledge can be acquired only through experience in business. Experience is knowledge. Personnel management and interpersonal skills are needed for entrepreneurs. Acceptance by others is an essential quality needed to enter business. Acceptance by others can be evolved through interpersonal relationships.

Learning by doing, doing by learning are each needed for acquiring computing skill. Internship training creates opportunities for learning by doing and doing by learning, and students can acquire learning skill and computing skill. Advanced development in technologically oriented products and their applications can be learned only in business enterprises. Classroom environments will not provide this advancement. Leadership skill is needed to guide the business. Industrial linkage builds leadership skill among students. Business success depends on work ethics and work values. Industrial experience gives the opportunity to learn business work values. Work values will secure consumers' confidence. Students can learn resilience in industrial training, which is essential for sustainability in all walks of life.

### **Research Gap for Future Studies**

A comprehensive research study is needed to find out the extent of skills development of students, before and after attending internship training in selected industrial enterprises. Internship training adds value to graduates and they become marketable and employable. Industry Linkage becomes essential to groom value-added graduates. Educational institutions, students and parents, academics, industrial enterprises, chambers of commerce, and industry should come forward, support, create and develop industry- higher educational institution linkage and industrial parks in the premises of arts and science colleges and universities.

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