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# Best Practice in Industry-Academic Collaboration

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**Abstract**

Industry-Academia relationship is not like that of technology donator-acceptor, but is of interactive and collaborative nature, acknowledging and ensuring mutual beneficiary for each other's role and contributions with an eye to attaining the true purpose of such relationships, namely, bringing about research-outcome synergy. It also describes the relationship among innovative teaching, learning, imparting knowledge and also correlating such teaching and learning with industry to generate ideas and innovate better results in terms of products and processes. Indeed, industry-academia interactions are a system that requires active and collaborative participations of all the stakeholders. Here, it has been tried to examine various issues associated with academic institutions and industry collaboration with special attention to the nature of resources and potentialities of stakeholders in the context of knowledge management. In this paper, it has also been made an effort to trace out the relevant policies and strategies to introduce such collaboration to boost the economic growth. It has been explored the motivation and figure out the barriers of industry-academia interaction. It identifies potential areas where industry's participation with academia would be most effective for synergism. Self-reliance and self-sustainability of industry-academia will be depending upon the strength and feedback of industry-academia collaboration. The findings of the study propose an integrated model of several new collaborative approaches that are possible, mainly in the Indian scenario to strengthen industry-academia interface for providing further support and growth of economy and each and every stakeholders of society.

**Keywords:** Industry-Academia, interface, knowledge economy, technology transfer, policies and strategies Economic growth, mutual beneficiary.

## Introduction

The collaboration or partnership of industry-academia brings together to improve the quality of education in terms of Excellence, modernization, collaboration and self-reliance are the four crucial elements in the development of Higher and Technical Education. Therefore, there are the major factors behind the emergence of collaborative practice of industries and academics. When companies and universities work in tandem to push the frontiers of knowledge, they become a powerful engine for innovation and economic growth. Silicon Valley is a dramatic example. For over five decades, a dense web of rich and long-running collaborations in the region have given rise to new technologies at a breakneck pace, and transformed industries while modernizing the role of the university.

Collaboration between academia and industry is increasingly a critical component of efficient national innovation systems. It is useful to examine the experience of developed countries to better understand the different types of Industry-Academia collaboration, motivations to form these agreements and barriers to cooperation, as well as the role of public policy in fostering such linkages. Developing countries face even greater barriers to such alliances, calling for a differentiated approach to promoting Industry-Academia collaboration.

The benefits of Industry-Academia linkages are wide-reaching. They can help coordinate R&D agendas and avoid duplications, stimulate additional private R&D investment (additionality effect), and exploit synergies and complementarities of scientific and technological capabilities. Industry-Academia collaboration can also expand the relevance of research carried out in public institutions, foster the commercialization of public R&D outcomes, and increase the mobility of labor between public and private sectors. The benefits of Industry-Academia collaboration are also evident in developing countries. For example, a study in Chile and Colombia shows that collaboration with universities substantially increased the propensity of firms to introduce new products and to patent.

### Types of Industry-Academia links:

Table 1 shows that collaboration may be more dynamic and may focus on intense and may focus on training or research activities. It may be formal or informal, from formal equity partnerships, contracts, research projects, patent licensing, and so on, to human capital mobility, publications, and interactions in conferences and expert groups, among. Also it is useful to differentiate between short-term and long-term collaboration. Short-term collaborations generally consist of on-demand problem solving with predefined results and tend to be articulated through contract research, consulting,

and licensing. Long-term collaborations are associated with joint projects and public-private partnerships (including private-funded university institutes or chairs, joint Industry-Academia research centers, and research consortia), often allowing firms to contract for a core set of services and to periodically re-contract for specific deliverables in a flexible manner. Longer term collaborations are more strategic and open-ended, providing a multifaceted platform where firms can develop a stronger innovative capacity in the long run, building upon the capabilities, methods, and tools of universities.

**Table 1: Types of Industry-Academia links**

| | | |
|---|---|---|
| **High** | Research partnerships . | Inter-organizational arrangements for pursuing collaborative R&D, including research consortia and joint projects |
| | Research services | Research-related activities commissioned to universities by industrial clients, including contract research, consulting, quality control, testing, certification, and prototype development. |
| | Shared infrastructure | Use of university labs and equipment by firms, business incubators, and technology parks located within universities. |
| **Medium** | Academic entrepreneurship | Development and commercial exploitation of technologies pursued by academic inventors through a company they (partly) own (spin-off companies). |
| | Human resource training and transfer | Training of industry employees, internship programs, postgraduate training in industry, secondments to industry of university faculty and research staff, adjunct faculty of industry participants. |
| **Low** | Commercialization of intellectual property | Transfer of university-generated IP (such as patents) to firms (e.g., via licensing). |
| | Scientific publications | Use of codified scientific knowledge within industry. |
| | Informal interaction | Formation of social relationships (e.g., conferences, meetings, social networks). |

(Source: Adapted from Perkmann and Walsh 2007)

Process of Best Practices: Research collaboration between academia and industry is a form of knowledge creation in construction industry project management. This research collaboration is motivated by the intent to provide solutions to issues and problems that industry faces through research expertise and a scientific approach. Notwithstanding the potential benefits acknowledged by researchers, collaborative academia-industry research has not been sufficiently explored and there only exist a few studies addressing research success and success factors.

**Seven Best Practices for Industry-University Collaboration**


Strategies and Policies: The industry-university partnerships analyzed for this report varied widely, but the executives and academics managing them agreed on the core elements needed to make a partnership work well. Their key lessons and recommendations were the following:

**(I) University leadership:**

- University presidents need to make industry-university partnerships a strategic priority and communicate the message regularly to the entire academic community.
- Strategic partnerships need input at the highest level from both the company and the university. Create a joint steering group including senior academics and company executives.
- Make the goals and benefits of partnering clear to the entire faculty.

**(II) Long-term strategic partnerships with flexibility:**

- The most fertile starting point for a partnership is one that allows industry to do something it can't do itself, executives said. The world's leading technology multinationals have dozens, if not hundreds, of strategic partnerships with universities.
- The growth of these alliances reflects the evolution of corporate R&D away from basic research toward research that is much nearer to the company's immediate needs. As a result, a gap has emerged in industry's ability to peer into the future, and industry is increasingly turning to universities to know what is going on at the frontiers of research.
- Long-term strategic partnerships focus the university's creativity and talent on enabling future innovations that

can be taken to market by industry and deliver benefits to society within five to 10 years.

**(III)Formulation of Shared vision and develop a strategy:**

- The first step to a healthy partnership is assessing the core academic strengths of the university and the core research competence of the company to identify promising opportunities for collaboration.
- Senior executives and university experts should map out together the key questions and research challenges that are a high priority for both. Encourage sufficient high-level exchange of information and brainstorming to enable common areas of interest to emerge.
- Understand the three different types of possible partnerships – strategic, operational or transactional – and select the type that fits your needs.

a) Strategic partnerships run for five to 10 years and need a broad, flexible agreement. The knowledge produced by the collaboration is likely to influence the university's future research and teaching and a company's strategy.

b) Operational partners have a research project with a division or particular R&D lab and run for one to three years. They can be valuable for building ties that lead to a strategic partnership.

c) Transactional partnerships are lesser interactions, such as an executive agreeing to teach a course, which may lead to doing more and bigger projects together in the future. These, too, can ultimately give rise to a strategic partnership.

**(IV)Put the right people in charge – those who cross boundaries:**

People determine the success or failure of industry-university partnerships. To attract industry involvement, universities must have people capable of building and managing partnerships. Collaborations only work well when they are managed by people who cross boundaries easily and who have a deep understanding of the two cultures they need to bridge.

**Truces, trade, and technology:**

Industrial–academic research partnerships have become an important part of corporate R&D. Several basic trends have fueled these alliances. They include the decrease in government funding of academic research mentioned above, an explosion in technology, a robust economy, and greater competition within industries. Over the past 20 years, all of these factors created an environment that fosters a codependency between industrial and academic research departments. The results of these partnerships are mainly positive for all parties involved; however, these alliances have also created new issues that may significantly affect the future of scientific research and education.

**Benefits for the Society:** Our curriculum provides a deep foundation in the traditional academic disciplines of engineering and management, while our future growth will take place in key areas where technological innovation can have a broad and bold impact on society: biology and health care, energy and the environment, information technology for society, and entrepreneurship. Global warming, environmental restoration, alternative energy sources, smart transportation. When we confront the major global challenges needed to create a sustainable society for the future, energy and the environmental technologies are at the heart of the solution.

Benefits for the health sector include more efficient ways of working, since the current system relies on decision-making on the basis of fragmented and insufficient data. This in turn leads to benefits for patients, better health as well as patient empowerment due to better access to data about one's own health.

**Focus on Economic Development:** The priorities and scope of Industry-Academia collaboration differ significantly between developed and developing countries, as shown in Table In developing countries, a major concern is the poor quality of education and the lack of financing available to universities, which often indicate insufficient capacity to join industry in innovation-related projects. Building effective Industry-Academia linkages in this context takes time and sustained effort, in part because universities in developing countries generally have little experience in industry collaboration and limited managerial capacity in research. Existing collaboration tends to be more informal and to focus on the firms' recruitment of university graduates for staffing, internships, and consulting. The research activity of universities is less likely to lead to spin-offs or patents that can be commercially exploited. In many developing countries Industry-Academia collaboration is constrained by historically based cultural and institutional barriers, which take time to overcome.

**Table 2: Priorities for Industry-Academia partnerships**

| University Orientation | Most developed countries | Least developed countries |
|---|---|---|
| Teaching University | √ Private participation in graduate programs<br>√ Joint supervision of PhD students | √ Curricula development to improve undergraduate and graduate studies<br>√ Student internships |
| Research University | √ Research consortia and long term research partnerships to conduct frontier research | √ Building absorptive capacity to adopt and diffuse already existing technologies<br>√ Focus on appropriate technologies to respond to local needs |
| Entrepreneurial University | √ Spin-off companies, patent licensing<br>√ Entrepreneurship education | √ Business incubation services<br>√ Entrepreneurship education |

**Who benefits from partnerships?**

First and foremost, we in industry receive answers to problems that we are not equipped to answer ourselves. Occasionally, we encounter a specific invention or technology with significant commercial value, as we did with Dalhousie. Working with the academic community exposes industrial researchers to the most advanced technical thinking, new research trends, and novel experimental techniques. Dialogues with academic scientists also provide a way to test the validity of our own thinking and directions. We gain discussion partners who challenge our beliefs and conclusions.

**Universities benefit from industrial funding:** The percentage of funding that universities receive from industry has risen sharply, from 2.6% in 1970 to 7.1% in 1997 . The reduction of tension in the world led to a reduction in military spending and in turn to significantly reduced military-funded R&D, which has been partially replaced by industry-funded research. In 1998, colleges and universities were awarded more than 2600 patents, a 14% increase over 1997. Royalties from these inventions exceeded $576 million, up 29% from 1997.

**Industrial–academic collaboration also allows universities to better prepare their students to enter the industrial work force:** obviously, a mutual benefit. By working on industry- funded projects, students gain greater and earlier exposure to marketing, manufacturing, business processes, and environmental concerns—factors that are of great importance to industry. These experiences facilitate the transition from academia to industry and increase productivity of these young people once they join an industrial organization.

Universities act as an important driver of economic development and catching-up through their role in education and technology absorption, adaptation, and diffusion (Yusuf 2007). Beyond the teaching-research-entrepreneurial taxonomy, some authors have advocated for shifting the focus toward creating developmental universities which collaborate with external agents, (including firms) not necessarily with a focus on commercialization and profit-making but rather with the broader purpose of contributing to social and economic development.

**Need to Bridge the Gap between Industries and Academics:** The reason that there are so few jobs to be found in academe is not because there are too few colleges, universities, departments, or programs. If anything, there are too many. The problem is that the number of available jobs is vastly outnumbered by the number of people applying for them. There are simply too many PhDs produced every year for the higher education establishment to absorb them all, despite the absurd degree to which it has absorbed them into jobs that have nothing to do with traditional research and teaching. Today, universities hire doctors of philosophy to be in charge of their dormitories, alumni associations, and police departments.

So it is important to consider all options, especially those in biotech/pharma/healthcare industry. More importantly, it is imperative that unless we start to train less PhDs every year, we need to prepare PhDs for the current job market. Otherwise, you may find yourself unemployed with a gap on your resume, or working a post-doctoral position into your late 30's.

Today, businesses are looking for innovative solutions from the academia to help meet their business needs of higher productivity and lower costs, yet increase efficiencies. In the area of talent, the US has to strengthen its technical and management resources as these are crucial to knowledge-based industries. A market-driven approach to higher education has to be fostered in order to encourage manpower development from the grass root level itself. The idea is to involve the private sector in higher education.

**Current Status of Collaboration in the world:** Currently, global investment in R&D of industry-academic collaboration is $1.2 trillion and significant share originates from the private sector through their collaborative research with academia. China has 300 research parks; and MIT has over 700 companies working with its faculty on projects of mutual interests. Some of the countries are persisting to implement such practice.

USA is a major player in contributing and investing its large portion of GDP in Research & Development projects as well as in such collaborative models of industry- academia. If we see the world's scenario, there are number of countries are considering its relevant importance. As far as USA is concerned, a major percentage of its total GDP (around 32%) is being employed in these types of ventures. China has 300 research parks; and MIT has over 700 companies working with its faculty on projects of mutual interests. Some of the countries are persisting to implement such practice.

China has empowered its R&D institutes, research funding and academia-industry linkages through profound policy based administration in 1985's S&T reform. As a result China is succeeding not only in Asian markets, but also in global market share. Strong academia-industry linkages exist across China's universities since 1950's as the university affiliated industries were the driving force for the development of this tie.

Malaysia and Singapore are other examples of Asian successors. These countries have realized the importance of academia-industry interaction and positively implemented them in their niche products like electronics, engineering and petrochemicals. Singapore reached the height of industrial development by the 1990; however, academia-industry collaboration was realized much ahead of 1990. Biotechnology has given top priority in Singapore and many pharmaceutical companies set up manufacturing plants there. The economic growth rate of Singapore is fastest in the world, 17.9% during the first half of 2010. Malaysia's

case is much different from Singapore but it is much ahead in term of academia-industry ties than Bangladesh, Nepal, Bhutan, Pakistan, etc.. On the other hand, it is the only Islamic country, contributing 86.5% of total high technology exports, such as microchips and microelectronics, which tells the story.

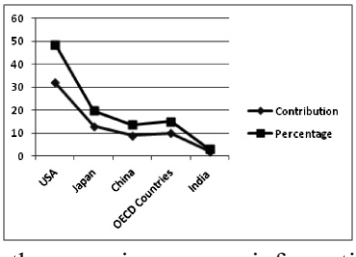
Kyoto University and Daikin Industries, Ltd. Collaborated on an agreement to implement a university- and company-wide project for fundamental research, the development of new products and innovation on 21 June 2013 and launched an innovation program.

**Current Scenario in India:** Government should take initiative to open various entrepreneurship cells in academia and it should be included in the curriculum to enlighten the students about the requirements of society and industry as well as freedom, challenges, and sphere of entrepreneurship, so that they can be interested to emerge as an entrepreneur instead of being entangled in the conventional jobs. This will provide a creative thought, risk taking capacity, and enthusiasm for accomplishing down-to earth problems in the young minds of the students. In India educational entrepreneurship is primarily need based but to promote it at a large scale a structured mechanism should be framed encompassing easy availability of fund for the project, attractive incentives, considerable tax reduction, provision of counseling service, and streamlining of labour and company laws. Moreover, academia should also arrange the resources and infrastructure necessary for spin off and incubation of technological achievements of research carried out there. Typical entrepreneurial initiatives in India are Center for Innovation, Incubation, and Entrepreneurship (CIIE) – IIM (Indian Institute of Management) Ahmedabad; Society for Innovation and Entrepreneurship (SINE) – IIT (Indian Indian Institute of Technology) Bombay; Cell for Tech Innovation, Development, and entrepreneurship support- IIT Chennai and Technology Incubation and Entrepreneurial Training Society (TIETS) – IIT Kharagpur.

In India, there are a number of initiatives for industry academia linkages have over years yielded positive results in research, but as these remain sporadic in nature India's share in world researchers has persisted at about 2 percent as compared to 20 percent of the USA and China's. The share of research and development (R&D) investments of the USA was 32 percent, of Japan 13 percent and China 9 percent, it was only 2.2 percent in India1 . Significantly, an analysis of the share in R&D shows that in India, the government share is between 75 80 percent, the private sector's share is 20 25 percent, and that of universities is 3 percent, while in OECD countries, the government share is 10 percent, the share of the private sector is 69 percent, the share of universities is 18 percent and of the non profit organizations is 3 percent. As a share of GDP also, India's R&D spend is about 1 percent as against a target of at least four per cent if double digit GDP growth is to be achieved. Currently, global investment in R&D is $1.2 trillion and significant share originates from the private sector through their collaborative research with academia. China has 300 research parks; and MIT has over 700 companies working with its faculty on projects of mutual interests.

**Comparison of India with Other countries in tune with Total GDP**

| Countries | Contribution | Percentage |
|---|---|---|
| USA | 32 | **48** |
| Japan | 13 | **20** |
| China | 9 | **14** |
| OECD Countries | 10 | **15** |
| India | 2 | **3** |




**Challenges in Implementation:** Despite the growing strength of these motivations, many barriers to Industry-Academia collaboration persist, including the following:

- There is an inherent mismatch between the research orientations of firms and universities, with an excessive focus on fast commercial results in firms and on basic research in universities. Collaboration is costly and the returns only accrue in the medium to long run, but firms seek short-term results and clear contributions to current business lines.
- In terms of outputs, firms are usually interested in how quickly new patents or new products can be obtained, and want to delay publications to avoid disclosing information. University researchers, in contrast, are typically motivated to publish research results as fast as possible.
- Industry is concerned about secrecy and misalignment of expectations with regard to intellectual property (IP) rights and making a profit from them. Thus agreements need to be established in a commercially timely manner that ensures the ability to commercialize with appropriate returns.
- Difficulties in negotiating collaboration include lack of information, difficulties finding contact persons, and transaction costs of finding the right partner, among others.

**Formation of a National Knowledge Network:** For strengthening, accelerating research activities, and dissemination of information all academic institutes should frame a common database for information and knowledge where all their research activities like ongoing projects, publications, and awarded thesis could be accessed easily by others. Academia and industry should also be aligned with a single internet connection for implementation of world class standard practices through online courses/tutorials/ conferences etc. An encouraging example is "Vidyanidhi", the database for Indian theses that has been raised by Department of Library and Information Science, University of Mysore.

**Conclusion:** With a goal to make India the global powerhouse in research and innovation, a new range of technology is required to meet the future challenges, and India has to head forward on innovative collaborations between industry and our universities through cooperative knowledge creation and exchange. Although cooperative research is the key word to fill the gaps existing in the present structure, there is a tremendous need to create other avenues that need to be intensified, stimulated, and above all integrated, for a close academia and industry interaction through all the stages of technology development, starting from conceptualization down to commercialization. Other avenues for tie ups are achievable and can be well explored. The most meaningful aspect is that such tie ups acknowledge and capitalize on the relative strengths of the academia and industry. Besides industry associations, the universities should also form linkages with government agencies which are entrusted with industrial development activities In spite of some shortcomings and inhibiting factors with respect to the academia-industry collaboration, government should put into place an integrated policy of academia-industry collaborative interaction encompassing a number of strategies enabling such an initiative to thrive in the country's quest for technological leadership.

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