



University- Industry Linkage Practices, Determinants and Challenges

Theoretical and Empirical Article Review: Lessons for Effective and Successful Collaboration

Abraham AbebeAssefa

Department of Management, Faculty of Business and Economics, Assosa University, Ethiopia

ABSTRACT

The academia industry interactions are rapidly moving towards the forefront of science and technology policy making, planning and management. The goal of supporting university-industry linkage is to promote the relevance and contribution of universities to socio-economic development of the society. However, neither universities nor public research institutes have any significant role as sources of information either in terms of suggesting new projects or help completing the existing one. Therefore, the purpose of this article review is to systematically review scholarly articles on university-industry linkage to find out best practices, determinants and challenges for sustainable collaboration. And the result indicates that; individual, organizational and institutional factors are identified as determinants and establishing multidisciplinary research centers with industry buy-in, student internship and job placement programs, entrepreneur-in-Residence programs, establishing University-Industry Liaison Office and leadership commitment are keyed out as best practices for effective university-industry linkage. However, the centralized education system, poor leadership, huge number of students, low numbers of qualified faculty, ageing faculty, inadequate research infrastructure and teaching rather than research-focused mandates, the over emphasized role of the government which coupled with challenges in finance explains why majority have remained teaching university rather than research and technology outreach center. Furthermore, it was concluded that establishing a technology fund, supporting the establishment and management of science parks and technology incubators for the purposes of technology transfer, private sector active participation in curriculum development, integration of the private sector, the research community and government agencies, establishing organizations and formulating programs that connect research with business and serve as an interface between idea creation and business generation are recommended suggestions to develop a collaborative culture, improve the innovation system and facilitate greater university-industry collaboration.

Key Words: University-Industry Linkage, Entrepreneur-in-Residence Program, Science Park, Technology Incubator and Technology Fund.

INTRODUCTION

Modern universities combining teaching and research, developed in the early nineteenth century, have evolved. From being largely institutions of higher education and basic research, universities



since then have increasingly assumed social functions and the third pillar of the university mission to the social environment – i.e. services – has gradually emerged and been increasingly consolidated (IIEP, 2000). Universities are increasingly considered to be central actors in the economic development processes of all countries. In recent times, their direct involvement with industry has increased, and policies have been designed to promote university–industry (U–I) networking (Elisa and Valeria, 2009). However, acting in isolation, academia cannot achieve its primary goals of knowledge creation and dissemination. Synergies between academia and industry secures and influence additional resources for higher education, promote innovation and technology transfer, and ensure that graduates have the skills and knowledge required to effectively contribute to the workforce (Sebuwufuetal., 2012).

University-industry partnership is a relatively new phenomenon that emerged during the past century and has strongly expanded in scope and number over recent decades. University-industry linkages cover a large range of diverse realities in both teaching and research, from the more traditional, such as student placement schemes, staff exchanges, consultancy services, continuing professional development, joint R&D, to recent areas such as small enterprise development – the creation of spin-offs for the joint commercialization of R&D products and the development of consortia for collaborative R&D at the international level (IIEP, 2000). According to Joseph and Abraham the industry academia interaction are rapidly moving towards the forefront of science and technology policy making, planning and management. With the ongoing economic reforms there has been a dramatic change in the economic and business environment confronted by industries, academia and public laboratories-protection is getting replaced with competition, controls are giving way to liberalization, and import substitution is replaced with export promotion and globalization (Joseph and Abraham, 2009).

However, the centralized economic and education system, which prevented establishment and expansion of private institutions and the over emphasized role of the government and relatively young ages of most universities which coupled with challenges in finance and basic infrastructures, explains why majority have remained teaching university rather than research and technology outreach centers (Mpehongwa, 2013). Other factors limiting private universities and higher learning institutions to engage in meaningful linkages with the industry include lack



of experience, poor leadership, and huge number of students, which constrain academic staff to undertake any other activity apart from teaching. Multinational companies are not interested in investing or collaborating with local academia, as they perceive them poorly prepared to handle challenges posed and skills required by the current knowledge economy (Goedhuys, 2005).

Further, strengthening university linkages with the productive industrial sector in Africa is constrained by low numbers of qualified faculty, including doctorate degree holders; brain drain, ageing faculty, and other issues associated with staff retention, inadequate research infrastructure including well-furnished laboratories at many universities and lack of access to up-to-date publications; funding constraints; and teaching rather than research-focused mandates (AAU, 2012). Universities are organizations that perform a key role within contemporary societies by educating large proportions of the population and generating knowledge. The goal of supporting university-industry linkages is to promote the relevance and contribution of universities to socio-economic development of the society.

UNIVERSITY – INDUSTRY LINKAGE THEORETICAL BACKGROUND

UNIVERSITY-INDUSTRY LINKAGE BEST PRACTICES

A university industry relation has changed dramatically in recent years. Universities, research laboratories and research institutions are keys in driving a nation's innovation system. According to Global Connect Report (2007) best practices related with commercialization researches and collaboration internal to the university and how it interfaces with the external community are the following.

1. The leadership of the university is strongly supportive of technology commercialization and student/researcher entrepreneurship. In addition to the willingness to embrace collaboration with industry leadership of universities can put in place policies that encourage entrepreneurial activity, ranging from promotion and tenure policies.
2. Entrepreneur-in-Residence programs. Entrepreneur-in-Residences are experienced business advisors from outside of the university who work with faculty interested in commercializing their research. They provide valuable coaching and mentoring to faculty and students, help align the expectations of what can be realistically commercialized, bring with them and



entrepreneurial culture, and lastly serve as a vehicle for bridging the university-industry divide.

3. Student internship and job placement programs. There is little disagreement that people are the most important form of knowledge transfer. Leading regions have multiple methods to link their students to work experience and job opportunities in the private sector. These include mentorship programs, internships and business plan competitions.

4. Multidisciplinary research centers or institutes with industry buy-in. Establishing and promoting centers or institutes that have a mandate to perform collaborative research with industry and cut across two or more academic disciplines.

5. Effective lateral communication within the institution. The sharing of information can foster a collaborative atmosphere within the university and between the university and the outside community.

NACRO (2012) identified five major elements characterizing best university industry relation program: a) Institutional (top management) support: - for the industry relations function is articulated by senior administration and university strategy is directly reflected in the structure, mission, and resourcing of the corporate relations office, b) The mutual benefits to both university and corporate partners are the focus of corporate engagement strategies, c) Research development is integrated between the industry relations office and the office of research administration in order to increase levels of industry-sponsored research and to facilitate technology transfer, and d) Cross-campus coordination on corporate strategy identification, execution, and information-sharing are routine and common place

THREE THINGS THAT DON'T AFFECT A UNIVERSITY-INDUSTRY COLLABORATION

According to Julio et al., (2010) several factors widely assumed to be significant to industry-university collaborations in fact had little influence on their collaboration. Geographic proximity: Companies explored for collaborators worldwide and were able to bridge geographic distance through visits, personnel exchanges and student internships. The important factor is not proximity but personal interaction between the academic research team and the company. Overall project cost: The time frame of the project, not the amount of funding, is important in university-industry collaboration. Type of research: - Basic, applied or advanced development.



There was no statistically significant difference in terms of impact between projects with different missions. What is important is that the research project addresses a tangible need for the company.

TYPES OF ACADEMIA ENGAGEMENT WITH INDUSTRY

According to Henry Etzkowitz (1998) Support for academia involvement with the industry and technology transfer varied widely from active encouragement to active discouragement. However, there has been a change of attitude among many academia members toward industrial funding. Three styles of participation in technology transfer have emerged reflecting increasing degrees of industrial involvement. 1. Hands off, leave the matter entirely to the transfer office. The approach of leaving it up to the technology transfer office to find a developer and marketer for a discovery precisely met the needs of many faculty members, then and now, who strictly delimit their role in putting their technology into use. A faculty member demarcated this perspective on division of labor in technology transfer: “it would depend on the transfer office expertise and their advice. I am not looking to become a business person. I really am interested in seeing if this could be brought into the market. I think it could have an impact on people’s lives. 2. Knowledgeable participant, aware of the potential commercial value of research and willing to play a significant role in arranging its transfer to industry and 3. No interest’ or non-involvement. However, an attitude of moderate involvement is becoming more common, with scientists becoming knowledgeable and comfortable operating in a business environment while retaining their primary interest and identity as an academic scientist. Faculty are learning to regulate their interaction to both scientific and business needs, giving out enough information to interest business persons in their research but not so much so that a business transaction to acquire the knowledge becomes surplus. The primary objective is still scientific; business objectives are strictly secondary. But once the contract is signed a much higher degree of involvement is expected of both parties. According to Henry most company’s attitude is we want you with your unique expertise to contribute, not to the development of an as yet un-invented product, but to the definition of this product which we as a company may need. In this context the academia becomes involved in helping set the strategic research direction of the company rather than merely handing over a technology, developed as a by-product of academic research that happens to coincide with a corporate need (Etzkowitz, 1998).



METHODOLOGY

This paper was compiled based on systematic review of selected literatures both from advanced and developing economies on university-industry linkage, determinants, practices, trends and challenges. The review paper was used two methods theoretical and empirical. The theoretical method reviewed the key theories forwarded with respect to university-industry linkages practices and the empirical method was employed to identify determinants, channels of interaction, drivers for the collaboration and challenges with respect to university-industry linkages.

The objective of this article review paper was to build or laydown the groundwork what is known about university-industry linkage determinants and challenges and to recommend key lessons for effective and successful University and industry collaboration to Ethiopian Higher Learning Institutions. First, I tried to identify and review sufficient number of relevant research articles and reports published on the topic. This procedure results more than hundred papers. Then, I strained relevant theoretical and empirical literatures according to the fit to the objective of the review and I discarded all irrelevant literatures from further consideration. This process eliminated more than 46papers. I, subsequently further reviewed and screened the remaining articles and reports to check whether they are published before or after the year 1985. Finally, this process results a total of 20useful and relevant articles to achieve the above mentioned objectives and these articles were used for review.

DISCUSSIONS AND FINDINGS

Many studies, pointed towards the important role of interaction of industries with universities and research laboratories. Universities being important sources of information and knowledge for firms seeking to enhance their innovative ability are considered as key actors in the interactive process of innovation. The findings of the survey conducted in India suggest that neither universities nor public research institutes have any important role as sources of information either in terms of suggesting new projects or help completing the existing ones and firms were found to be largely inward looking and depended mainly on its own manufacturing process, and customers as the major sources of knowledge for innovation (Joseph and Abraham, 2009). One of the major finding of the review is that, the probability of forming university–industry linkage



increases with the strength of the firms' knowledge base and the scientific quality of universities (Elisa and Valeria, 2009).

Association of African Universities (AAU) conducted a survey on strengthening university-industry linkages in Africa. And the most common activities identified in university-industry linkages include; organizing seminars and workshops on industry-related issues, conducting short courses for industry personnel, providing consultancy services to enterprises, running short courses for small-scale local entrepreneurs and supporting development-oriented technology transfer for local communities (AAU, 2012).

CHANNELS OF UNIVERSITY-INDUSTRY LINKAGES

Academia-industry linkages can be either formal or informal. It could be organized formally with liaison offices and technologies transfer offices and in some cases establish science parks on or near campuses to facilitate such interaction (Lundvall, 2009). Industry and the academia may set up leadership, dedicated posts, clear strategic direction, and policies for managing the effective governance of the linkages (Kruss, 2008). Informal arrangements could include guest lecture, or stakeholder meetings to revise curriculum (Mpehongwa, 2013).

Joseph and Abraham tried to identify the channels through which knowledge flow from university to industry. These channels include, personal networks of academic and industrial researchers, spin-offs of new firms from universities, participation in conferences and presentations, flows of fresh graduates to the industry, publications and reports, public conferences and meetings, informal information exchange, contract research with universities, joint or cooperative R&D projects, participation in networks that involve universities, temporary personnel exchanges, incubators, joint science and/or technology parks and firm is owned by an university. According to Schartingeretal., (2002) university-industry interactions and knowledge transfer categorized in to four distinct groups; U-I joint research (including joint publishing), contract research (such as consulting and financing of university research), mobility (staff movement between universities and industry, joint supervision of students during industry placement and internship) and training (such as training of firm staff at universities, lecturing by industry staff on selected topics).



DETERMINANTS OF UNIVERSITY-INDUSTRY INTERACTION

Besides, the challenges that affect the formation of effective university-industry linkage, according to recent research findings there are a number of factors considered as determinants of U-I interaction. Markus Perkmann et al., (2013) they classified these factors into; individual, organizational and institutional characteristics. According to them individual characteristics play an important role in predicting academic engagement with the industry and it includes factors such as; gender, seniority and scientific quality and success of the academic staff. Male academics are significantly more likely to engage with industry as compared to female counterparts (Azagra, 2007). The academic engagement with the industry is often seeded by personal contacts; more experienced researchers are likely to have wider networks and more social capital enabling them to find potential partners in the private sector (Giuliani et al., 2010). In other words, the best and most successful scientists are also those who engage most with industrial partners. In addition, individuals' ability to mobilize resources for their research is also positively linked to collaboration with industry (Bekkers and BodasFreitas, 2008). According to Markus et al., (2013) researchers' productivity and success in fund raising acts as a signal for private companies when identifying potential collaborators, leading to more opportunities and consequently more engagement activities. Moreover, the ability to acquire public resources may indicate a general ability to attract funds, which will also increase the likelihood of moving into collaborative projects with industry.

In line with individual characteristics organizational characteristics significantly influence the university academia engagement with the industry. According to Markus et al., (2013) the most salient organizational-level determinant for academic engagement is represented by the quality of academics' university or department. Above all organizational factors are likely to moderate the impact of individual characteristics on external engagement. The third factor is

The level of development and the focus of university-industry linkages depend on a number of boundary conditions, in particular on; research and teaching capacity found within higher education institutions and industry (foremost, but not exclusively, in technological, scientific and managerial areas), an industrial base (e.g. multinationals and, to a lesser extent, small and



medium-sized industry) involved in R&D activities and concerned with staff development, a traditional interaction practiced between higher education and enterprises and an entrepreneurial culture within the higher education sector. These boundary conditions shape the particular profile that university-industry interactions take. The existence of outward-looking academic staff with experience in both industry and academia is another factor which may facilitate, just as it may hinder, the development of joint activities (IIEP, 2013).

CHALLENGES OF UNIVERSITY – INDUSTRY LINKAGE

Review and analysis of different scholarly literatures reveal various impediments of university-industry linkage. According to Mpehongwa (2013) the centralized economic and education system, which prevented establishment and expansion of private institutions and the over emphasized role of the government and relatively young ages of most universities which coupled with challenges in finance and basic infrastructures, explains why majority have remained teaching university rather than research and technology outreach centers.

Other factors limiting private universities and higher learning institutions to engage in meaningful linkages with the industry include lack of experience, poor leadership, and huge number of students, which constrain academic staff to undertake any other activity apart from teaching. Multinational companies are not interested in investing or collaborating with local academia, as they perceive them poorly prepared to handle challenges posed and skills required by the current knowledge economy (Goedhuys, 2005).

On the survey conducted by Joseph and Abraham (2009) on university-industry linkage patterns, determinants, and effects in select industries in India, they explored the reasons why industries not interacting with universities. They categorized these factors in to firm specific, cultural, transactional costs and other factors. First, when we examine firm specific factor the survey result reveals that majority of respondents believe that their firm's R&D is enough to innovate. This meant that a large number of firms agreed that the firm's internal sources or firm specific sources of information were valuable and sufficient for innovation. Second, concerning cultural factors the beliefs that universities have no understanding of their line of business, they are concerned only with big and hard science and they lack practical knowledge are considered as



the main challenges for effective university-industry linkages. The third most important factor was linked to high levels of transaction costs. Majority of respondents indicated that contractual agreements were difficult with universities and there was lack of trust between them. However, contrary to expectations, geographic distance and difficulties in dialogue does not seem to have a great role in making the universities relevant to firms (Joseph and Abraham, 2009). Further, interactions with industry have become complicated as industries see the university as a potential competitor through its role in the creation of new firms. Although some academics and industrialists wish the university to return to its traditional role of training students and publishing research findings, many states and local governments fund centers and programs to encourage academic institutions to generate new economic activity from the campus (Etzkowitz,1998)

DRIVERS OF UNIVERSITY-INDUSTRY COLLABORATIONS

A number of studies have attested drivers of the formation of linkages between universities and industry (Julio et al., 2010, Elisa, 2008, Lawewnce, and David, 2007, NACRO, 2012, Atlan, 1988, World Economic Forum, 2011, Joseph and Abraham, 2009). These studies have identified a number of factors that force the formation of strong university industry relation in recent years. In the broader literature, perceived benefits from university-industry collaboration include: providing alternative funding channels in an era of constrained financing; access to/or acquisition of equipment; improved curriculum and training in technology oriented programs and problem-solving; enhanced employment prospects for students; supplemental income for academic staff; and clearer contribution of universities to the economy, among others (World Economic Forum, 2011).

In order for university and industry to establish and sustain collaboration, they must gain mutual benefit from the interactions. According to Atlan (1990) several main reasons which are claimed to motivate the university to increase university-industry cooperation include; industry provides a new and additional source of fund for university, universities relationship with the industry, reduce governments' responsibility for the economic support of university research, industrial money involves less "red tape" than government treasury, industrially sponsored research provides student with exposure to real world research problems, industrially sponsored research



provides university researchers a chance to work on an intellectually challenging research programs and some government funds are available for applied research, based upon a joint effort between university and industry. On the other hand, the reasons for industries to seek cooperation with universities are; access to manpower, including well-trained graduates and knowledgeable faculty, access to basic and applied research results from which new products and processes will evolve, solutions to specific problems or professional expertise, not usually found in an individual firm, access to university facilities, not available in the company, assistance in continuing education and training, obtaining prestige (influence) or enhancing the company's image and being good local citizens or fostering good community relations (Atlan, 1990).

KEYS LESSONS FOR EFFECTIVE AND SUCCESSFUL UNIVERSITY AND INDUSTRY COLLABORATION OR LINKAGE

Align Industry-university collaborations with the universities research and development strategy and address a tangible needs of the industry or company: If not, there is high risk of investing in projects that have little or no impact. The point is that there should be a vision within the industry about what the university project will provide to the industry (**Julio A., Etal., 2010**)

Select boundary-spanning individual: In every organization, there are certain individuals who naturally engage in networking activities, maintaining relationships that cross organizational lines. These “boundary spanners” are the main conduits by which knowledge is acquired from external sources and disseminated inside the organization, and they play an essential role in how any organization benefits from and adapts to its environment. Boundary spanners contribute to the success of university-industry collaboration in two primary ways. First, they effect a broad dissemination of the research results inside the university. That is especially true for introducing the findings to individuals beyond the research community who have responsibility for development, manufacturing and other functions. Second, they provide feedback to the company through information they bring back from the universities research community, a mechanism for keeping the research aligned with the university needs.



Share with the industry team the vision of how the collaboration can help the university:

When the university researchers have a strong knowledge of the business setting, company practices and how the research fits company strategy then, the academic research is more likely have positive impact on a company.

Invest in long-term relationships: Plan multiyear collaboration time frames and cultivate relationships with target industry, even if research is not directly supported.

Establishing strong communication linkage with the industry team: It is beneficial to have the company team visit university researchers and interact with university community. The more often these visits occur, the better the outcome and impact of the relationship will be. Such visits can facilitate the creation of strong personal relationships. Personal interactions are also crucial in the transmission of unwritten tacit knowledge such as details of design or development practices. Regular meetings at the company thus foster the success of the collaboration. It specifically involves the following activities such as; conducting face-to-face meetings on a regular basis, developing an overall communication routine to supplement the meetings and encouraging extended personnel exchange, both company to university and university to company.

Build broad awareness of the relation within the university: Contact between university researchers and individuals in the company increases the researches and the relationship impact.

Support the work internally both during the contract and after, until the research can be exploited: Provide appropriate internal support for researchers and include accountability for the university as part of the researchers' role.

A government policy which creates conducive environment to innovation: There is clearly a role for government to play in supporting innovation by developing the scientific, physical, human, and legal infrastructure for technology-based economic developing. However, how it structures the support mechanisms can foster greater collaboration and integration, particularly in



areas where there are market failures such as in the pre commercialization research and early stage business phases of technology development.

CONCLUSIONS

Universities play a very key role to socio-economic transformation and development of the nation through; innovation of new technology, upgrading the existing low-level technology to medium or high technology, devising a better or new and effective management techniques and formulating and suggesting economic and other relevant policies. However, the existing scenario reveals the fact that government is primarily considered as sources of new policies and management techniques not only the general public but also for higher learning institutions. Hence, the question is then; was the hands of the government long and influence the innovative capability of the academia or the academia hand is short to influence government through innovation?

Therefore, whenever universities and industries work together one after the other to push the boundaries of knowledge, they turn out to be a powerful engine for innovation and socio-economic development of the nation. University-Industry engagement requires both sides to engage far beyond the traditional and common exchange of research for funding and staff training. When they work well together, strategic partnerships merge the discovery-driven culture of the university with the innovation-driven environment of the company. But to make the chemistry work, each side must overcome the traditional partnership culture and communication boundary that tends to weaken industry and university collaboration of all types which was weakened their potential to the development of their nation. Generally, the theoretical and empirical discussions, findings, suggestions and lessons in this article review lead to the following policy implications and intervention strategies.

- Collaboration within the universities or academia itself should better be enhanced. Because, due to young age, most of the universities or higher learning institutions in our country lack infrastructures such as laboratories, testing facilities, qualified and experienced staff. Though, the situation is not uniform across all universities; some have well-furnished laboratories and facilities, but lack well-qualified and experienced staff. In this regard, collaboration among



institution may counterbalance these challenges. They could share the existing facilities, organize joint research and development, exchange experience and plan together.

- Establishing organizations and programs that connect research with business and catalyze collaboration. Organizations that act as platforms for communication, networking, and the development of shared goals among community stakeholders, e.g. entrepreneurs, trade associations, university researchers and administrators, capital providers, and business support service providers among others to foster innovation and entrepreneurship across and within the private sector as well to facilitate greater university-industry engagement. These organizations sit at the interface between idea creation and business generation.
- Establishing a technology fund should be considered as alternative ways of inspiring and enhancing sustainable collaboration between academia-industry and government. The fund, possibly established by the government, should be availed to the academia and it can be used to co-finance Research and Development programs.
- Establishment of science parks and technology incubators for the purposes of technology transfer. Enhance training of faculty in requisite business and management skills to run the science parks and technology incubators
- Active participation of the private sectors in curriculum development. Especially in areas of entrepreneurship and technology should be considered and ensured. Because, the private sector can support educational and training programs by employing and extending sponsorship to graduates, and allowing for apprenticeships and assistance with graduate students projects.

REFERENCES

Association of African Universities (2012). Strengthening university-industry linkages in Africa: A study on institutional capacities and gaps.

Atlan, Taylan (1987). Bring Together Industry and University Engineering Schools, in Getting More Out of Research and Development and Technology, The Conference Board, Research Report No. 904.

Azagra-Caro, J.M., (2007). What type of faculty member interacts with what type of firm? Some reasons for the delocalization of university–industry interaction. *Tec innovation* No. 27, pp. 704–715



- Bekkers, R., BodasFreitas, I.M., (2008). Analyzing knowledge transfer channels between universities and industry: to what degree do sectors also matter? *Research Policy*, No.37, 1837–1853
- Elisa G., and Valeria A., (2009). What drives the formation of ‘valuable’ university–industry linkages? Insights from the Wine Industry; Elsevier *Research Policy*, Vol. 38, Issue 6.
- Gaspar Mpehongwa., (2013). Academia-industry-government linkages in Tanzania: trends, challenges and prospects; *Journal of Educational Research and Reviews*; Vol. 8(21), pp. 2093-2100
- Giuliani, E., Morrison, A., Pietrobelli, C., Rabellotti, R., (2010). Who are the researchers that are collaborating with industry? An Analysis of the Wine sectors in Chile, South Africa and Italy. *Research Policy* 39, 748–761.
- Global Connect Report, (2007). Integrating and Enhancing the British Columbia Knowledge Transfer System; Ference Wicker and Company. (www.connect.org)
- Goedhuys M (2005). Learning, Product Innovation and Firm Heterogeneity in Tanzania. United Nations University Discussion Paper.
- Henry Etzkowitz (1998). The norms of entrepreneurial science: cognitive effects of the new university–industry linkages; *Research Policy* 27, 823–833
- International Institute for Education Planning (2000) Management of University-Industry Linkages: Policy Forums, No.11.
- Julio A. Pertuzé, Edward S. Calder, Edward M. Greitzer and William A. Lucas., (2010) Best Practices for Industry-University Collaboration; MIT Sloan Management Review
- K. J. Joseph and Vinoj Abraham., (2009). University-Industry Interactions and Innovation in India: Patterns, Determinants, and Effects in Select Industries; *Seoul Journal of Economics*, Vol. 22, No. 4
- Kruss G (2008). Balancing Old and New Organizational Forms: Changing Dynamics of Government, Industry, and University Interaction in South Africa. *Technol. Anal. Strat. Manage.* 20(6):667-682.
- Lundvall Be (2009). Handbook of Innovation Systems and Developing Countries: Building Domestic Capabilities in Global Settings. Cheltenham, Edward Elgar Publishing Ltd.
- Markus Perkmann., Valentina Tartari., Maureen McKelvey., Erkko Autio., Anders Broström., Pablo D’Este., Riccardo Fini., Aldo Geuna., Rosa Grimaldi., Alan Hughesm., Stefan Krabel.,



Michael Kitsong., Patrick Llerena., FrancesoLissoni., Ammon Saltera., and Maurizio Sobrero.,(2013).Academic engagement and commercialization: A review of the literature on university–industry relations; Research Policy 42, 423-442

Network of Academic Corporate Relations Officers Benchmarking Committee (2012). Metrics for a Successful Twenty-First Century Academic Corporate Relations Program; White paper; found at (www.narcoonline.org)

Schartinger, D., Rammer, C., Fischer, M.M. and Fröhlich, J., (2002). Knowledge Interactions Between Universities and Industry in Austria: Sectoral Patterns and Determinants. Research Policy, 31, 303–328.

Ssebuwufu J, Ludwick T, and Béland M., (2012). Strengthening University Industry Linkages in Africa: A Study on Institutional Capacities and Gaps, Association of African Universities, Accra, Ghana

World Economic Forum (2010).The Global Competitiveness Report.Geneva