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AN ASSESSMENT OF UNIVERSITY-INDUSTRY RELATIONS FOR COLLABORATIVE TECHNOLOGY TRANSFER: THE CASE OF INSTITUTE OF TECHNOLOGY OF BAHIR DAR AND TECHNOLOGY FACULTY OF GONDAR UNIVERSITY

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ABSTRACT

University-industry technology transfer activities are increasingly important as a source of regional economic development and revenue for the university. This research is conducted to assess collaborative university industry technology transfer. Questionnaire and interview have been used as tools to collect the data. Descriptive statistics have been employed to analyze the data collected using the questionnaire and explanation building techniques were used to analyze the interview. It was possible to understand from the study that there is weak collaborative technology transfer from universities into the industry with regard to the cases selected in this study.

KEYWORDS

Collaborative Technology Transfer, Innovation, University-Industry.

INTRODUCTION

University-industry technology transfer activities are increasingly important as a source of regional economic development and revenue for the university (Friedman and Silberman, 2003). Ethiopia has very limited resources at her disposal to allocate for building up of advanced national Science and Technology (S&T) capability. Extensive and sustained development of S&T capability is required to bring about massive social, economical and technological changes, to rapidly achieve increases in agricultural and industrial productivity, to rationally conserve and use natural resources to provide for basic human necessities, to modernize communication network (Blumenthal and et al., 1996). Such long-term undertakings, with limited resources, can succeed if university-industry linkages are guided by open and collaborative partnerships. Transferring the results of university research to industry may take several forms and thus can be achieved in different ways. i.e. patenting, licensing, spin-off firms, etc. Although the transformation of academic research results into industry is widely accepted as a crucial factor for the industrial growth and competitiveness, this is not an effortless or simple linear process that flows directly from academy to industry.

REVIEW OF THE RELATED LITERATURE

University-industry linkages have long been at the centre of academic and policy attention. In spite of the copious literature on different aspects of such linkages, there is still rather inconclusive evidence on both the specific nature of the interactions between universities and businesses. In modern times, collaboration between university and industry is regarded as an important social experiment in the nation's innovation system. This suggests that joint efforts are needed to concretely enhance society's development, through technology transfer. University technology transfer has become an important mechanism for economic growth in the U.S. and much of the world. The Association of University Technology Managers (AUTM) reports that Over 65% of innovations of developed countries is licensed by universities and institutions in 2004 were granted to small businesses for commercialization purposes (AUTM, 2005). There are also efforts the developing countries to speed up technology transfer from universities to the industry. For instance in February 1994 United Nations Educational, Scientific and Cultural Organization (UNESCO) launched the University-Industry Science Partnership (UNISPAR) Programme in Africa with the view of promoting cooperation between universities and industries in the region. These activities include conferences, dissemination of information, publications and award of grants for university-industry joint projects. The constraints to achieving effective collaboration between university and industry are however many. The ignorance on the part of scientists of the needs and characteristics of local industry are few among many (IETC, 2003, Link and Siegel, 2005, Jabar and Soosay, 2010.). At the purely academic end of the spectrum, university technology transfer can mean a faculty member's presentation of basic research at a symposium or perhaps the publication of a journal article. At the commercial end, university technology transfer may involve the licensing of university inventions to an industrial firm. University faculty and students may even be directly involved with such a firm as consultants, shareholders and employees (Bozeman, 2000).

TECHNOLOGY TRANSFER IN AFRICA

In the developed or industrialized countries, partnership between university/research institutes on one hand and industry on the other, is one of the most effective strategies for technology development and a useful tool for assuring the effective and efficient application of science and technology to the resolution of social problems. Such partnerships take many forms including the joint execution of research projects, the award of research contracts, the development of curricula and the provision of continuing engineering education for practicing engineers and scientists. In most African countries, however, partnership between local industries and universities is not very common. Therefore, the transformation of research results to products/technologies is usually left to the individual who, without the necessary institutional framework and experience, only allows the idea to collect dust in a little known journal (Trigeorgis, 1996). There are of course several reasons why such partnerships (or the enabling institutional arrangements for such partnerships) have not developed over the years. These include the weakness of the research infrastructure in some countries, which inevitably leads to a scarcity of scientific research of economic value. There is also inability to develop research results into commercial products among scientists and even brain drain (Pfeffer & Salancik, 1978)

A CONCEPTUAL MODEL OF UNIVERSITY-INDUSTRY TECHNOLOGY TRANSFER

University-Industry technology transfer relationships are one strand of activity in a larger set technological innovation processes. Technological innovation involves the successive transformation of knowledge (often derived from scientific research) into practical artifacts, tools, or practices which are subsequently deployed to users, via public dissemination or private markets (Bowen, 1980). Without going into the huge theoretical or empirical literature on technological innovation, there are a few key concepts of relevance to the topic:

- ❖ Technological Innovation involves a life cycle of stages and phases which are qualitatively distinct (e.g., research, development, technology adoption, implementation). Viewed retrospectively, this life cycle has the appearance of being quite linear (e.g., research leads to development) but usually is not during its execution.
- ❖ The processes are influenced by different levels of factors, which range from very macro (e.g., government policy, market structure) to very micro (project manning, group dynamics, organizational rewards and incentives). All levels of influence operate concurrently, and one can "explain" the success or failure of the innovation process by the influence of each, although that explanation is likely to be incomplete (Lee, 1996, Klawe, 2010).

All of this suggests a complex, context-sensitive, multi-layered, and interdependent approach to understanding university-industry technology transfer.

TYPES OF UNIVERSITY-INDUSTRY INTERACTIONS

Research relationships are a subset of many different interactions between universities and companies. Six research mechanisms can be identified for universities and industry to work together (Albert and et.al. 2005, UNESCO, 2005, Business-Higher Education Forum, 2001). These are:

- A. Sponsored research: The most frequent form of research relationship, which involves companies directly funding university research.
- B. Collaborative research: University-industry research partnerships that are encouraged through partial federal funding.
- C. Consortia: Groups of companies and universities engaged in various research efforts of common group interest.
- D. Technology licensing: Licensing of university patents (usually stemming from federally funded research) to companies for commercialization.
- E. Start-up companies: Usually involving university faculty, they often obtain licensing agreements to access university technologies.
- F. Exchange of research materials: Used to expedite the performance of research and accomplished through material transfer agreements.

WHY UNIVERSITIES AND INDUSTRY COLLABORATE

Why do universities and industry collaborate? The reasons are many, though this list is by no means exhaustive the following can taken as common reasons:

- Materials exist in industry for research and educational purposes that may not exist in institutions of higher education.
- Collaborations with industry provide research funding to universities. Universities come to rely on the generation of extramural funding as they structure their budgets. A sad reality, though, as money should not drive every decision made within universities.
- Collaborations can advance the service mission of universities.
- Collaborations provide for local and regional economic development.
- Collaborations between universities and industry often are novel to high technology areas, as opposed to low technology areas (such as basic manufacturing).
- At some universities these collaborations are part of their internal reward structure (financial incentives to faculty which are critical for research development and retention of 'star' faculty).
- Universities often have research infrastructure that industry wants.
- Industry outsourcing to universities, to reduce the costs of doing business and increase profits.

As this list illustrates, this symbiotic relationship reflects benefits to each partner. This is one strong characteristic of university-industry collaboration (James and Casey, Jr, 2010, Baba, 1988).

IMPORTANCE OF THE STUDY

Technology transfer, the accumulation of knowledge and its spill-over into production process is considered as the primary engine of economic development (Romer, 1990; Grossman and Helpman, 1991). This trend has resulted in the full recognition of the role of knowledge and technology in economic growth. Simultaneously the transition to a knowledge-based society and the application of knowledge in the production systems has changed the role of universities and industrial firms. In today's global world of knowledge, learning and innovation have become strategically important factors that foster competitiveness and economic growth of countries. Globalization, international knowledge exchange and the increasing global competition require the rapid transfer of scientific knowledge and understanding into everyday life (Ziman, 2001 in Göktepe, 2004, Tornatzky, 1990). Both universities and many firms have faced these challenges, therefore, studying university industry relation has a great significance for Ethiopia in an endeavour towards the success of the transformation plan of industrialization in the coming five years.

STATEMENT OF THE PROBLEM

Ethiopia's industrial sector is backward in its sectoral structure, employment, and technological content (World Bank, 2006). This problem further compounded due to the short supply of scientists, engineers, technicians and skilled workers in the field of science and technology. According to the 2006 World Bank report, manufacturing in Ethiopian has stagnated at about 5% of GDP over the last 20 years. Manufacturing industry is largely limited to simple agro-processing activities (sugar, grain milling, edible oil production, leather tanning) and production of basic consumer goods (beer, footwear, textiles and garment). Industries that might help accumulate technological capabilities and create dynamic inter-industry linkages – such as chemical, electrical and electronics, metal-processing and other engineering industries – are almost non-existent. Overall, the technological level of firms in Ethiopia is very low, even by regional standards; e.g. only 4% of firms use technology licensed from foreign companies, and likewise only 4% have ISO certification compared to 12% in both cases in Sub-Saharan Africa (World Bank / IFC 2006).

OBJECTIVE OF THE STUDY

The purpose of this paper is to identify the characteristics and forms of the university and industry relations, the enablers and barriers to university-industry relations as well as the role of organizational and institutional structures of universities and industries in this process. For this purpose, an empirical study on the institute of technology of Bahir Dar and the Technology Faculty of Gondar University have been conducted. This paper make an assessment on the extent and forms of the university-industry relations; enablers and disablers of this process; role of the university and industry in this process.

BASIC RESEARCH QUESTIONS

1. What are the characteristics of university-industry relations at the institute of technology of Bahir Dar and technology faculty of Gondar University?
2. What are the forms of communications practised in university-industry collaborative relations?
3. How do universities and collaborating firms evaluate their relations?
4. What differences are there between universities and firms engaged in collaboration?
5. What are the enablers and barriers in university-industry relations?

RESEARCH DESIGN AND METHODOLOGY

In light of the complex research issues and scarcity of any available material from the Ethiopian context dealing with technology transfer from universities to industries, a combination of qualitative and quantitative methods appeared the most appropriate and suitable strategy for the research by performing desk research, conducting interviews and a survey (Patton, 2002, Yin, 2003).

RESEARCH PROCEDURE AND SELECTION OF CASES

My main research interest is to investigate technology transfer from university to the industries. Thus, the aim will not be to sample for proportionality, but instead the goal will be to cover representatives of a specific group of actors. Given my aim to analyze the university-industry relations, I will focus on Technology Institute of Bahir Dar and the Technology Faculty of Gondar University and related industries that have relation with the universities in one way or the other were selected in this research. I have collected the empirical evidence through questionnaire surveys among the employees industries that have collaborated or worked with universities in one way or the other in these settings.

PRIMARY DATA COLLECTION

Questionnaire have been used for both universities and collaborating firms in order to obtain a general overview of the phenomenon and firm specific information on the conditions for technology transfer. The interviews, however, have provided deeper information on the why and how questions. Both methods are thus complementary.

DATA SOURCES AND DATA COLLECTION INSTRUMENTS

The empirical materials that have been used in this paper include both primary and secondary data sources. Primary data have been collected through a survey and interviews from both Institute of Technology (IOT) of Bahir Dar and the Technology Faculty of Gondar University and firms that have collaborative relation with these universities. A total of 80 Questionnaire were distributed to academic members of IOT of Bahir Dar university and technology faculty of Gondar university i.e. 40 questionnaires to each. However, only 67 questionnaires were filled and returned back. On the other hand, 50 questionnaires (25 questionnaires to industries in Bahir Dar and Gondar each) were distributed to industries that have some form of relationship with universities and 42 of them have been filled and returned. A total of six interviews (2 interviews in each of IOT of Bahir Dar and Technology faculty of Gondar and one interview with companies in Bahir Dar and Gondar each) have been made and analyzed using explanation building techniques. By means of triangulation of different types of data (i.e. to include documents, interviews and observations in the study), an easier construction of validity for the study will be improved. The interview group have received guidelines and an interview protocol representing a list of possible items that could be addressed in the survey questionnaire.

METHOD OF DATA ANALYSIS

The empirical evidence from the review of documents have been summarized in the review of the relate literature. Then, the data collected using the questionnaires was analyzed. Descriptive statistical analysis to measure the percentages, frequencies and mean of the responses were calculated. The interviews have been written down during the interview in the form of note writing then further elaboration have been made and rewritten. The interview data obtained during the interview have been analyzed by using explanation building techniques (Eisenhardt, 1989).

RESULTS AND DISCUSSIONS

The data obtained from both the questionnaire and interview is analyzed in this chapter. The data obtained from the questionnaire is entered in to SPSS 15.0. Then, the SPSS 15.0 is run to generate frequency table. The findings obtained from the questionnaire are interpreted by comparing the responses of both universities and the collaborating industries. The interview data is also analysed and triangulated with the information obtained from the questionnaire using explanation building techniques.

University-industry collaboration need to be based on mutual trust and understanding for effective partnership. To this effect most (more than 68%) of the respondents from both university and collaborating firms replied that they have a strong feeling of trust between them. In terms of knowing whether respondents know their organization have relationship with partners; both universities and collaborating organizations believe that they do not know about relationship activities between universities and the industry. However, the interview result shows us that there are relationships although they are uncoordinated. For example, students are sent for some kind of practical attachment works in to the industry. The finding of this study shows that employees of universities and the industry (80%) are interested to deal in an open manner with each other. Respondents were also asked whether they use knowledge, technology available from other sources. The data showed that (55%) of respondents do take knowledge available from outside sources. This implies that the parties to the partnership are more open and willing to take ideas and information from others which again are a considered as an important quality of innovativeness. In addition, both (75%) of employees of universities and the industry are willing to work for an extended period of time in collaborative activities. The data obtained from participants of the study also revealed that universities and collaborating organizations are willing to commit themselves (86%) in to relationship and have a strong desire to establish a partnership relationship that can last for more than five years (82%).

Respondent were also asked to choose specific type of communication dominantly used during the interaction, accordingly, respondents from both universities and the collaborating industry confirmed that the form of communications usually used for communication are informal communication among members ,the written communication, Telephone conversation, Email, and face to face interaction in order of their importance. This implies that universities and collaborating industries are not working well in introducing formal means of communication with the industries that is why most of the respondents (80%) from both universities and the collaborating industries responded the absence of feedback to communications. It is also possible to understand from the data that even though the collaborating organizations are aware of the importance of sharing information (76%) both the universities and collaborating industries neither agreed nor disagreed with regard to sharing of proprietary knowledge and technology. This may imply that there is no invention or technology that is protected with intellectual property rights. Universities and industries are not keeping informed each other about what is going on in them (75%). This might mean new inventions, knowledge or technology developed in universities is not being communicated to the surrounding (collaborating) industries. The industries on the other hand are reluctant to let the universities know their problems and seek for solutions as there is no formal relationship established as there is no dialogue between the two.

Respondents were asked whether the partner universities and companies were satisfied with their relationship so far, accordingly, a considerable number of the respondents (72%) from both the university and collaborating industries reported that the relationship is not effective up to their expectations.

TABLE 1: THE COLLABORATING ORGANIZATIONS AND UNIVERSITIES CARRIED OUT THEIR RESPONSIBILITIES AND COMMITMENTS WITH RESPECT TO THE RELATIONSHIP SO FAR, MEETING MY EXPECTATIONS

	University		Industry	
	Frequency	Percent	Frequency	Percent
Strongly Disagree	16	23.9	9	21.4
Disagree	35	52.2	21	50.0
Indifferent	6	9.0	3	7.1
Agree	10	14.9	9	21.4
Total	67	100	42	100

Source: Computed based on the author survey on 2012

A great majority of respondents also believe that the relationship between university and the industry as unproductive (70%). Respondents were also asked whether they are happy or not with the relationship performance, accordingly, on the average 73% them reported that they are not happy. The following items were asked to respondents in order to identify potential differences between the university and their organizations. Understanding the differences between them will help to design appropriate tools for establishing effective university industry collaborative platform. To this end, questions asking about the similarity of interests, consistency of goals and objectives and compatibility of reward system between individuals in the university and collaborating industries are included in the questionnaire and are analyzed as follows.

With regard to whether universities and collaborating industries share similar interests, the respondents replied as they have different interests. This might be because these two different organizations are established to achieve different objectives; however, they have to cooperate and collaborate to bring effectiveness and efficiency in an effort to reach to their respective goals. The above information is further strengthened with the respondents' reaction to the consistency of goals and objectives between them. As can be observed from the following table both the industry and university acknowledged the difference of their goals and objectives.

TABLE 2: OUR GOALS AND OBJECTIVES ARE CONSISTENT WITH THOSE OF THE COLLABORATING ORGANIZATIONS

Scale	University		Industry	
	Frequency	Percent	Frequency	Percent
Strongly Disagree	14	20.9	9	21.4
Disagree	43	64.2	25	59.5
Indifferent	4	6.0	4	9.5
Agree	5	7.5	4	9.5
Strongly Agree	1	1.5	-	-
Total	67	100.0	42	100.0

Source: Computed based on the author survey on 2012

In terms of encouraging employees to take initiatives to bring new ideas in to their organization, I found somewhat different views from the university respondents and that of the industry. It seems that employees of universities to have better freedom to take initiatives than that of the people in the industry. The possible reason for industries not to encourage their employees to take initiatives could be attributed for their low risk taking behaviour or for new ideas might be feared by managers for they are not tested. Respondents were asked whether they anticipate what their partners and customers would probably need in the future and seek for technologies to meet them. According to the data obtained from the respondents from the industry there is no such effort made by their company to engage in forecasting of their customers and partners need, however, a better response have been found on the side of the university on this issue.

Respondents were also asked what motivates them to engage in research activities. Accordingly university employees reported that publication and access to government funding as the main motivators while peoples from the industry identified profit making, applied research and development of technology as primary issues that motivates them to engage in research activities.

TABLE 4: WHAT MOTIVATES YOU TO ENGAGE IN CONDUCTING RESEARCH

	University		Industry	
	Frequency	Percent	Frequency	Percent
Development of technology	42	64.62	39	92.86
Generation of knowledge	51	78.46	30	71.43
Publications	56	86.15	23	54.76
Patents, licences	30	46.15	28	66.67
Profit making	7	10.77	41	97.60
Funding for future research	47	72.31	8	19.05
Access to government funding	50	76.92	5	11.90
Basic research	47	72.31	7	16.67
Applied research	32	49.23	40	95.24

Source: Computed based on the author survey on 2012

It also possible to understand from the data that employees of both universities and the industry do not seem know about the environment of the other. This may create barrier on both sides to understand and initiate what type of technology or knowledge could be transferred. Both universities and the industry need to create the platform to discuss and understand each other in order to achieve their respective objectives effectively.

INTERVIEW DATA ANALYSIS

University industry coordinators and technology transfer officers of Institute of Technology (IOT) of Bahir Dar and Gondar University have been asked to describe the characteristics of university-industry relations. Respondents replied that the relationship with the industry is beset with many problems. On the side of the university there is no coordinated effort to identify technology needs of the industry and most of the attention of the university is focused on teaching and learning activities. The relationship with the industry is usually through student placement. Students are assigned to various companies for their practical attachment. The relationship is usually initiated by universities. There are no indications where industries approach universities to get their technology and other work related problems solved. But, there are beginnings where the industries are requesting universities to come with solutions for their problems. Students are required to identify problems of the company where they are assigned for practical attachment and give solution in a scientific approach. Students are also expected to report every problem they come across and the solution given. In this regard, respondents from the industry replied that universities are not open dealing with us. They said the doors of the universities are closed. If we want to get solution for our problems we better approach individuals that the formal approach. Respondents from the industry replied that university graduate lacks practical knowledge and as a result they take longer time to work independently. Universities respondents replied that they have engaged in technology transfer activities, they identified training, graduating students, research and publication as the mechanisms through which technologies are transferred in to the industries and the society at large. They have also reported that students are actively participating in technology creation in their respective fields. However, universities reported that they do not spin-off start up companies. Universities also reported that they give consultancy services to the industry. They have cited the Bahir Dar Marine enterprise and other companies as an example.

RECOMMENDATIONS

To accelerate the cycle of university-industry partnerships, universities must adopt open minds and be receptive to mutually beneficial partnerships. One approach to initiate such contacts is to establish sabbatical programs for faculty members to spend time in industrial labs.

- Government interventions are also recommended when both industry and universities are weak.
- At the university level, the reward system needs to be realigned to encourage such partnerships.
- Encouraging national networking through national forums for young scientists and young leaders could connect problem-solvers with problem-identifiers.
- Both universities and the industry shall create the platform to discuss and understand each other in order to achieve their respective objectives effectively.

CONCLUSIONS

- Both university and collaborating firms replied that they have a strong feeling of trust between them.
- Both universities and collaborating organizations believe that they do not know about relationship activities between universities and the industry.
- The finding of this study shows that employees of universities and the industry (80%) are interested to deal in an open manner with each other.
- Universities and collaborating industries are not working well in introducing formal means of communication with the industries
- There is limited instances where new ideas been brought in to universities and collaborating industries. This means they are busy of their daily routines and no extra effort is paid to try out new ideas
- Employees of universities to have better freedom to take initiatives than that of the people in the industry. The possible reason for industries not to encourage their employees to take initiatives could be attributed for their low risk taking behaviour or for new ideas might be feared by managers for they are not tested.

- Universities and collaborating industries take immediate corrective actions when partners are unhappy with the quality of service provided by the other party to the relationship.
- Employees of universities do research mostly with the intent of satisfying their need for publication and access to government funding while industries are doing research with the purpose of profit making, applied research, and development of technology.

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