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Determinants of University-Industry Linkage: Evidence from Dire Dawa City

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Abstract
It is recognized that the importance of linkage of higher education institutions with various industries for a given country sustainable development. However, in one or another way the linkage between universities and industries seems to be very weak particularly in developing countries. The aim of this study is to investigate factors that determine the University-Industry linkage in the case of Dire Dawa city. For the sake of achieving this objective, primary data was collected through structured questionnaire from a sample of 159 academicians that were selected using systematic random sampling techniques. Moreover, questionnaire was distributed to 31 companies that are selected using convenience sampling technique. Furthermore, interview for the focal person of Institute-Industry Technology Transfer office were conducted. While descriptive narrations through concurrent triangulation strategy were applied to analyze the data collected from interview, data collected using questionnaire were analyzed using descriptive statistics and econometric model (ordinal logistic regression). Hence, access of funding, previous experience and publication were found significant factors in determining University-Industry Linkage. The result of the study indicates that training and student internship programs are the two major areas where the university is collaborating with the industries. Thus, the university has to reform its incentive mechanism for researchers. Academicians should also have to conduct demand driven and quality researches to the industries in order to gain industries' trust. Industrialists should support the academicians those who engaged in industry related tasks by offering financial and other supports. The Institute-Industry technology transfer office should re-establish again as University-Industry Linkage office with a directorate level.
Keywords: Academicians, Industry, Linkage, knowledge transfer, University.

1. Introduction

Universities have long been recognized as sources of knowledge creation, innovation, and technological advances. Experience demonstrates that a mutual integration between university and industry can foster the development of the communities in which both are operating (Camagni et al, 2004). According to Martin (2000), University-industry linkages can take various forms and involve different intensities of engagement. These include R&D, training and curriculum development, and consultancy. Enterprises and other actors may commission a specific research project, sponsor a university chair in an area of interest, or engage in joint R&D with universities. Through prototype development, technology incubation, the creation of spin-off companies for commercialization, licensing and royalty agreements and other related-activities, universities promote technology transfer to the productive sector. Other universities focus on providing consultancy and business services, such as testing and certification (Basant and Chandra, 2007). 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 (Ssebuwufu et al., 2012). In terms of teaching and training, university-industry activities include offering professional courses on a fee-basis to respond to the particular skill and training needs of industry. Universities may engage industry and other productive sector representatives in course curriculum development to ensure that degree programs can produce graduates with the required knowledge and skills for the workforce. Creating opportunities for student attachments and co-op placements in the productive sector is another common way in which universities link up with industry (Homma and Attalage, 2008; Munyoki et al, 2011). Industries may also play a role in defining student research projects that focus on issues and problems of direct interest to industry (Boersmaa and Gibbons, 2008).

Besides to its responsibility to render quality education to the students, Dire Dawa University (DDU) has also other two major obligations which connect it directly to the community; i.e. research and community service. Starting from its inauguration the university tried to provide community services and conducted different research on the thematic areas as much as possible. In the university both the research and community services are provided by separate directorate. Both directorates strive to deliver the necessary services and activities to the community, surrounding industries and in general to the country's growth and development. However, the interaction of the university with the surrounding community and industries is not found as where it expected or demanded.

It is already recognized that the importance of linkage of higher education institutions with various industries for one's country sustainable development. This is supported by Ssebuwufu, et al., (2012), in their

study universities need to produce work-ready graduates with the requisite skills for the job market, it is also increasingly recognized that universities should play a pivotal role in applying research and innovation to address socio-economic problems and promote innovation for economic growth by forging strategic partnerships with the productive sectors of the economy and national innovation systems. Collaboration between universities and industries is critical for skills development (education and training), the generation, acquisition, and adoption of knowledge (innovation and technology transfer), and the promotion of entrepreneurship (start-ups and spin-offs). The benefits of university-industry linkages are wide-reaching: they can help coordinate R&D agendas and avoid duplications, stimulate additional private R&D investment, and exploit synergies and complementarities of scientific and technological capabilities. University-industry 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 (Guimón, 2013). On the opposite side, the insubstantial linkage of university and industry can affect the competence of graduates, the productivity of firms, the quality of output, the ability of solving problems, and in general the speedy of economic development of the country.

Even if, University – Industry linkage (UIL) has been promoted widely by governments and institutions across continents since the 1980s, African universities have not been active in this regard (Dzisah and Etzkowitz, 2008 as cited Wondwosen, 2008). Higher institutions in Sub-Sahara Africa have specially been found very slow in terms of engaging in university-industry linkage (World Bank, 2009). Ethiopian does not look an exception in this regard and the university-industry linkage is underdeveloped (Wondwosen, 2008). There is no such a strong linkage among industry and university in Ethiopia (Teshome, 2014; workshop on industry & university linkage). Thus, in order to fill the aforementioned gap this study needed to conducted with the following objectives.

1. To investigate factors that can determine the integration of the university with industries
2. To identify the challenges that impedes the university-industry linkages.
3. To measure the level of University-Industry linkage.

2. Literature Reviews

D'Este and Patel (2007) showed that university researchers interact with industry using a wide variety of channels, and engage more frequently in the majority of the channels examined – such as consultancy & contract research, joint research, or training – as compared to patenting or spin-out activities. In explaining the variety and frequency of interactions, they found that individual characteristics of researchers have a stronger impact than the characteristics of their departments or universities. Abraham (2016), reported 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.

According to World Bank (2013), successful industry-university collaboration needs to support the missions and motivations of each partner. For universities, typical motivations to collaborate with industry include the improvement of teaching, access to funding, reputation enhancement, and access to empirical data from industry. Bureaucratic hindrances experienced in the mutual relationships slow down the rate of collaboration and extend the time taken to complete projects. As universities are public institutions, the internal registration procedure following an application often prevents a project from being realized at the speed demanded by industry. The bureaucratic structure of universities seriously slows down the decision-making process. Another key factor for the success of university-industry collaborations is two-way communication. Research states that the two-way communication mechanism should be structured to allow parties to continue collaborations (Schartinger et al., 2002). Communication between universities and industry has been determined to take the form of including several academic disciplines and several areas of industry.

Previous collaboration experiences and the level of success influence decisions about the future of collaborations (Hagedoorn & Achakenraad, 1994). While collaboration that present successful results will encourage the next collaboration project, problems experienced for parties or collaborations that did not reach a result weakens the organization's image and has a possible negative effect on the partnership. However, bad collaboration experiences have the possibility of supporting the organization's learning process.

The efficiency of the university-industry collaboration centers is closely related to the success of the joint studies between academic institutions and industry. University-industry collaboration development, application and research centers, R&D laboratories, techno-parks (Kökocak, 2006), technology transfer offices (Kiziltaş, 2009), centers of excellence, and information licensing offices are important structures for building bridges between universities and industry. Firm size is one of the most obvious variables representing the firm-level

resources, which affects firms' decision regarding R&D cooperation with external factors (Fontana et al., 2006; Segarra-Blasco and Arauzo-Carod, 2008; Eom and Lee, 2010).

Cohen and Levinthal (1990) argued that absorptive capacity can be seen as a byproduct of a firm's R&D investment, they acknowledged also that manufacturing experience can provide the firm with the necessary background, in order to both recognize and implement new methods. Moreover, absorptive capacity can be developed by deliberate efforts in order to benefit from personnel exchange and training. In particular, they suggested that when a firm wishes to acquire and use knowledge that is unrelated to its current knowledge base, deliberate efforts are required for creating absorptive capacity. Firms that invest heavily in R&D are likely to possess a high technological capability allowing them to absorb the knowledge developed outside the firm (Fontana et al., 2006). Firms whose R&D capacities are large enough to absorb external knowledge are expected to seek such linkages easily and more actively. However, the opposite situation may occur as well; these capable firms may want to try to substitute in-house efforts for the external cooperation (Eom and Lee, 2010).

Audretsch and Stephan (1996) emphasize the geographic proximity in terms of specific roles played by scientists, e.g. technology transfers. This is particularly important if knowledge is tacit, such that its transfer can be facilitated by face-to-face communication. Jaffe (1986) suggests that the closer the proximity of university research to corporate laboratories, the more probable the potency of spillovers from university. Santoro and Gopalakrishnan, (2000) argued that organizational trust plays a role in knowledge transfer and technology transfer activities. They offered two reasons to illuminate how trust reduces this vulnerability and facilitates technology transfer and knowledge transfer activities.

3. RESEARCH METHODOLOGY

In this study a mixed research approach were employed. This is due to the reason that many good research projects are conducted through a combination of both qualitative and quantitative research approaches (Zikmund, 2005) and the nature of the study that requires describing and explaining quantitatively and qualitatively.

The target populations of the study are employees that are employed at Dire Dawa University and surrounding industries which are operated in Dire Dawa city. The sampling technique for this study was random sampling technique for the university's academicians and non-probability method specifically convenience sampling method was used for selecting sample from the industry. After the total population from the university is identified, the sample size was determined by applying a formula provided by Yemane (1967), i.e.

$$n = \frac{N}{1+Ne^2} = \frac{604}{1+604(0.05)^2} = 241$$

From the industry side, convenience sampling method was used and 31 companies are selected as the sample. Open and close ended questionnaires were prepared and personally distributed by the enumerators for academicians from university and industry to collect relevant data for the study. In addition to the questionnaire, interview questions were prepared and conducted to the University-Industry Linkage office focal person. The study was analyzed using descriptive statistical tools like percentages, table, chart and graph. Beyond the descriptive analysis, the econometric model, i.e., ordered logit model was used to examine the relationships between and among variables of University-Industry linkage as well as to identify the determinants of university-industry linkages. The study was used ordered logit model to identify what factors and to what extent those factors could affect the university-industry linkage by specify the following regression model.

$$UI_i = \alpha + \beta_1 FUN_i + \beta_2 INTR_i + \beta_3 EXP_i + \beta_4 PUB_i + \beta_5 BUR_i + \beta_6 COL\_CEN_i + \beta_7 COMM_i + \varepsilon_i$$

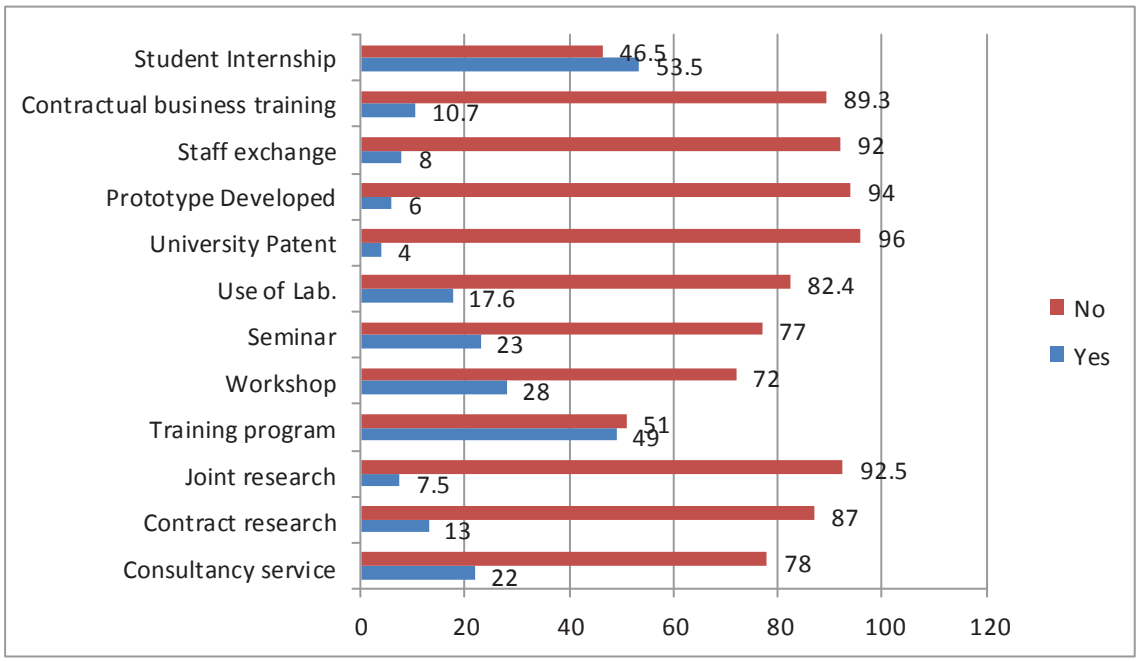
4. DATA DISCUSSION AND ANALYSIS

4.1. Descriptive Analysis from academicians perspective

Although the sample of the study was 241, questionnaires were returned from 159 respondents.

4.1.1. Areas of University-Industry Linkage

Fig.1. Areas of linkage



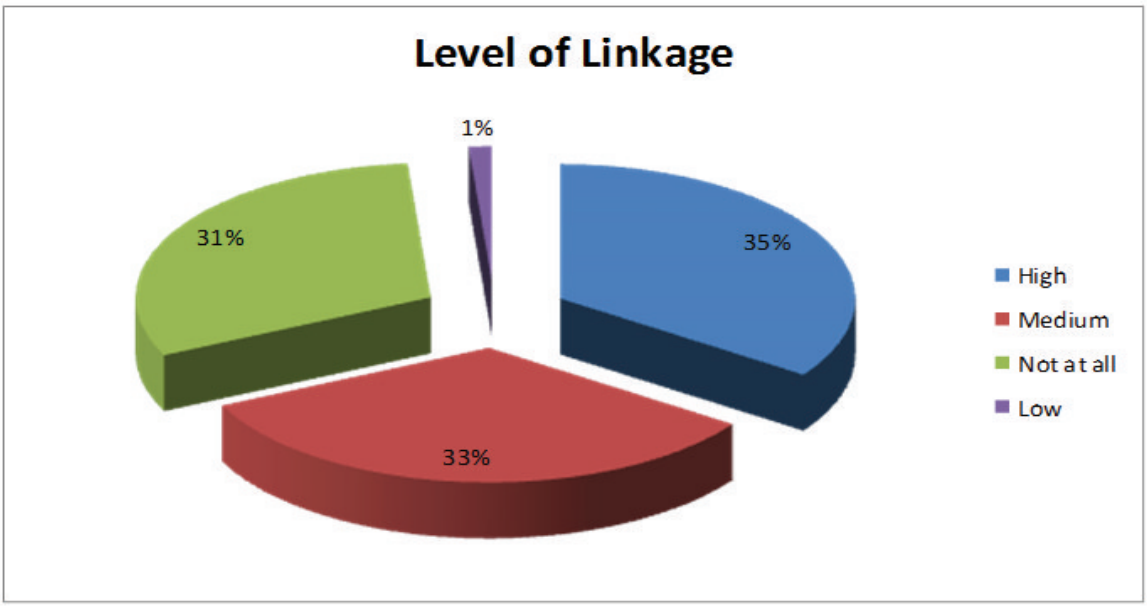
Source: Survey 2016

The above table depicts that the areas of linkage between the university and the industries is not as such exciting. Student internship and training program are the two areas which have satisfactory level of linkage. The other areas of linkage are found at a very low level and almost nil in some other areas. Even if most of the areas are the keys for producing qualified graduates, solving community problems, and in general fostering economic development, the interaction the university with the industries is low. These indicate that the university and industries are not striving for stronger interaction between themselves.

Level of linkage

The excellence in engineering education and research is attributed to many factors among which the university-industry linkage has proven to be very important. It is the most effective mechanism where both the university and the industry act as complementary organizations to share resources to achieve a common goal. In spite of this the researchers tried to see the level of linkage between the university and industries. So, the following pie chart revealed that the level of linkage.

Figure.2: level of linkage



Source: Survey 2016

The above chart shows that around 35% of the respondents acknowledge that there is high level of linkage and 33% respondents admit that there is medium level of linkage. The other 31% and 1% of the respondents' response indicated that there is no linkage at all and low linkage between the university and the industries, respectively.

Determinants of University-Industry Linkage

In this section we tried to investigate factors that affect University-Industry Linkage from the academician perspectives. Hence we incorporate access to funding, interest of academicians, previous experience, bureaucracy, availability of collaboration center, communication with industry and publication are considered as the factors that determine the University-Industry Linkage.

Access of Funding

Governments can seek to stimulate university-industry collaboration through their role in funding public universities. The performance measures that determine the funding received by public universities normally include indicators like numbers of students, PhD graduates, scientific publications, and patents. In order to stimulate collaboration with industry, other criteria should be introduced, such as the number of consulting or R&D contracts with industry, income from patent licensing, number of spin-offs, number of start-ups by university faculty or graduates, and so on. The UK, Canada, India and Singapore governments, for example, offer universities supplementary earmarked funding for research, conditioned on the university achieving a certain level of contracts with industry, spinoffs, or start-ups (Yusuf 2007).

Table: 4.1.1 Access to funding for industry related works

		Not applicable	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Total
Enough fund for collaboration	Freq.	9	27	54	40	24	5	159
	Percent	5.66	17	34	25	15	3.1	100
Interest of industries to sponsor research works	Freq.	10	20	46	45	30	8	159
	Percent	6.29	12.6	28.9	28	19	5	100
Easily transfer of Knowledge	Freq.	8	13	33	36	41	28	159
	Percent	5.03	8.18	20.8	23	26	18	100
Providing incentives	Freq.	8	26	37	45	32	11	159
	Percent	5.03	16.4	23.3	28	20	6.9	100
Government fund for UIL	Freq.	7	14	32	56	38	12	159
	Percent	4.4	8.81	20.1	35	24	7.6	100
University spending	Freq.	7	17	36	48	37	14	159
	Percent	4.4	10.7	22.6	30	23	8.8	100

Source: Survey 2016

As it is indicated in the above table, more than half of respondents responded that the fund allocated for U-I linkage was insufficient. On other hand, nearly half of respondents responded disagree and strongly disagree on the interest of industries in sponsoring university research work while 19 % and 5% of respondents replied that industries are interested to sponsor researches from university. Regarding with the easiness of knowledge transfer, majority of the respondents replied as knowledge transfer to the industry was easy while 29% responded are responding transferring knowledge to the industry task for the academicians. Concerning the availability of incentive mechanism to encourage cooperative work, around 41% of respondents replied as no incentive mechanism that encourage the cooperative work while around 26% of responds responded as an incentive mechanism and 28% of respondents were neutral. Regarding government as the source of fund, majority of the respondents agree as the government allocating funds to encourage U-I linkage while 35 % of the respondents were neutral.

Interest of Academicians

Table: 4.1.2 interest of academicians to involving with industry related tasks

		Not applicable	Strongly disagree	disagree	neutral	agree	Strongly agree	Total
motivation sprit of academicians	Freq.	4	14	34	35	47	25	159
	Percent	2.52	8.81	21.4	22	30	16	100
confidence to undertake research	Freq.	5	11	29	34	59	21	159
	Percent	3.14	6.92	18.2	21	37	13	100
Convinced about research as part of job	Freq.	7	15	32	37	51	17	159
	Percent	4.4	9.43	20.1	23	32	11	100
Willingness to spend time	Freq.	5	8	21	37	59	29	159
	Percent	3.14	5.03	13.2	23	37	18	100
Interest on collaborative works	Freq.	11	18	42	39	28	21	159
	Percent	6.92	11.3	26.4	25	18	13	100

Source: Survey 2016

As it is shown in the above table, regarding the interest of academia on U-I collaboration, majority of the respondents answered as they have motivation , confident to undertake industry oriented research, convinced as industry collaboration as part of their job and willing to work and spend part of their time in transferring their knowledge to industry.

Previous experience

Previous collaboration experiences and the level of success influence decisions about the future of collaborations (Hagedoorn & Achakenraad, 1994). While collaboration that present successful results will encourage the next collaboration project, problems experienced for parties or collaborations that did not reach a result weakens the organization's image and has a possible negative effect on the partnership. However, bad collaboration experiences have the possibility of supporting the organization's learning process. Experienced problems can directly give rise to using new methods aimed at avoiding the same previous problems. Thus, forming a legal standard agreement and defining more closely the internal functioning mechanism of the joint institutions can have the effect of ensuring the continuous development of the collaboration process (Bruneel et al. 2010).

Table: 4.1.3 previous working experience of academics with industry

		Not applicable	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	total
agreement B/n University and Industry	Freq.	12	29	30	30	43	15	159
	Percent	7.55	18.2	19	19	27	9.4	100
previous contact with Industry	Freq.	9	20	30	39	39	22	159
	Percent	5.66	12.6	19	25	25	14	100
provide a wide range of training	Freq.	8	24	39	33	39	16	159
	Percent	5.03	15.1	25	21	25	10	100
provide research output	Freq.	6	26	40	46	27	14	159
	Percent	3.77	16.4	25	29	17	8.8	100
Identified thematic area	Freq.	8	15	26	37	45	28	159
	Percent	5.03	9.43	16	23	28	18	100
previous cave for current	Freq.	10	17	35	35	43	19	159
	Percent	6.29	10.7	22	22	27	12	100

Source: Survey 2016

As the above table shows, regarding the prior agreement with the industry, around 37% of respondents reported as the university/department has no prior agreement with the industry while 36 % replied as their department had prior agreements with industries on collaboration work and 19% were replied neutral. Concerning availability of previous contact, around 32 % of respondents answered as their department has no any contact with industries while 39% of respondents replied as their department has a number of prior contacts with industries and 25% of respondents were neutral to respond. In the context of training and research outputs, majority of the respondents responded as they were providing a wide range of training program for industrialists, and research outputs for the industries. Concerning on research thematic areas, most of the respondents agreed as their department identified thematic areas for U-I linkage

Bureaucracy

Bureaucratic hindrances experienced in the mutual relationships slow down the rate of collaboration and extend the time taken to complete projects. As universities are public institutions, the internal registration procedure following an application often prevents a project from being realized at the speed demanded by industry. The bureaucratic structure of universities seriously slows down the decision-making process (*Kurtulus* and *Kadir*, 2011).

As table 4.1.4 revealed that around 44 % of respondents agreed as the university has no clear procedures and process that support U-I collaboration while 23% of respondents responded as the university has a clear procedure and process that support the U-I linkage and 30% were responded neutral. Regarding the university orientation towards industry related research, 36% of respondents replied strongly disagree and disagree while 33 % respondents answered as the university has high orientations towards industry related researches and 28 % were selected neutral. Concerning the availability of policy framework, 37% of respondents replied as the university has the policy framework that support U-I collaboration work while 24 % 0f respondents responded strongly disagree and disagree. With reference to the adaptability of university structure, half of the respondents replied as the university structure is adapted to the needs of industrial collaboration, 27% of respondents responded strongly disagree and disagree regarding the adaptability of the structure while 26 % replied neutral.

Table: 4.1.4. Bureaucratic related factors

		Not applicable	Strongly disagree	Disagree	neutral	Agree	Strongly agree	Total
Clarity of procedures & process	Freq.	7	28	39	48	25	12	159
	Percent	4.4	18	25	30	16	7.6	100
Highly oriented U-I research	Freq.	6	24	33	45	36	15	159
	Percent	3.77	15	21	28	23	9.4	100
Policy framework availability	Freq.	9	18	21	52	43	16	159
	Percent	5.66	11	13	33	27	10	100
University structure	Freq.	6	22	36	41	38	16	159
	Percent	3.77	14	23	26	24	10	100
University policy encourage joint work	Freq.	7	17	31	42	44	18	159
	Percent	4.4	11	20	26	28	11	100
Appropriate leadership for UIL	Freq.	7	30	40	32	34	16	159
	Percent	4.4	19	25	20	21	10	100

Source: Survey 2016

On the subject of leadership, 44% of respondents answered the lack of appropriate leadership to initiate, guide and support university-industry linkage while 41% of respondents support the availability of supporting leadership.

Availability of Collaborative Center

The efficiency of the university-industry collaboration centers is closely related to the success of the joint studies between academic institutions and industry. University-industry collaboration development, application and research centers, R&D laboratories, techno-parks (Kökocak, 2006), technology transfer offices (Kızıltaş, 2009), centers of excellence, and information licensing offices are important structures for building bridges between universities and industry. As we know start-ups are always difficult to get through in the early stage because of lack of business operational experiences and knowledge. Though the involvement and residential program in incubators, entrepreneurs can gain advice and required skills, including technology, finance, marketing, business law, taxation, and initial public offering, etc.

Table: 4.1.5. Availability of collaboration center

		Not applicable	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Total
Availability of laboratory	Freq.	23	29	39	24	27	17	159
	Percent	14.5	18	25	15	17	11	100
incubation center	Freq.	20	38	35	40	14	12	159
	Percent	12.6	24	22	25	8.8	7.6	100
liaison office	Freq.	10	33	45	35	24	12	159
	Percent	6.29	21	28	22	15	7.6	100
Research team	Freq.	8	23	46	38	29	15	159
	Percent	5.03	14	29	24	18	9.4	100
Participation on exhibition	Freq.	10	25	38	36	33	17	159
	Percent	6.29	16	24	23	21	11	100

Source: Survey 2016

As per it is exhibited in the above table, the majority of respondents agreed that the university has no adequate incubation centers, laboratory and liaison office that facilitate the university industry collaborations while the university has active research teams that undertook industrial and commercial projects. 33% respondents replied as the university has prepared and/or actively

participates on different exhibitions so as to show its output to the industries while 40% of respondents responded strongly disagree and disagree on the participation of universities on different exhibitions to exhibit the research output .

Communication with Industry

Another key factor for the success of university-industry collaborations is two-way communication. Research states that the two-way communication mechanism should be structured to allow parties to continue collaborations (Shartinger et al., 2002). Communication between universities and industry has been determined to take the form of including several academic disciplines and several areas of industry.

Table:4.1.6. Communication of academics with industry

		Not applicable	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Total
Two way	Freq.	9	33	43	40	21	13	159
	Percent	5.66	21	27	25	13	8.3	
Availability of channel	Freq.	8	29	51	35	29	7	159
	Percent	5.03	18	32	22	18	4.4	100
Awareness level in getting sponsor	Freq.	12	22	44	42	28	9	159
	Percent	7.55	15	28	26	18	5.7	100
participation on conference & workshop	Freq.	10	28	38	37	32	14	159
	Percent	6.29	18	24	23	20	8.8	
Informal contact	Freq.	14	22	43	42	24	14	159
	Percent	9	14	27	26	15	9	100
contact via membership	Freq.	15	30	35	42	25	12	159
	Percent	9.4	19	22	26	16	7.6	100
level of trust	Freq.	14	29	39	39	25	13	159
	Percent	8.8	18	25	25	16	8.2	100

Source: Survey 2016

According to the above table, regarding the level of two way communication, nearly half of respondents replied the level communication between the industry and university at low while 20% responded high & and 25% replied the level of communication at the medium level. In the view of awareness level of academicians in getting sponsored research, 43 % of respondents responded as the academician's awareness level high in getting sponsored research and consultancy services.

Publication

Table: 4.1.7. Number of published researches and the university's facilities for publication

Author of paper on journal	Number of published papers						Database		University support for publication	
	0	1	2-4	5-7	>7	Total	Freq.	%	Freq.	%
No	125	0	0	0	0	125	105	66.46	110	70.5
Yes	0	20	12	1	1	34	53	33.54	46	29.5
Total	125	20	12	1	1	159	158	100	156	100

Source: Survey 2016

As it is revealed in the above table, regarding experience of journal/ paper publishing, 79 % of respondents responded as they had no experience of journal publishing while 21% of replied as they have published journal. Regarding the number of paper published, 12 %(20) of respondents published a single paper, 7.5(12) of respondents has published 2-4 number of papers and only one individuals has a publications greater than seven. Concerning the availability of university database for journal publishing, 66.46% of the respondents responded no whereas 33.54 % replied as the university has the database for publishing papers. On the support of university on paper publication, 70.5 % of respondents replied no and I don't know, whereas, 29.5% gave their answer as the university is facilitating the publication of the paper.

Another question was raised by the researchers to the respondents in relate to the effect of unavailability of database on their research activity. The respondents replied that the unavailability of publication database could be the obstacle for communicating easily and it could be very difficult to generate better research ideas. In addition they said that it has an impact on staff qualification since its difficultness to check the plagiarism problem so that some staff may involve in such plagiarism activity thereby lowering their qualities on research capability. Furthermore, they said that researchers may face some difficulties to access literatures on their study area.

In order to identify the factors which can challenge the UIL, a question was designed to the respondents. Below are responses relating with challenges of UIL. The University-Industry Linkage is challenging by;

- ✓ Lack of interest of industrialists to have linkage with the university
- ✓ The staff may discouraged by benefit scheme, unavailability of incentive mechanism, and inadequate budget provided by the university
- ✓ Higher management of the university do not give responsiveness for the UIL, they do not have commitment and weak leadership of officials may lead to have low UIL
- ✓ Industrialists are not interested to sponsor researches proposal which are developed by academicians
- ✓ Lack of experience, lack of skill, poor communication, lack of motivation, lack of trained manpower, lack of interest, overload (busy) on their teaching-learning tasks and lack commitment of academicians to engaged in university-industry interaction

- ✓ Lack of standard of operation, inadequate infrastructure, bureaucratic procedure, lack of harmonized implementation strategy and unclear procedure of research policy of the university.
- ✓ Absence of formal communication, absence of guidelines to collaborate with industry, lack of trust on academician and lack of confidence on students' or instructors ability and knowledge by industrialists.

4.2. Descriptive Analysis from Industry perspectives

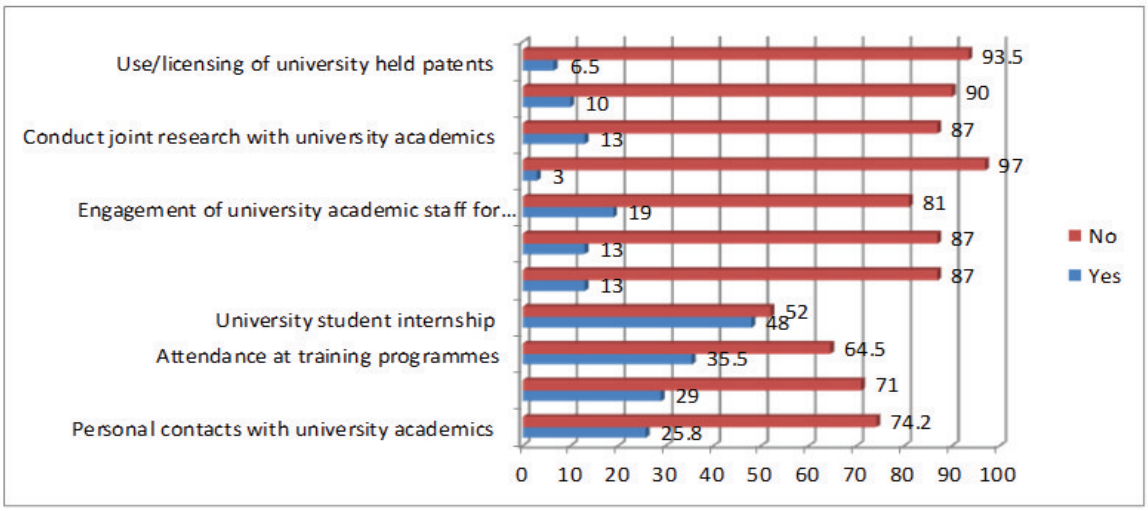
This section is the discussion part of the data which was gathered from the industrialists.

4.2.1. University-Industry Linkage areas

This section discussed with the areas in which Industries interact with the University. In light with this all of the companies are interact with the university at least in one of the collaboration areas. From the total respondents 25.8% are collaborating by personal contact with the university academics and the remaining 74.2% respondents didn't have such contacts. In case of attendance at seminars, symposiums, workshops and conferences 29% of the sample companies are involved and 71% didn't have engagements in such manner. One of the areas of linkage between university and industry is training programs. In this case 35.5% of the companies attend the training program which was prepared by the university whereas 64.5% didn't get this opportunity due to the problem arises from the university side or by themselves. The area of linkage which has high participation from the industry side as compared to the other areas is student internship. Around 48% of the companies are took the university's students from varies department in order to show the practical work of their specialization. Conversely, the remaining 52% of the companies are not willing to take students for the internship program.

The result of the table discloses that around 13% of the companies are linked with the university in exchange of information, literature, data, etc. with the academicians; they involved ii using the university's laboratory and engaged in conducting joint research with the university's staffs. On the other side 87% of the companies didn't have any engagement of the aforementioned areas of linkage. Engagement of university academic staff for contract research is almost null; it takes 3.% of the companies which involved the contract research with the academic staff. The other 97% of the companies didn't have in any involvement of contract research with the staff of the university. In case of engagement of academic staff in projects, 10% of the companies responded positively whereas 90% are not positive to engage the academic staff in their projects. Among the total respondents 6.5% are use/licensing of university's patents and 93.5% are not using/licensing of the university's patents.

Fig. 3 Areas of linkages



Source: survey 2017

4.2.2. Factors that affect the University-Industry linkage

Size of the organization

Table:4.2.2. The organization's size in terms of number of employees

Number of employees	Freq.	Percent
Less than 100	14	45.16
100 to 1000	10	32.26
Greater than 1000	4	12.90
Not described	3	9.68
Total	31	100

Source: survey 2017

The above table discuss about the number of employees hired at the given sample of the study. Thus, 45% of the companies managed less than 100 employees under their control and 32.3% companies managed 100 to 1000 employees; and again around 13% of the companies hired more than 1000 employees. The remaining 9.7% of the companies didn't disclose how many employees they had.

Research and development intensity

Table:4.2.3. Research and development intensity

Output	Department					
	No	Perc.	Yes	Perc.	Total	Perc.
No	15		7		22	71
Yes	2		7		9	29
Total	17	54.8	14	45.2	31	100

Source: survey 2017

In relate to research and development intensity, the respondents are asked to whether their respective company has a section/unit/division/department devoted to research and development (R&D) or not; 54.8% (17) of the respondents said that 'No' while the remaining 45.2% (14) of the respondents confess that their respective company has such departments. The same table depict that the response of the companies with regard to using of the research output from the university side. Out of the total respondents 71 % of them said against using of the research output and 29% of the total respondents said that their company used the research output of the university. When we try to analyze the matrix of R&D Department with using of Research output, it is found that those who said that they don't have R&D department, 2 of 17 used research output whereas 15 of 17 respondents are not used research output which comes from the university side. On the other hand, those who do have R&D department 7 of 14 respondents don't using research output and 7 of 14 again are using research output.

Absorptive capacity

Table: 4.2.4. Absorptive capability of the industries

Absorptive capability	**Strongly disagree**		**disagree**		**neutral**		**Agree**		**Strongly agree**	
	Fre.	**Per.**	**Fr.**	**Pe.**	**Fr.**	**Pe.**	**Fr.**	**Pe.**	**Fr.**	**Pe,**
The company has ability to identify knowledge	3	9.68	0	0	5	16.13	16	51.61	7	22.58
The company has ability to absorb knowledge	3	9.68	0	0	7	22.58	13	41.94	8	25.81
The company has ability to exploit knowledge	3	9.68	0	0	8		14	45.16	6	19.35
The company has capability to combine the existing and newly acquired knowledge	2	22.58	2	22.58	7	22.58	12	38.71	8	25.81
The company is willingness to learn from other institutions like universities	2	22.58	4	12.90	2	22.58	9	29.03	14	45.16

Source: survey 2017

From the given indicators of absorptive capability 73% of the respondents agree about their company's ability to identify knowledge. Regarding with the company's ability to absorb knowledge above 67% supporter of it and around 64% of the respondents are agree about their company's ability to exploit knowledge. In relate to the company's capability to combine the existing and newly acquire knowledge above 64% of the respondents are agreed. Above 74% of the respondents agreed that their company is willing to learn from other institutions, like universities.

Structure

Table: 4.2.5. Structure of the organization

Structure	Strongly disagree		Disagree		Neutral		Agree		Strongly agree	
	Fre.	Per.	Fre.	Per.	Fre.	Per.	Fre.	Per.	Fre.	Per.
The company has rules, standard policy, and procedures to guide employees' behavior	3	10	2	6.67	4	13.33	10	33.33	11	36.67
It has the habit to transfer new knowledge from/to different departments	4	13.33	4	13.33	7	23.33	8	26.67	7	23.33
It follows decentralized structure to make decision	2	6.67	4	13.33	8	26.67	11	36.67	5	16.67
It follows centralized structure to make decision	4	13.33	9	30	6	20	5	16.67	6	20

Source: survey 2017

The above table indicates that the organizational structure of the firms. Regarding with whether the firm has rules, standard policy, and procedures to guide employees' behavior; 70% of the respondents agreed with that of their company has such mechanisms and 30% of the respondents are unfavorable to support that the company has mechanisms. In relate to the habit to transfer new knowledge from/to different departments 50% of the respondents are agreed with this habit of the company. Around 27% of the respondents disagreed about the habit of their company to transfer knowledge. The remaining 23% of the respondents are neither agreed nor disagreed. The other parameter to describe the organizational structure is way of decision making. In this regard above 53% of the respondents support that their respective company follows decentralized decision making structure and 20% of the respondents said that their company does not follow such structure. The remaining 27% of the respondents do not know whether their company follow decentralized or not. Again they are asked whether their company follows centralized decision making structure or not and 37% of them confirm that their company follows centralized structure. Around 43% of the respondents do not agree with the availability of centralized structure and the remaining 20% of respondents are confused which structure is applied in their company.

Trust

In order to create strong linkage between the university and the industries, the two parties should have to trust each other on their partner's performance. Thus, if the industries are confident with the ability and professionalism of academicians', they could be willing to offer different collaboration works, for instance; projects, research, training, etc.

In relate to this the respondents were asked whether they ever offer collaboration to the university or not. Accordingly, 48.3% of the respondents are said that "Yes" and the remaining 51.7% of the respondents said that "No".

Location

Table: 4.2.6. Distance of the firms apart from the university

Distance	Frequency	Percentage
Less than 1 km.	2	6.45
1 to 5 km.	17	54.84
5.1 to 10 km.	11	35.48
Above 10 km.	1	3.23
Total	31	100

Source: survey 2017

As it indicated in the above table, more than half of the total sample located within 5 km radius of the university. Generally from the given sample, 6.45% of the firms found within 1 km. radius, 54.84% of the firms found between 1 km. to 5 km., 35.48% of the firms are found between 5.1 km to 10 km and the remaining 3.23% of the firms are located above 10 km away from the university.

In relate to this we designed the question to firms whether their proximity affect their collaboration with the university or not. Thus some of the respondents replied for the above question that their location distant would have an impact on their regular attachment with the university.

4.3. Regression analysis

In addition to the descriptive statistical analysis discussed above, in this study an econometric model (ordered logistic regression analysis) was also used to regress the dependent variable (University-Industry linkage level) in relation to the specified explanatory variables (fund, interest of academicians, bureaucracy, collaboration

center, two way communication, previous experience and publication).

Table: 4.3.1. Ordered logit regression result

ologit level i.fund2 i.interest2 i.bureaucracy2 i.center2 i.commun2 i.experience2 i.author, or						
Iteration 0: log likelihood = -183.04148						
Iteration 1: log likelihood = -160.24382						
Iteration 2: log likelihood = -159.9366						
Iteration 3: log likelihood = -159.93616						
Iteration 4: log likelihood = -159.93616						
Ordered logistic regression =					**Number of obs**	159
					LR chi2(7) =	46.21
					Prob > chi2 =	0.0000
Log likelihood = -159.93616 =					**Pseudo R2**	0.1262
level	**Odds Ratio**	**Std. Err.**	**z**	**P>|z|**	**[95% Conf.**	Interval]
2.fund2**	**2.312373**	**.8962449**	**2.16**	**0.031**	**1.081791**	4.942791
2.interest2	**.96076**	**.3740812**	**-0.10**	**0.918**	**.4479106**	2.060813
2.bureaucr~2	**1.126352**	**.4535079**	**0.30**	**0.768**	**.5116245**	2.479688
2.center2	**.8374274**	**.3049239**	**-0.49**	**0.626**	**.4102115**	1.709569
2.commun2	**1.436931**	**.5292477**	**0.98**	**0.325**	**.6981083**	2.957664
2.experien~2 ***	**4.146728**	**1.566094**	**3.77**	**0.000**	**1.978028**	8.693179
1.author ***	**3.227033**	**1.314443**	**2.88**	**0.004**	**1.452413**	7.169962
/cut1	**.9490622**	**.4161099**			**.1335017**	1.764623
/cut2	**1.024516**	**.417547**			**.2061387**	1.842893
/cut3	**2.775698**	**.4665684**			**1.861241**	3.690155

Source: Survey 2016

4.3.1. Interpretation and Discussion of the Result of the Model

Before interpreting and discussing the result of the model and to get reliable output from the research, different tests were run. These tests mainly intended to check whether proportional odds assumption or the parallel regression assumption and some classical linear regression model (CLRM) assumptions were fulfilled when the dependent variable is regressed against the independent variables.

The result of the coefficients (ordered log-odds and proportional odds) of each variable are used to interpret the effect of each explanatory variables on dependent variable. The z-test and associated p-values, and the 90% confidence interval of the coefficients are also used to identify the significant and insignificant variables of the model. If the p-value of a given independent variable is less than 10 percent, they would reliably predict the dependent variable, whereas if the p-value is more than 10 percent, it would conclude that a given independent variable is not reliably predict the dependent variable (Gujarati, 2004).

In this study the previous experience of academician is found that at 1 percent significant level and access to fund and publication are found significant factors for the linkage between university and industry at a p-value of 5 percent. However the other four explanatory variables, such as interest of academicians, bureaucracy, collaboration center and communication, are insignificant factors even at 10 percent. The interpretation of the regression result is given below.

Access to funding is one of the significant explanatory variables which can affect the linkage of university with the industries. The coefficient of ordered log-odds and the proportional odds of this variable are given in the above table. Hence, the coefficient of ordered log-odds and the proportional odds for who agree with the fund related factors are 0.8382742 and 2.312373. This indicate that for those who agree with access of funding problem, the availability of fund is increases by one unit would result in a 0.8382742 unit increase in the ordered log-odds of being in higher UIL category while the other variables in the model are held constant. As the accessibility of fund is increase by one unit, the odds of high UIL category versus the combined middle, low and not at all UIL are 2.312373 times greater, given the other variables held remain constant in the model. Likewise, for one unit increase in accessibility in fund, the odds of the combined high and medium UIL category versus the low and not at all UIL category are 2.312373 times greater when other variables are held constant. The same, the odds of combined higher (high, medium and low) UIL category versus not at all UIL category are 2.312373 times greater while the other variables are remaining constant.

The other significant factor which affects UIL is previous experience of the university engaging in different collaboration activities with industries. The coefficient of ordered log-odds and the proportional odds for who agree with previous experience of the university are 1.42232 and 4.146728 respectively. The interpretation of these figures is that, if the previous experience of the university level were increase by one, it would result in a

1.42232 point increase in the ordered log-odds of being in a higher UIL category while the other variables are remain constant. As the university level of experience were increases by one, the odds of high UIL versus the combined medium, low and not at all UIL are 4.146728 times greater, other variables held constant. Equally, the odds of the high and medium UIL category versus the low and not at all UIL category are 4.146728 times greater when the level of previous experience increases by one while other variables held constant. Correspondingly, as the university previous experience were increases by one level, the odds of the high, medium and low UIL category versus not at all UIL category are 4.146728 times greater, given the other variables are held constant in the model.

Publication (author) is another significant explanatory variable which can determine UIL. The coefficient of ordered log-odds and the proportional odds being author are 1.171563 and 3.227033 respectively. The ordered log-odds tells that for the author being in higher UIL category is 1.171563 greater than from those who didn't have publication. For the authors, the odds of high UIL versus combined lower (medium, low and not at all) UIL are 3.227033 greater than for non-authors, given other variables held constant. Similarly, the odds of combined high and medium UIL category versus the low and not at all UIL category is 3.227033 times greater for authors as compared to non-authors, given other variables are held constant in the model. In the same way the odds of combined high, medium and low UIL category versus not at all UIL category is 3.227033 times greater for authors as compared to non-authors, given other variables are held constant.

Surprisingly, most of the variables are not significant even at 10 percent p-value. These are the interest of academicians, bureaucracy, collaboration center and communication with the industries.

4.4. Analysis of Interview

In this section we prepared unstructured interview for the Technology Transfer Institute-Industry Linkage (TTIIL) focal person. The office started its operation in 2012 G.C. as supervised by the scientific director in order to facilitate the internship programs. Then after, it stands as an office by named as University-Industry Linkage (UIL). Currently it called as TTIIL and facilitates the linkage between the Dire Dawa Institute of Technology and Industries. The focal person was asked about the responsibilities of the office and he replied that the main responsibilities of the office are linked the university with industries, technology transfer, internship, and the like. Regarding to the industry definition the office define it as any company which are participate on manufacturing and construction regardless its size is considered as industry.

In relate to the scope of the TTIIL the focal person said that so far there is no stated restriction on the type of linkage; nevertheless the office more focused on internship programs which helps the students to gain the necessary skills from the industry, training programs which are provided to the industries and externship programs. The externship is prepared for the staff of the university so as to fulfill the skills gap of the teachers. Recently, the office facilitate for many teachers to take training in their particular field of study from different industries. The most important question was raised to the focal person regarding to the level of the linkage. He replied that the linkage of the university with the industries is poor. He responded that the factors which make poor level of the linkage are

- ✓ Most of the staff or departments do not focus on problem solving areas
- ✓ The poor structure of the office which is owned by only one person. This makes very difficult to address all issues of linkage
- ✓ Departments do not prepare their study on the demand based
- ✓ To some extent the fund allocation for the linkage is contribute to have poor linkage
- ✓ The management of the university do not give attention to the office

From the industry side there may be different factors but most of time they are not interested to work with the university. This is because they do not trust the university.

Lastly the focal person was asked to give recommendations which may strengthen the University-Industry Linkage. The following are the points which may help the university to strengthen the linkage with the industries.

- ✓ The university should restructure the TTIIL office again in terms of human resource and scope
- ✓ The staff of the university should give priority to demand/thematic based research
- ✓ More emphasized should be given by the management of the university to the office.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

Although universities could interact with industries in various areas, DDU has linkage with industries mainly within two areas which are training program and students internship. With regard to the determinants of UIL, access of fund for different collaboration work was insufficient and the training programs provided by the departments to few industries are not supported by formal agreement and contact with industries. Moreover, lacks clarity on the university procedures and process that can support U-I collaboration, poor tendency of university's orientation on U-I research, lack of quality leadership that support UIL, inadequate incubation

centers and poor communication are identified as the obstacles of UIL. In addition to the descriptive analysis, the study was analyzed using inferential analysis techniques. With the help of this technique, the study was revealed that only three independent variables were significant. Therefore access of funding, previous experience and publication were found significant variable which determine the University-Industry Linkage with the positively sign. Conclusion also made based on the response from the industry perspective. As it was found from the University side, the linkage of industries with the university is weak in relate to variety means of interaction. As compared to the given areas of linkage mechanisms, student internship is considered as the better one followed by attending in different training program prepared by the university. Most of the industries do not use the research output of the university, this shows that there is a big gap between the two parties to work together. Inadequate research facilities by the university and lack of interest of the university to work with the industries are the major constraints to strengthen the university-industry linkage. Of course, the awareness problem of industries about the facilities and expertise of the university's and the poor structure of the university to fulfill the needs of the industries are also the other major factors which can impede the university-industry linkage.

5.2. Recommendation

The university should reform the incentive mechanisms for the university's academicians for those who are researcher and engaged in collaboration work with industries. This can be done by permitting research grants for industry focused works and the other is offering attractive share of sales level which is getting from selling of research output to industries by the university. Besides, the university should encourage the researchers to transfer their research output into projects thereby benefited to industries as well as the surrounding community. Staff development program also another means in order to enhance the academia research capability thereby strengthen the UIL. The bureaucratic obstacles have to be eliminated by formulating clear procedures and policies so as to accelerate and smooth the university-industry linkage. This can be supported by scrutinizing and justifying all stages starting from the proposal delivery for applying of collaboration works with industries. Unnecessary documentation must be removed, and decisions should be more quickly made. The university should create a formal agreement with various industries, i.e. memorandum understanding in order to strengthen the UIL. It is better to be formal to create good interaction rather than being informality. Independent UIL office should have to be established so as to develop, foster and focus on the interaction of the university's all colleges and institute with industries rather than running one institute-industry technology transfer office which concern only the interaction of one part of the university (only Institute of Technology). This office should be established as one Directorate office responsible for research and community engagement vice President. Academicians (researchers) should have to develop excellent proposal so as to attract better fund from external sponsor organizations. Moreover, they should have to provide quality services to the stakeholders in order to gain the trust of the industries. Since the past experience of the academicians is the significant variable to strengthen the University-Industry Linkage, the today's better performance and good relation of the university in general, academician in particular, would be the helpful strategy to strengthen the tomorrow's UIL.

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