Determinants of University - Industry linkage on Knowledge and technology transfer effectiveness   in some selected Ethiopian universities

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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 is essential. However, in one or another way the linkage between universities and industries seems to be very weak particularly in developing countries. In relation to this few studies have been conducted which were mainly focused on European and middle east countries and entrepreneur universities Hence to fill this gap, this study was conducted with the aim of examining the factors that determine the University-Industry linkage knowledge and Technology Transfer effectiveness in the case of two selected Universities (Mizan Tepi and Wollega Universities). Moreover, a mixed method approach (both descriptive and explanatory) was used to collect and analyze data for this study. For the sake of achieving this objective, primary data was collected through structured questionnaire from a sample of 235 academicians that were selected using stratified sampling techniques followed by random sampling for each strata selected. Moreover, informant interview was conducted with 11 industries concerned bodies that are selected using convenience sampling technique. While descriptive narrations through concurrent triangulation strategy were applied to analyze the data collected from document analysis and interview, data collected using questionnaire were analyzed using descriptive statistics and econometric model (binary logistic regression). The study conclude that the status of university-industry linkage knowledge and technology transfer is at a growing/ infant stage in selected universities while it has long distance to go forward, as can be seen from senior and experienced local and international universities point of view. The result of the study indicates that the common types of university-industry interactions were limited to student internship program, consultancies (applicable for WU only) and training programmes. The result revealed also that lack of research funding, lack of laboratory facilities, Lack of enough encouragement for researchers to undertake more applicable research , weak capacity of industries to absorb and apply graduate research results ,Lack of mutual trust between university and industry, Insufficient publicity, weak exchange of researchers between industry and university, Weak dissemination of research out puts and weak implementation of policy frame that foster the link with academic research and industry were found significant factors in determining University-Industry Linkage knowledge and technology transfer effectiveness .

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Whereas, The enabling factors identified are national policy frame work to stimulate university - industry linkage, the Quality of academic research (research skill of academic staff) and interest of industrialist and academicians. Hence future researchers have to focus on the main measures to promote collaboration of universities with industries.

Keywords: *university-industry linkages; knowledge and technology transfer; effectiveness, STATA Version 13*

1. Introduction
1.1 Background of the study

Recently, the role of university - industry interaction for the economic development of a country is taking the attention of policy makers both in developed and developing countries. As one of the rapidly growing countries in the world, Ethiopia is undergoing various transformation works (Ayenew, 2017).

In general when we come to developing Countries like Ethiopia, where the culture of indigenous, technology development and utilization is low and most industries are traditional trade based, formal university- industry linkage has to be pursued aggressively (Mengesha Mamo, 2013). As known, the researchers should have their research projects geared towards the solution of the socio- economic problems prevailing in our country. However, as my opinion which emanated from different literatures and sources, there is very little known about the linkage between academic research and industry in Ethiopia context. As part of among Ethiopian Universities Mizan Tepi and Wollega Universities university industry linkage knowledge and technology transfer effectiveness was also sharing the above status and challenges. Therefore, this study intends to examine the link between university and industry and explores the enablers and barriers for university and industry link and the mechanisms to solve the problems regarding the link between university and industry in terms of WU & MTU in case of CET.

1.2 Statement of the Problem

The effectiveness of UIL is not as such fruitful yet and the contribution of industries for the university is still not discovered and the benefit of new curricula and case studies to the industries are not well tested. What is more, there is no clear policy: at college/department level regarding university-industry interaction and less known about the role of other stakeholders in fostering industry-university linkage (UIL conference host by BU, 2017).

In addition as it can be understand from different literatures and journal (the researcher address about 26 sources), majority of the researchers (21(80.77%)) consider limited channels of the collaboration to assess the status of UIL. But, in this paper the researcher considers variety of collaboration channels that are expect to represent and provide valuable outcomes.

Majority of the literature on these partnerships often stresses the one-way transfer of knowledge and technology from university to industry and there is rare conversation about the

contribution of industry to universities (Munyoki, Kibera & Ogutu, 2011). Hence this study has attempted to balance that point of view by looking at different angles on the issue.

When we come to the two case study universities (Mizan Tepi and Wollega Universities), the interaction of the university with the surrounding community and industries is not found as where it expected or demanded though it is 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), that states 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 spinoffs). University-industry collaboration can also expand the relevance of research carried out in public institutions, foster the commercialization of public R&D outcomes, and output, the ability of solving problems, and in general the speedy of economic development of the country.

Hence, conducting such a research seems essential in the light of the fact that different problems centered in UIL and to fill the aforementioned research gaps on the effectiveness of UIL. Thus, this study intends to investigate the current status of UIL and its barriers and promising measures that has to be taken in case of Wollega University (WU) & Mizan Tepi University (MTU) targeted to College of Engineering and Technology.

1.3 Research questions

To address the above mentioned issues in the statement of the problem section, this study focuses on the following research questions.

➢ What is the current status of university-industry linkage in two selected Ethiopian universities (WU & MTU) in case of CET?

➢ Are there policy frame works in place that govern the link between the university and industry in WU & MTU in the case of CET??

➢ What are the determinants of effective university -industry linkage on knowledge and technology transfer in WU & MTU in the case of CET??

➢ What are the promotional measures to strengthen the link between university industry (U-I) in WU& MTU in the case of CET /Ethiopian context?

1.4 Objectives of the Study

1.4.1 General objective

The general objective of this study is to investigate the determinants of effective university - industry linkage on knowledge and technology transfer in the case of WU and MTU targeted to Institute of Technology.

1.4.2 Specific objectives

Under the umbrella of the general objective, the following specific objectives are formulated:-

➢ Assessing the current status of university-industry linkage in relation to knowledge and technology transfer targeted to Ethiopian universities particularly at WU & MTU in case of CET.

➢ To assess the effectiveness of policy frame work that governs the link between the university and industry in WU & MTU in the case of CET.

➢ To investigate determinants of university- industry linkage in WU & MTU in the case of CET.

➢ To identify possible measures for strong/sustainable university industry linkage in WU & MTU in the case of CET/ Ethiopian context.

1.5 Significance of the Study

Ethiopia is a developing country which currently is undergoing economic revolution. It will be difficult for this transformation to travel long unless it is supported by a joint effort of academic institutions and industries. Hence this study is considered to be significant because University and Industry linkage was very important for one Country economic development. Moreover since our government and university leadership being deal with this problem intensively, the researcher think that it will provide much awareness about the level of the link between university and industry in terms of knowledge and technology transfer.

1.6 Scope of the study

This study focus on only two selected Ethiopian Universities (Wollega & MizanTepi) which are found in Oromia regional state and southern nation, nationality and people of Ethiopia (SNNP) respectively based on their experience in university-industry interaction works.

2. Related Literature Review

2.1 Theoretical Literature review

The primary duties expected from universities are thought to be teaching-learning, research and community service (which can be interpreted in various ways).

The triple helix model considers the academia-industry-government linkage as an interconnected dynamic relationship rather than a simple one way communication. It also suggests that the role of each actor in the linkage will change over time and these will in turn bring in a change in the internal structures of the acting bodies (Martin, 2011). The linkage here is overlapping with relatively independent institutional spheres and hybrid organizations emerging at the interfaces (Esham, 2008).

University industry linkages have gone through different stages. The early forms of linkages include student placement schemes (internship), staff exchanges, consultancy services, continuing professional development and joint R&D.

2.2 Benefits of University-Industry Linkage

A meaningful collaboration between universities and industries could provide a variety of benefits. These benefits primarily relate to income generation, access to technology and equipment, practical experience, curriculum development, community service and image building, and employment opportunities for students. Specifically, various stakeholders tend to benefit from the U-I linkages as follows (Economic Forum, 2011):

Academic Staff (Professors and other researchers)

- Technical collaboration through contract research: Project-based funding to address specific industrial needs; unique training opportunities;
- Longer term collaborations: Industrial investment advancing specific areas of research (3-5 years); and
- Technology transfer: Translation for social, commercial, health benefit and completion of the research lifecycle; financial gain.

Benefits to Students

- Practical, hands-on experience with unique industry expertise and equipment;
- Extension of knowledge gained through academic experience;
- Development of marketable skills, contacts and possible employment;
- Refined, scaled-up entrepreneurial skills; and
- Provides opportunity of networking with potential employers, other job seekers and representatives from the productive sector community.

Benefits to Industry

- Cost savings through established university labs, infrastructure and workforce;
- Matching funds, very generous tax incentives;
- Ability to train workforce to its needs and to mine the talent pool produced by universities; and
- Because universities are research centers, long term research projects that are too cost prohibitive in an industry setting can easily be undertaken by the universities through the linkages

Benefits to Government

Whereas the government provides funding and creates a conducive policy environment for the linkages to function, it turn, it gets quality advice, increased taxes and new products / services.

Benefits to Community

Members of the community benefit from increased job opportunities arising from the linkages as well as improved services which result into empowering the community. Figure below depicts the stakeholders in the linkages and benefits flow emanating from the practice.

Figure 1: Stakeholders in U-I Linkages and Benefits
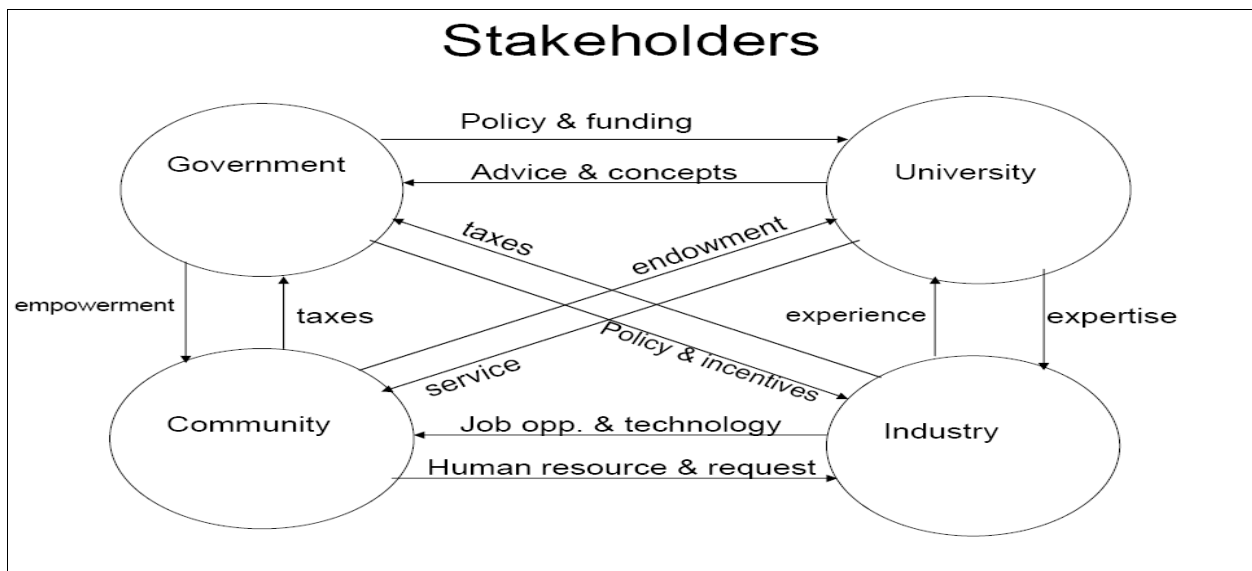
Source: Soemantri (2009)

2.3 The Rationale for University-Industry Linkage

The links between university and industry encourages the use of academic research by-industries (Cohen, et al, 2012). It also enables both universities and industries to maximize

capitalization of knowledge and technological innovations through knowledge spillover. The main reasons for enhancing university-industry linkage include the following (James, 2004):

• Universities provide a ready pool of graduate and undergraduate students that industry may access for their work requirements
• Technical opportunities exist in industry for faculty and students that may not exist in universities
• Materials/facilities exist in industry for research and educational purpose that may not exist in universities
• Collaborations with industry provide research funding to Universities
• Such collaborations can advance the service mission of Universities
• Collaborations provide for local and regional economic development.
• Universities often have research infrastructure that industry wants.
• Industry outsourcing to universities, to reduce the costs of doing business and increase profits.

2.4 Effectiveness of University-Industry Knowledge Transfer Mechanisms

A university-industry collaboration landscape is complex and varies in scope, duration, funding mechanism, geographic location, expected outcomes and impact. These variables make it challenging to evaluate effectiveness of university-industry collaboration and develop metrics for comparison.
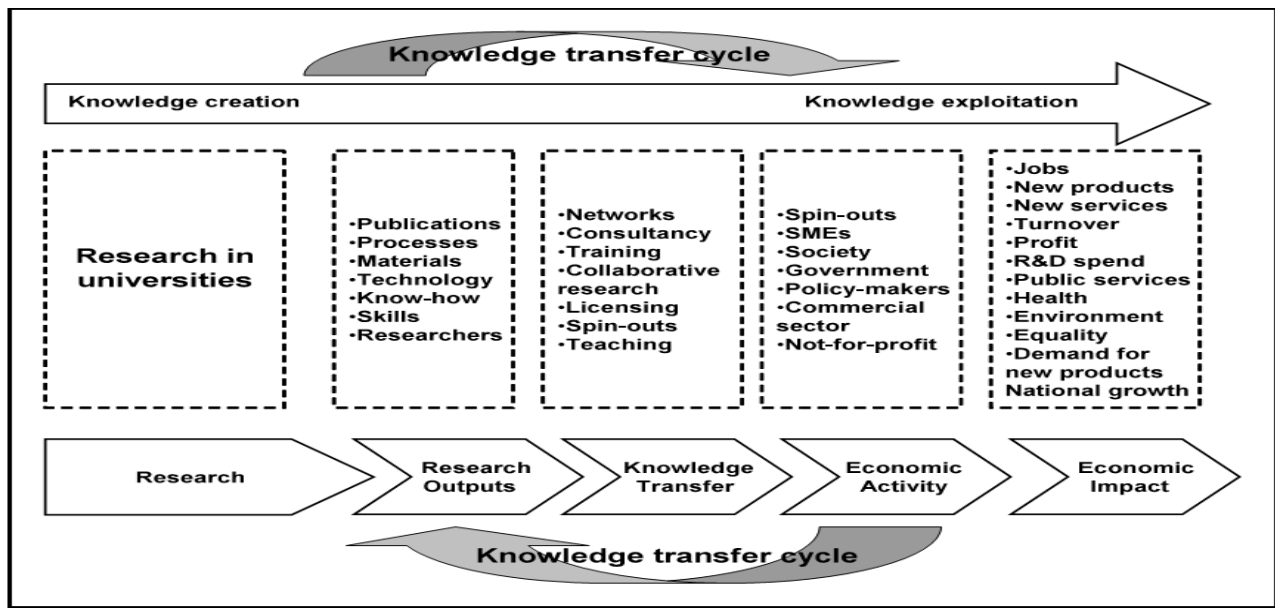

Figure 2: Knowledge transfer cycle. Adapted from Lockett (2009), UNICO report (2008)

2.5 Factors That Influence the University-Industry Linkage

The link between university research and economic development is subject to the influence of many factors. The major contributing factors include among others, University characteristics, industry characteristics and the legal and policy environment, which are briefly described as follows.

a) University characteristics: this refers to the factors that are internal to the university. These include the motivation and willingness of the University to engage in collaboration with industry in terms of research and innovation; competent and committed leadership and adequate funding and research infrastructure to produce relevant and quality products (research outputs and graduates). Other factors include availability of policies and supportive internal governance system and procedures for research, innovation and technology transfer; networking and capacity for knowledge transfer to other actors; entrepreneurial mind set; and a research culture.

b) Industry characteristics: this refers to the factors that are external to the university. In this paper, industry is conceptualized in terms of all the manufacturing and non-manufacturing stakeholders influenced by the products of the University. The extent to which the industrial sector is developed matters a lot for a meaningful and strong partnership with the Universities. The major industry related factors influencing the linkage include readiness and motivation of the industrial sector to engage in partnership with university in terms of research, innovation and technology transfer; availability of adequate research and development infrastructure and personnel; investment(funding) in research and development activities; the absorptive capacity of the industry.

c) The legal and policy environment: this refers to the legislative and regulative aspects through which governments steer the behavior and operation of organizations in general and universities and the industry in particular. It includes policies, systems and regulatory bodies such as higher education policy and proclamation; Science, Technology and Innovation (STI) policy; national research priorities and strategies; rules and regulations; incentives including national government research funding, matching funds and tax exemptions; availability of

technology parks and regulatory bodies for quality and relevance of education and research. Additionally, the broader political and socio-economic environment also influences the nature of the link/partnership among these actors.

2.6 Conceptual frame work of the study

Based upon the theoretical and empirical literature on UIL, the most important variables expected to influence the effectiveness of UIL by considering the study area. In line to the theoretical and empirical reviews discussed above, the conceptual framework of the study is given below:
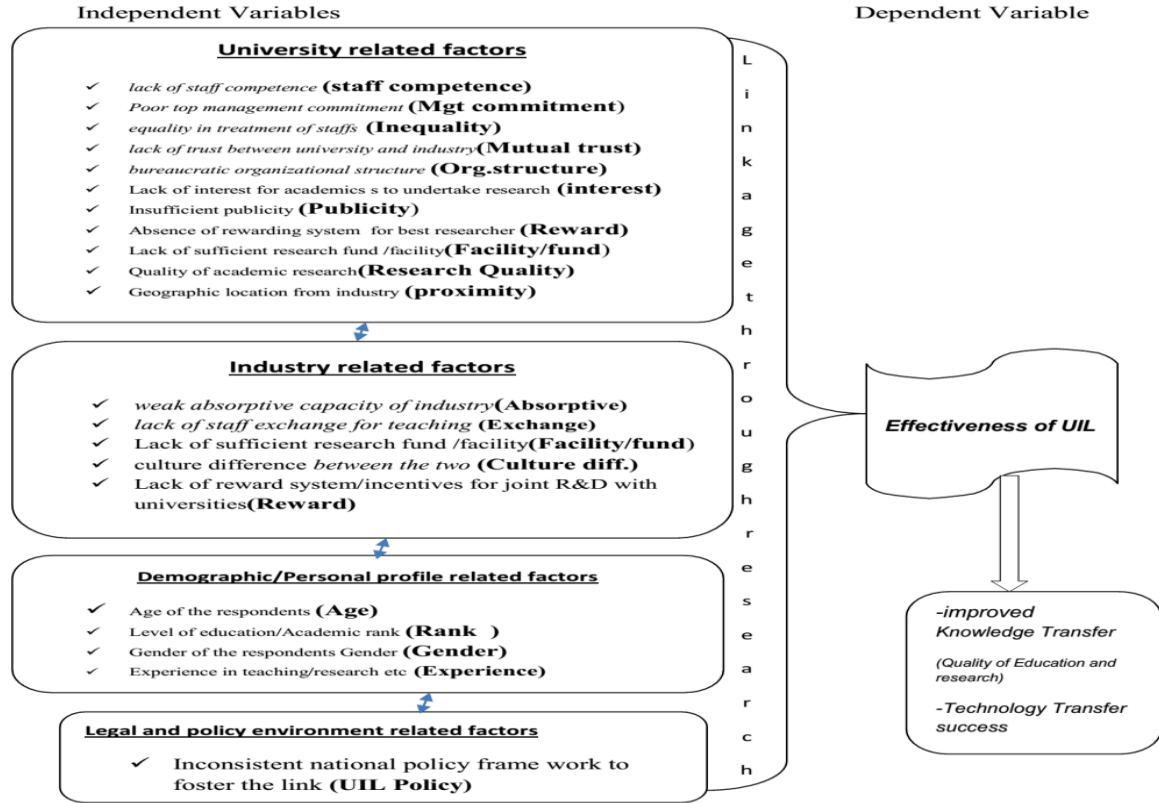
Independent Variables

University related factors
- ✓ *lack of staff competence* **(staff competence)**
- ✓ *Poor top management commitment* **(Mgt commitment)**
- ✓ *equality in treatment of staffs* **(Inequality)**
- ✓ *lack of trust between university and industry* **(Mutual trust)**
- ✓ *bureaucratic organizational structure* **(Org.structure)**
- ✓ Lack of interest for academics s to undertake research **(interest)**
- ✓ Insufficient publicity **(Publicity)**
- ✓ Absence of rewarding system for best researcher **(Reward)**
- ✓ Lack of sufficient research fund /facility **(Facility/fund)**
- ✓ Quality of academic research **(Research Quality)**
- ✓ Geographic location from industry **(proximity)**

Industry related factors
- ✓ *weak absorptive capacity of industry* **(Absorptive)**
- ✓ *lack of staff exchange for teaching* **(Exchange)**
- ✓ Lack of sufficient research fund /facility **(Facility/fund)**
- ✓ culture difference *between the two* **(Culture diff.)**
- ✓ Lack of reward system/incentives for joint R&D with universities **(Reward)**

Demographic/Personal profile related factors
- ✓ Age of the respondents **(Age)**
- ✓ Level of education/Academic rank **(Rank)**
- ✓ Gender of the respondents Gender **(Gender)**
- ✓ Experience in teaching/research etc **(Experience)**

Legal and policy environment related factors
- ✓ Inconsistent national policy frame work to foster the link **(UIL Policy)**

Linkage through researchea rch

Dependent Variable

Effectiveness of UIL

-*improved Knowledge Transfer*

(Quality of Education and research)

-*Technology Transfer success*

Figure 3: Conceptual Framework of the study

Source: Researcher's own formulation based on different literatures, 2023

The above conceptual model indicates that, university and industries are depending to each other. This means, time and again, academic institutions do require various kinds of products produced and services rendered by the industries. Similarly, industries depend on higher learning institutions for the supply of skilled manpower, providing training to them, and

upgrading their skills through various forums and workshops. To have strong linkage between the two entities, they should have suitable institutional characteristics, regarding university, promotion program, clear mission with respect to research and development, patent policy, innovation policy, financial incentives for laboratory development, developing staff and improving the quality and relevance of research, community service and teaching by applying their knowledge to relevant industrial projects, university licensing association, clear allocation of matching fund, office to foster technology transfer, annual funding contingent on evaluation with regard to scientific quality and commercialization, rewarding system for individual researcher according to their contribution , joint laboratory with industry, knowledge transfer organization or office ,highly engaging university researcher in research and development activity, and etc. Whereas, industrial institutional characteristics are joint research center and strategic partnership, capable size and orientation of research and development, absorptive capacity, knowledge flow (e.g. joint publication, patent and cooperative R and D) innovation policy, R and D financing by industry for university, university researchers moving to industry, and industrial technical centre to enhance the quality of research by stimulating collaborative research. Hence, implementing legal and policy environment is very determinant for effective and efficient university and industry linkage so that without government legal and policy support, effective university and industry linkage is unbelievable.

3. Research Methodology

3.1 Study design

The study employs a mixed method approach to assess the university research and industry linkage in the case of WU & MTU college of Engineering and Technology (which are the target populations of the study). After the total population from the university and industry are identified, the sample size was determined by applying a sample size determination formula provided by Yemane (1967) at 95% confidence level with the 5% precision. The formula provided as:

$$n = \frac{N}{1 + Ne^2}$$

Where N= Number of population; n= the required sample size; e = marginal of error or precision (0.05), Confidence level = 95%.

Accordingly, n respondents selected from the total of N populations and then numbers of respondents from different departments were selected on their proportion basis.

Hence total sample was assigned to all staffs using proportionality sampling technique. i.e., final numbers of respondents have been computed to each stratum of departments using the proportionality formula:

$$ni \ = \ \frac{n.\,Ni}{N}$$

Where, ni = category sample, Ni = category population and, **n**= total sample size and N = total study population

In general both open and close ended questionnaires were prepared and personally distributed and collected for academicians from university and industry to collect relevant data for the study to increase the reliability of data.

The researcher used stratified random sampling techniques to select participants of the study. This technique is preferred because it is used to assist in minimizing bias when dealing with the population. With this technique, the sampling frame can be organized into relatively homogeneous groups (strata) before selecting elements for the sample. The strata's include civil Engineering, Electrical and computer science Engineering, Mechanical Engineering, Surveying Engineering and COTM by giving emphasis to senior local staffs having exposure to research and Industry. After the Stratified sampling method used to determine the number and type of academic staffs under departments, random sampling also used to select the final respondents which were given equal chance of being selected into sample (through lottery method). Purposive sampling was employed to select interviewees working on different positions.

Since the study is qualitative and concerning social phenomenon, it used triangulation since more than one method is used (Bryman and Bell, 2007). All data gathering instruments should be piloted to test the items validity and reliability.

3.2 Data Analysis and model specification

Data analysis was done for each of the questionnaires. The detailed codification scheme was evolved, and data found on the questionnaire returned was codified according to the scheme. Data was analyzed by using explanatory and econometric models to see the variation in the effectiveness of UIL in relation to the different levels of the explanatory (independent) variables. To address the research question of the study, binary logistic model will be used while for the analysis purpose, computerized Econometric software (STATA version 13) was used .However, responses from open-ended items, those from the interviews and document analysis were also analyzed qualitatively for triangulation.

The econometrics model shown below was designed for measuring the effectiveness of UIL in terms of knowledge & technology transfer for the selected study .In this study nonlinear model the so called binary logit model was used. There are a number of reasons for selecting nonlinear model (logit model) in this study other than linear models such as OLS multiple regression models. The first reason was the existence of unequal difference between ranks of ordinal variables unlike with interval and continuous scales which have equal difference among results of variables resulting in a linear relationship between independent and dependent variables analyzed with multiple regression model since multiple regression model requires the fulfillment of linearity assumption among variables making it easy to use for interval and continuous scale data (quantitative data in nature). But, in this study since binary scale of measurement used, which reveals unequal difference among ranks of responses reflecting non-linear relationship between independent and dependent variables that needs non-linear model for analysis. Secondly, the beta coefficient of linear multiple regression model reflects only the linear contribution (it only assumes that each unit change in independent variables has a fixed effect on dependent variable) of independent variables on the dependent variables while non-linear models describes the nonlinear impacts of independent variables on the dependent variables through marginal effects. Unlike linear models which show the direction of the effect of coefficients of independent variables on the dependent variable, marginal effects in

nonlinear models show how the probabilities of each outcome change with respect to changes in the independent variables.

In general the study was analyzed using descriptive statistical tools like percentages, table, chart and graph. Beyond the descriptive analysis, the econometric model, i.e., binary 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 knowledge and technology transfer effectiveness (dependent variable) by specify the following regression model over the independent variables listed below:

$$UILK\&TTeff_i$$
$$= \alpha + \beta_1 * Age + \beta_2 * Rank + \beta_3 * Exp + \beta_4 * SC + \beta_5 * IEq + 6 * Pub$$
$$+ \beta_7 * Rew + \beta_8 * MT + 9 * Exch + \beta_{10} * AC + \beta_{11} * MgtC + \beta_{12} * Cdf$$
$$+ \beta_{13} * OrgS + \beta_{14} * Prx + \beta_{15} * RQ + \beta_{16} * FF + \in_I$$

Where
Age: Age of the respondents
Rank: academic rank of the respondents
Exp(Experience)=Teaching/research experience of academic staffs
SC(staff competence)=Competence of academicians to conduct productive research
IEq (Inequality)=The perception of different level managements on equal treatment of staffs
Pub(Publicity)=The extent to which the universities are publicizing t their research output
Rew(Reward)=Presence of rewarding system for those staffs conducting productive research
MT(Mutual trust)=Mutual trust between university and industry during linkage
Exch(Exchange)=Staff exchange in between university and industry during linkage
AC(Absorptive)=University graduates and research works absorptive capacity of industry
MgtC(Mgt commitment)=Commitment of top managements to support UILK&TT
Cdf(Culture diff.)=Culture difference between university and industry
OrgS(Org.structure)=Organizational structure effect of the universities and industries
Prx(proximity)=Geographical location (proximity) of the universities to the industries
RQ(Research Quality)=Quality of the researches conduced at universities for K & TT
FF(Facility/fund)=Availability of adequate research facilities and fund from both side

4. Results and Discussion

4.1 Background Information of Respondents

The questionnaire was distributed to a total of 282 respondents and 235 of the respondents completed and returned the questionnaires, which represent 83.33% response rate as shown below.

4.1.1 Participation level from University side

Table 1: participation level of respondents from both universities and each strata/departments

Departments/strata Under CET	Mizan Tepi University (MTU)			Wollega University (WU)			Total response		
	sample selected	No. of respondents	Response rate (%)	sample selected	No. of respondents	Response rate (%)	Total sample selected	Total No. of respondents	Total response rate (%)
Civil Engineering,	32	29	91.7	30	24	78.8	62	53	85.4
Mechanical Engineering	28	27	96.6	28	21	73.8	56	48	85.1
Electrical and computer Engineering	30	27	89.5	32	25	78.7	62	52	84
Surveying Engineering	24	17	72.2	26	22	85.2	49	39	79
Construction technology & management	25	21	84	27	22	81	52	43	82.5
Total	138	121	**87.5**	144	114	**79.2**	282	**235**	**83.3**

Source: Survey 2022

As it can be seen from above table majority of the respondents returned the questionnaire. However, the percentage deviation between the two university is due to the fact that Wollega University's questionnaire was distributed through enumerators while that of Mizan Tepi University was distributed and collected by the researcher since the researcher's address is nearby this university.

4.1.2 Participation level from Industry side

In a similar fashion informant interview was conducted with different management and expertise level concerned bodies of the selected industries as shown below.

Table 3: Participation level of respondents from the industry side

Table 2: Participation level of respondents from industry side

Industries/strata in contact with Universities	Industries having good Contacts with Mizan Tepi University (MTU)			Industries having good contacts with Wollega University (WU)			Total response		
	sample selected	No.of respondents	response rate(%)	sample selected	No.of respondents	response rate(%)	Total sample selected	Total No.of respondents	Total response rate(%)
Manufacturing(METECH)	1	1	100	3	3	100	4	4	100
Civil works & Construction	1	0	0	2	1	50	3	1	33.3
Power generation	2	2	100	1	1	100	3	3	100
Other business(consult)	1	1	100	1	1	100	2	2	100
Total	6	5	**83.3**	7	6	**85.7**	13	**11**	**84.6**

Source: Survey 2022

As it can be seen from above table, the researcher had n attempt to address pre-planned respondents from the industry side which is 84.6%. The big problem from industry side was difficult to get the right person who can assist and provide sufficient information regarding UIL. However, the researcher have tried to illustrate and brief them about the aim of data collection and its importance for the industry in the future. Accordingly, the industry managements bodies were delegating the most related or concerned technical expertise and leaders to give and respond to the researcher queries.

4.2 Descriptive Analysis (Analysis from both academicians and industry perspective)

4.2.1 Status/effectiveness of University – industry linkage

Table 3: Response of participants on the extent of the current practices of university industry linkage

S.No	Channels of linkage	Total score	Percentage of agreement	Mean	Standard Deviation
1	Students internship practice at industry	1065	91.382	3.37	1.33
2	Joint consortium/discussions	824	70.7296	3.54	1.20
3	Participation senior staffs in consulting	316	27.0987	3.45	1.19
4	Dual way staff exchange	146	12.5451	3.08	1.30
5	Joint trainings, workshop and seminar	436	37.4464	3.62	1.24
6	Signed memorandum of understanding	854	73.2618	3.16	1.22
7	staff externship	246	21.1459	3.11	1.29
8	Fund raising from industry	401	34.4077	3.27	1.29
9	The existence of Joint research	482	41.4077	3.27	1.17
10	Technology transfer between them	662	56.7811	3.34	1.21
11	Joint laboratory between them	733	62.9013	3.55	1.20
12	Joint publication between the two	89	7.64378	3.53	1.11
13	Joint technology incubation centers	546	46.8627	3.19	1.26

Source: Survey 2022

As indicated in table 7 and graph below on average 91.4 % and 70.7% of the respondents from the two universities greed on the effective implementation of students internship to industry and existence of discussions/consortium in between universities and industry on related issues. Hence it indicates that the channel of linkage in this regard seems good. On the other hand, 34.41 % of the respondents agreed on the effectiveness of the fund rising from industry which is poor.

Regarding, joint research collaboration b/n University and industry 41.41 % perceived its effectiveness, similarly, 56.78 %, of respondents agreed on the Technology transferred to industry. With respect to the use of Joint laboratory and Joint publication, 62.9 %, and 7.6 % of respondents agreed. Whereas, in view of the issues on staff exchange and Participation of industries in university research/teaching as a guest and providing consultancy service to industry 12.5 % and 27.1 % rate effectiveness respectively.

 In the other side 73.3% of the participant reported agreed on existence of signed memorandum of agreement between university and Industry which can be rated as good.

In general according to the response of respondent the status of the linkage between industry and the two universities college of Engineering and technology towards academic research is unsatisfactory.

Figures 4 depicts that the areas of linkage between the university and the industries is not as such exciting. Student internship and signing MoU through common discussion are the 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.
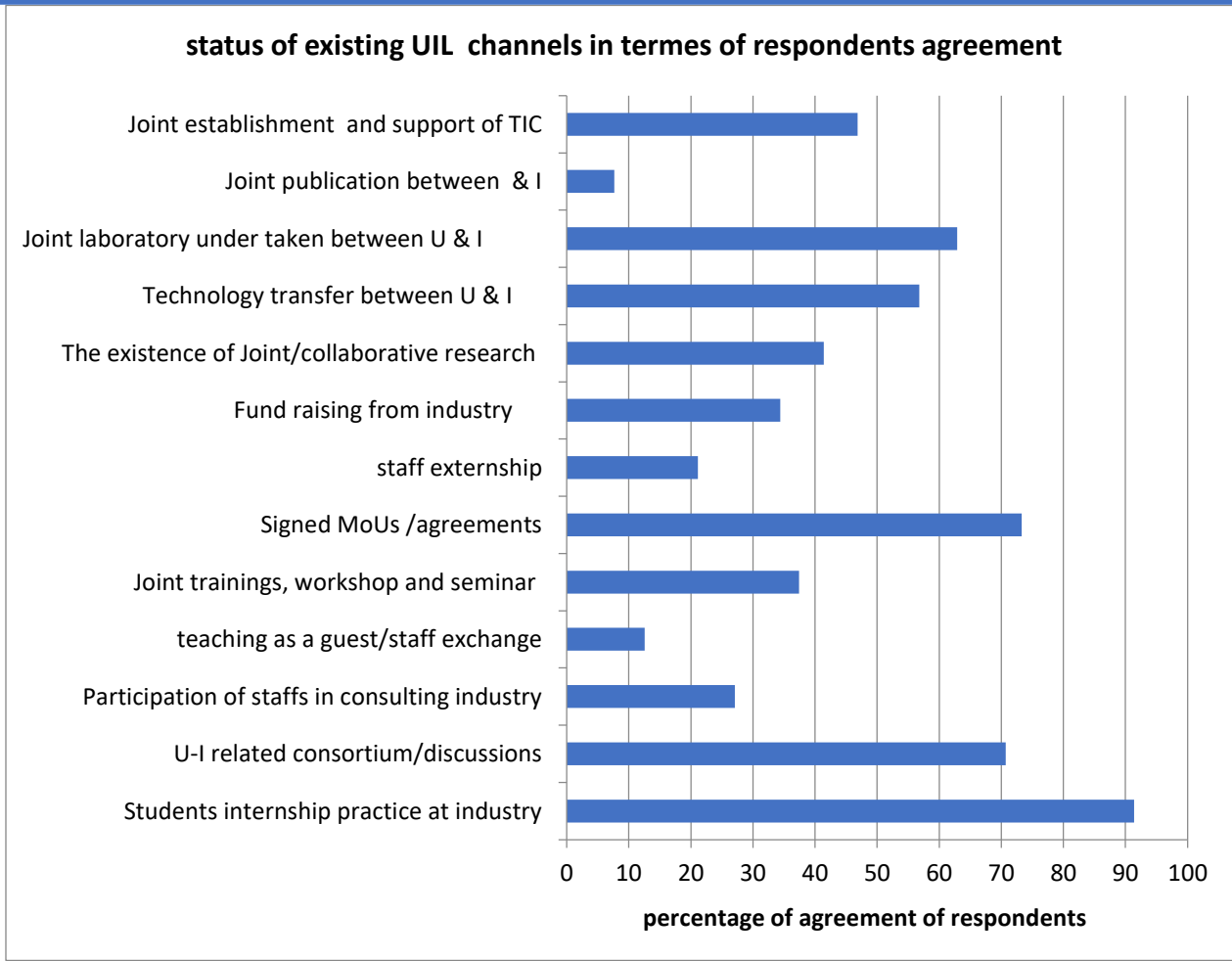
status of existing UIL channels in termes of respondents agreement

Figure 4: Response of participants on the extent of the current practices of university industry linkage

Source: Survey of 2022

Figure 5 on the other hand indicates that on average all the respondents participated on research survey are agreed that the status of existing UIL channels in selected universities are not satisfactory since all value of the mean are above 3 and all standards deviations are lower.

In other words the results from informant interviews and document mining were considered to triangulate with other quantitative results.
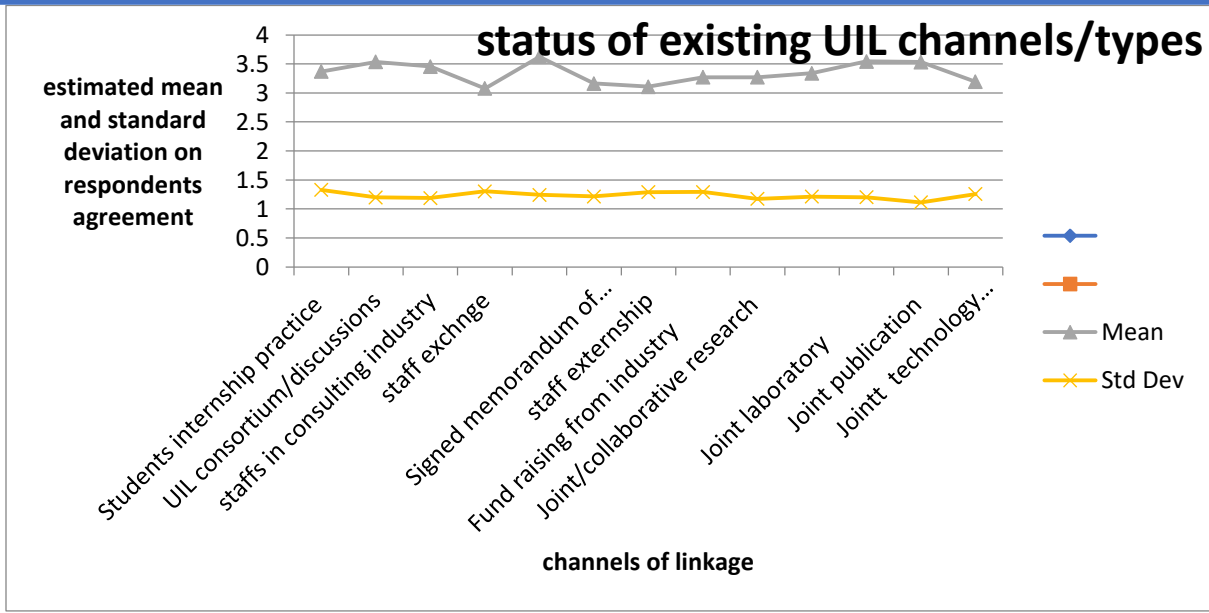
Figure 5: Status of existing UIL channels in terms of mean and standard deviation response of respondents

Source: Survey 2022

In general the result obtained from questionnaires, interview and document mining indicate that Mizan Tepi and Wollega University college Engineering and of technology conducted number of discussions and signed MoUs to form linkage with different industries and public organizations. But, it seems that there is no strong university industry linkage in terms of joint research ,consultancy service and capacity building with public and private industries rather than routine student internship which is already included in the curriculum.

4.2.2 Factors that influence the link between industry and university

Table 4: Respondents agreement level about the academic staffs competence influence on UILKTT effectiveness

		competence				Total
		disagree	neutral	agree	strongly agree	
eff	not effective	10	10	17	2	39
	effective	53	40	74	28	195
Total		63	50	91	30	234

Source: Survey 2022

As shown in table 8. about (93) 47.7 % respondents believe that academic -staff competence in initiating research agenda and their engagement on research which is base for Knowledge transfer to industry is very poor. Whereas, (74+28=102) 52.3% of respondents reported that,

Staff capacity to undertake research projects and university researchers' capacity to create and diffuse knowledge to industries are rated as good.

Interviews from the unit director in the university strengthen the above argument:

As known, university researcher has capacity to undertake research project, it means individually some instructors working innovative research work. But to use their potential exhaustively, there is a gap to have effective university research–industry linkage institutionally. (UIL,April 10,2022.)

Table 5: Respondents agreement level about the availability of facility and sufficient fund influence on UILKTT effectiveness

		facility fund				Total
		disagree	neutral	agree	strongly agree	
eff	not effective	11	7	15	6	39
	effective	63	44	50	38	195
Total		74	51	65	44	234

Source: Survey 2022

As indicated in table 9. Most of the respondents (107) 45.7% reported that adequacy of infrastructure , facilities and matching research fund in university that industry want for R and D is poor. Whereas, (88) 45% of the respondents perceived about the adequacy of these variable.

Table 6: Respondents agreement level about the leadership/top management commitment influence on UILKTT effectiveness

		commitment				Total
		disagree	neutral	agree	strongly agree	
eff	not effective	9	9	12	8	38
	effective	49	37	70	39	195
Total		58	46	82	47	233

Source: Survey 2022

On the subject of university leadership commitment in enhancing research and development and flow of income to universities through consultancy, research contracts and the commercialization of innovations and research findings,(86) 44.1% of respondents answered

the lack of appropriate leadership to initiate, guide and support university-industry linkage while 55.9% of respondents support the availability of supporting leadership.

The data obtained from interview:

There is no sufficient fund either from industry or university to work innovative and applied research.
(Professor Daniel Kitaw, sep, 2022)

In similar fashion here under is respondents' perception/agreement level on other variables that are selected as influencing factors on UILK&TT effectiveness.

Table 7: Respondents agreement level about variables influence on UILKTT effectiveness

Effectiveness in terms of the following variables	Agreement level of respondents				Total frequency
	disagree	neutral	agree	strongly agree	
Mutual trust	52	50	64	29	195
Staff exchange	24	37	96	38	195
Absorptive capacity	47	39	77	32	195
Publicity of research output	35	34	91	35	195
Culture difference	74	42	53	26	195
Organizational structure	48	38	68	41	195
Geographical location	38	33	75	49	195
Quality of Researches	25	34	91	45	195

Source: Survey 2022

As we can see from table 11,(102) 52.3% of the respondents believe that there is lack of trusting each other in between the two parties(university and industry) on joint research,

publication, consulting and other activities while the rest (93) 47.7% perceived about the presence of mutual trust between universities and industries.

As indicated in table, some of the respondents (61) 31.3% reported that staff exchange as a guest and research collaboration is not functional while (134) 68.7% of the respondents perceived about the functionality of theses variable. Similarly, the information from above table indicated that about 44.1% have doughty on absorptive capacity of industry and 35.34% are criticizing openness of universities in publicizing their different research output to industries and surrounding communities while the rest respondents are support the existing absorptive capacity of industry and publicity capacity of the universities. On the other hand majority of the respondents are not satisfied with organizational structure of the university to attract industry and believe that there is huge culture difference between universities and industries. Beside this, majority of them agreed that the geographical location (farness from center and industries) as well as quality of the researches done in universities has less influence on the effectiveness of the UILK &TT .Once again from document mining analysis:

In general, the university research policy is well expressed and identifies the research area. However, it is minimal level of implementation especially in university research and industry linkage and technology transfer related policies.

4.2.3. Promotional Measures to strengthen the UILK&TT effectiveness

Table 8: Respondents response on promotional measures to strengthen the UILK&TT effectiveness

Promotional measures for strong university industry linkage	Score	%Age	Mean	Std Dev
strictly follow students internship progress	145	76.31579	3.82	1.09
Encourage staffs for regular industrial visits	159	83.68421	4.18	1.06
Improve laboratory facilities	159	83.68421	4.18	1.04
encouraging staff exchange	162	85.26316	4.26	0.95
Setup industrial parks closer to universities	157	82.63158	4.13	1.12

Academicians representation in industrial committees	159	83.68421	4.18	0.87
Joint meetings, talks, and communication	159	83.68421	4.18	0.98
industrialists representation in curriculum dev't	164	86.31579	4.32	0.87
Setup strong U-I linkage& technology transfer units	160	84.21053	4.21	0.91
Publicize university activities relevant to industry	156	82.10526	4.11	0.92
Join seminars, workshops ,annual research conferences	165	86.84211	4.34	0.85
allowing tax deduction for joint RD work	142	74.73684	3.74	1.13
encourage academics to undertake research with industry	148	77.89474	3.89	1.03
Devise rewarding system based on researcher contribution	149	78.42105	3.92	1.05
Provide consultancy/collaboration based promotions	157	82.63158	4.13	1.02
Give more autonomy for academics to work with industry	158	83.15789	4.16	0.89
Assign sufficient research fund/budget	158	83.15789	4.16	1.05
Creating awareness t about UIL & TT policies	156	82.10526	4.11	0.92
Curriculum development based on industries demand	160	84.21053	4.21	0.84
staff and management bodies exchange	160	84.21053	4.21	0.93
Accessing Education Sponsorship for industrialists	154	81.05263	4.05	1.06
capacity building training to industry managers	159	83.68421	4.18	0.83
Strengthening technology and business incubation centers	155	81.57895	4.08	1.08
Development of intellectual property rights guidelines	155	81.57895	4.08	0.97
joint scientific publications in refereed journals	152	80	4.00	1.04

Participation of university staff in conferences	161	84.73684	4.24	1.02
Initiating joint RD projects Consultancy services	155	81.57895	4.08	1.02
Joint knowledge & technology transfer strategies	155	81.57895	4.08	1.00
Inheriting governmental and NGO's	147	77.36842	3.87	1.07
Reduce bureaucracy to bring entrepreneurial climate	150	78.94737	3.95	1.04
Giving special attention and financial support to UIL & TT Offices	150	78.94737	3.95	0.90

Source: Survey 2022

As is can be depicted from the table 12 above, majority of the respondents agreed that promotional measures like devising new internship strategies to train and evaluate students towards knowledge and technology transfer, announcing for academic and research staffs to involve in research and technology transfer by giving full autonomy and facilitating enormous amount of funds and research facilities, creating awareness and working on publicity to encourage both university and industry different level management bodies, encouraging and facilitating joint workshops, trainings, consultancy works and publications regularly, participating different NGO's in UIL related issues and giving much attention on establishing business incubation centers and equipping UIL & TT office with enough budget and human resource are taken as promotional measures to strengthen UILK&TT effectiveness in the study area under consideration.

Source: Survey 2022

The above figure 6 indicates that on average almost all the respondents participated on research survey are agreed that all promotional measures to strengthen UIL that recommended by researcher in selected universities are positively accepted since all value of the mean are above 3 and all standards deviations are lower. Hence the universities under study have to take these variables in their future plan and have to work on it.
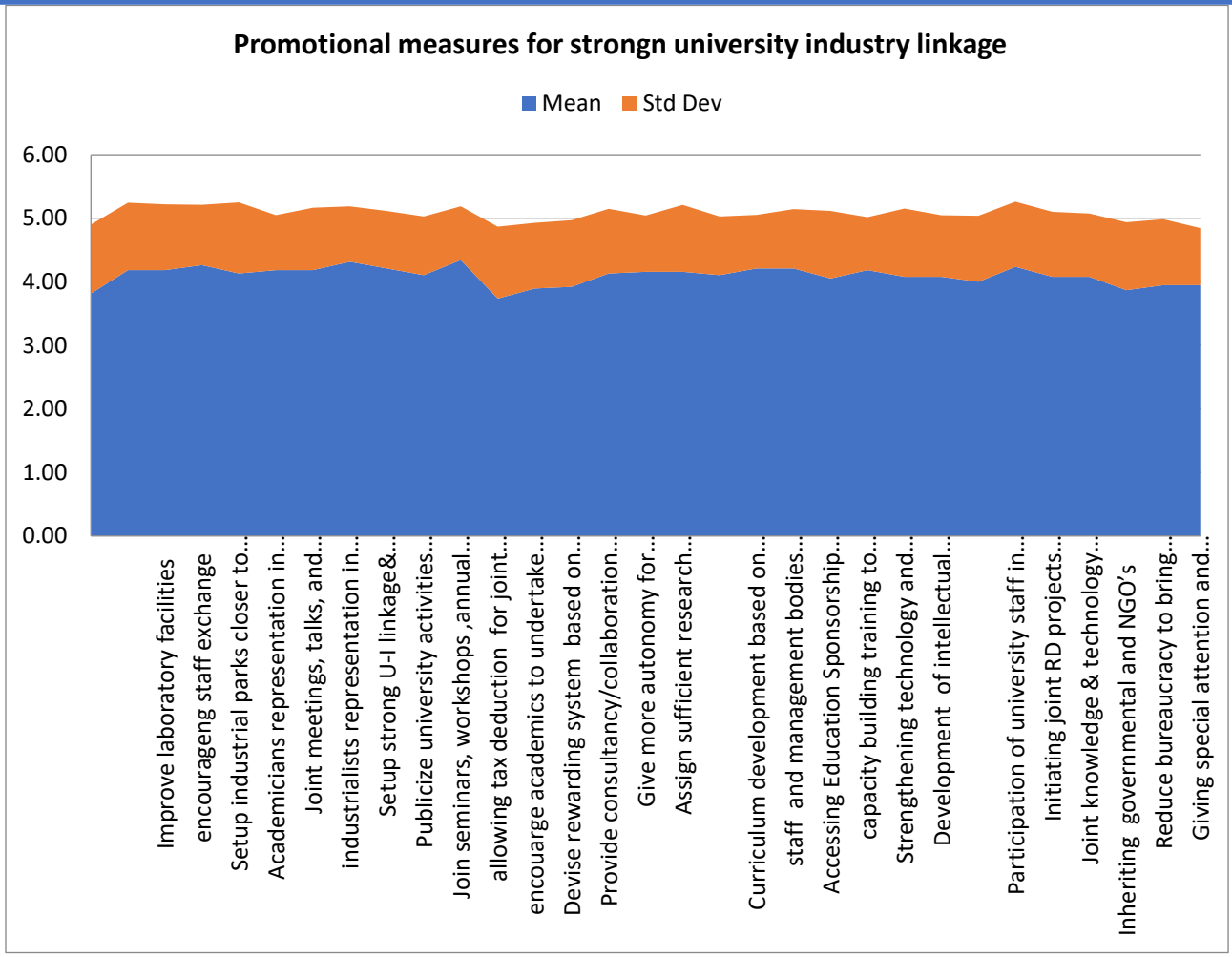
Figure 6: promotional measures to strengthen UIL that recommended by respondents (in terms of mean and standard deviation measures)

4.3. Determinants of UILK&TT effectiveness (with Binary logistic regression)

In addition to the descriptive statistical analysis discussed above, in this study binary logistic regression model was applied with the help of an econometric model (STATA version 13) to regress the dependent variable (University-Industry linkage K & TT effectiveness) in relation to the specified explanatory variables (staff competence unequal treatment of researchers, research output publicity, presence of reward system, Mutual trust between university and industry, staff exchange, absorptive capacity of industry, top management commitment ,Culture difference, organizational structure, proximity barrier ,research quality and adequacy of facility for research and other joint activities).

4.3.1 Results of binary logistic regression model using econometric model (STATA version 13)

Table 9: Binary logistic regression result (Odds ratio)

Logistic regression		Number of obs =234				
		LR chi2(16) =36.67				
		Prob > chi2 =0.0023				
Log likelihood =87.096955		Pseudo R2 =0.1739				
eff	**Odds Ratio**	**Std. Err.**	**z**	**P>/z**	**[95% Conf. Interval]**	
Age	.9636526	.2483971	-0.14	0.886	.5814462	1.597098
rank	1.339098	.3628492	1.08	0.281	.7873471	2.277501
exp	.8168448	.1996033	-0.83	0.408	.5059887	1.318676
Staff competence	1.129242	.2665098	0.52	0.607	.7110443	1.793399
enequality	.9774658	.1995416	-0.11	0.911	.6551426	1.458369
publicity	1.121227	.2396525	0.54	0.592	.7374911	1.704631
reward	.9671735	.2132029	-0.15	0.880	.627865	1.48985
Mutual trust	.5074883	.1335393	-2.58	0.010**	.3030001	.849981
exchange	1.514859	.3710404	1.70	0.090 *	.9373115	2.448276
absorptive	1.586641	.3408392	2.15	0.032 **	1.041418	2.417309
Mgt commitment	1.665496	.4381463	1.94	0.052 *	.9945249	2.789146
Culture diff.	.7008136	.141848	-1.76	0.079 *	.4713194	1.042053
Org. structure	.5358392	.1269208	-2.63	0.008 ***	.3368339	.8524191
proximity	2.08819	.5700824	2.70	0.007 ***	1.222896	3.565749
Research quality	.8159756	.1959445	-0.85	0.397	.509652	1.306413
Facility	.5876959	.135768	-2.30	0.021 **	.373689	.9242619

_cons	9.260654	21.08977	0.98	0.328	.1066979	803.7619

***: significant at significant level 1% (p<=0.01), ** significant at significant level 5% (p<=0.05), * significant at significant level 10% (p<=0.1)

Source: Survey 2022

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 and variable selection were done.

The p-value associated the chi-square/ Overall significant of the model (Liklihood Ratio or LR test) is equal to 0.0023 and indicates that the model as a whole is statistically significant (i.e explanatory variable significantly affect the dependent variable UILK&TT effectiveness because prob>chi2= 0.0023 is less than 0.01 (1% significant level)).

Odds ratios and interpretation:

The result of the coefficients (log-odds and the proportional odds ratio) of each variable are used to interpret the effect of each explanatory variables on dependent variable.

The interpretation of the logistic regression models can be more manageable if it comes in terms of odds ratios (ORs). The odds of an event occurring are defined as the probability of an event occurring divided by the probability of that event not occurring. In terms of logistic regression models, the odds ratio then compares the change in the odds that results from a unit change in the predictor.

Access to research facility or funding:

The result of the analysis has found that access to research facility or funding has significant (<5%) and positive association with UILK&TT effectiveness.

The odds ratio for research facility or funding indicates that when holding all other variables constant, university industry linkage supported with access to research facility or funding is 0.5876959 times more likely to be effective than the UIL facing finance and facility constraints to attain effective UIL.

Organizational structure of the university/industry:

The result of the analysis has found that the organizational structure of the university has significant (<1%) and positive association with UILK&TT effectiveness.

The odds ratio for . organizational structure as factor indicates that when holding all other variables constant, university industry linkage where there is good and decentralized organizational structure established is 0.5358392 times more likely to be effective than the UIL suffering from poor and centralized organizational structure to attain effective UIL.

Proximity of universities to industry:

The result of the analysis has found that Proximity to industry has significant (<1%) and have positive association with UILK&TT effectiveness.

The odds ratio for Proximity to industry as factor indicates that when holding all other variables constant, university industry linkage between universities located near to industries is 2.064657 times more likely to be effective than the UIL where they are far away from each other to attain effective UIL.

Mutual trust between university and industry

The result of the analysis has found that Mutual trust between university and industry has significant (<5%) and positive association with UILK&TT effectiveness.

 The odds ratio for Mutual trust between university and industry as factor indicates that when holding all other variables constant, university industry linkage where there is good Mutual trust between university and industry exist is 0.5074883 times more likely to be effective than the UIL where they fear and suspect each other for common works to attain effective UIL.

Absorptive capacity of industry:

The result of the analysis has found that the Absorptive capacity of industry has significant (<1%) and positive association with UILK&TT effectiveness.

The odds ratio for Absorptive capacity of industry as factor indicates that when holding all other variables constant, university industry linkage where larger absorptive capacity of students,

staffs and other common works is 1.586641 times more likely to be effective than the UIL where there is smaller size industries to absorb university requests to attain effective UIL.

Explanatory variables, such as staff competence, publicity, quality of research, reward systems and other demographic factors are not significant even at 10 percent p-value. However, as it was triangulated from descriptive analysis some of the explanatory variables (including those which are not significant in STATA/logit model) odd ratio were significantly determine the effectiveness of UILK&TT level.

The rest four are significantly determine effectiveness of UILK&TT at p-value of 10 percent and surprisingly explanatory variables, such as staff competence, publicity, and quality of research, reward systems and other demographic factors are not significant even at 10 percent p-value. However, as it was indicated from descriptive analysis some of the explanatory variables (including those which are not significant in STATA) were significantly determine the effectiveness of UILK&TT level.

***: significant at p-value at 1% (p<=0.01), ** significant at p-value at 5% (p<=0.05), * significant at p-value at 10% (p<=0.1)

Source: Survey 2022

In the above Logit Model, the probability of UILK&TT effectiveness when significant variables are improved is 0. 889684151 when all explanatory variables are fixed at their mean values. Based on the marginal effect test results, variables mtrust, absorptive structure, exchange, culture, commitment, proximity, and facility are statistically significant and shall play greatest role for the UILK&TT effectiveness improvement.

Table 10: Marginal Effect at their Mean values for Logit Model

mfx
Marginal effects after logit
y== Pr(eff) (predict) =.88968415

variable	dy/dx	Std. Err.	z	P>z	[95%	C.I.]	X
age	-.0036338	.02531	-0.14	0.886	-.053233	.045965	2.62393
rank	.0286583	.02667	1.07	0.283	-.023606	.080923	2.75641
exp	-.0198556	.02383	-0.83	0.405	-.066553	.026842	3.01709
compet~e	.0119293	.02303	0.52	0.605	-.033218	.057076	3.37179
enequa~y	-.0022369	.02004	-0.11	0.911	-.04152	.037046	3.33761
public~y	.0112303	.02091	0.54	0.591	-.029746	.052207	3.5
reward	-.0032759	.02162	-0.15	0.880	-.045648	.039096	3.49573
Mtrust	-.0665708	.02425	-2.74	0.006***	-.114109	-.019032	3.38889
exchange	.0407623	.02418	1.69	0.092*	-.006621	.088145	3.73504
absorp~e	.0453062	.02061	2.20	0.028***	.004905	.085708	3.45726
commit~t	.0500666	.02497	2.01	0.045**	.001134	.098999	3.63248
Culture	-.0348923	.01958	-1.78	0.075*	-.073278	.003493	3.22222
sructure	-.0612355	.02234	-2.74	0.006***	-.105029	-.017442	3.61966
proxim~y	.0722649	.02494	2.90	0.004***	.023375	.121155	3.63675
quality	-.0199601	.02357	-0.85	0.397	-.06616	.02624	3.83333
Facility	-.0521692	.02179	-2.39	0.017**	-.094883	-.009455	3.8547

4.5 Summary of Major Findings

4.5.1. The status of linkage between industry and university research in the study area

As it is indicated in the analysis part Joint publication between university and industry, Joint laboratory under taken between university and industry, number of innovations transferred to

industry and Technology transfer between university and industry, the existence of Joint research collaboration between University and industry with regard to Academic research, and fund raising from industry for university research have poor status (it also supported and triangulated by result from interview and document mining). Moreover, the data from WU indicate that, the university has consultancy and capacity building linkage with the public institute than private productive sector (which is not applicable in MTU), WU research policy and others which has significant role in creating the desired linkage, but it cannot institutionalize the linkage between university research and industry in the case of WU college of Engineering & of Technology. Therefore, the status of university research & industry linkage in the case of college of Engineering & of Technology is in an infant stage which is in line with finding by (Ayenew and Hiwot, 2017).

4.5.2 The factors that hinder the link of university research and industry in the study area

 The major factors that hinder the link of university research and industry of study area in the case of college of Engineering & technology are poor organizational structure , geographic location or proximity to industry, research experience of staff, inadequacy of research facility in university, top management commitment in university , improper implementation of academic as well as research staffs exchange ,weak absorptive capacity of industry, culture difference between university & industry, lack of sufficient research fund in industry, lack of competence & enough encouragement for researchers to undertake more applicable research, lack of mutual trust between university and industry, and poor publicity of university research output. However, based on the qualitative analysis through informant interview and document analysis the most determinant factors among the above UIL hindering factors are top management commitment and budget constraint and it is in line with finding results of (Ayenew and Hiwot, 2017).

4.5.3 The policy frame works in place that governs the link between university research and industry in the study area

Legal policy frame to facilitate the link of university and industry is very fundamental. In line of that, there is strategy to facilitate university and industry linkage and clearly stated .Moreover,

the university research policy is well expressed and identifies the research thematic areas. However, it is minimal level of implementation especially in university research and industry linkage in the case of study area .To support with evidence, MTU for inistatnce have developed UIL & TT policy frame works and signed MoUs with industries like Omo Kuraz sugar, Bahirdar textile and fashioning, Tepi soil and spices institutes, Mizan Aman and Tepi TVET, southern ICT agency and so on. However, the implementation of these MoUs from the policy frame work designed point of view is almost nil except students internship related relationship.

4.5.4 The factors that enable or promotional measures for the link of university research and industry in the study area

The enabling factors are: national policy frame work to stimulate university -industry linkage, the quality of academic research (research skill of academic staff) and University research policy. Moreover, devising new internship strategies to train and evaluate students towards knowledge and technology transfer, announcing for academic and research staffs to involve in research and technology transfer by giving full autonomy and facilitating enormous amount of funds and research facilities, creating awareness and working on publicity to encourage both university and industry different level management bodies, encouraging and facilitating joint workshops, trainings, consultancy works and publications regularly, participating different NGO's in UIL related issues and giving much attention on establishing business incubation centers and equipping UIL & TT office with enough budget and human resource, conducting workshops for industry staff, encouraging regular industry visits by academics and setting up strong and decentralized industry linkage offices are identified by the academics as the main measures to promote UILK&TT effectiveness in the study area under consideration which is in line with result of (Belayneh , 2014) .

5. Conclusion and Recommendation

5.1. Conclusion

Even though one of the major responsibility of the university is conducting research and creating technology transfer mechanism, the result of this study conducted in MTU & WU college of Engineering & Technology indicate that the linkage in terms of university research

with industry is in an infant stage, moreover, Creating linkage with university doesn't get priority attention by the industry owner because the industry owner did not give priority for local technology and expertise, not only this but also they are interested with profit, accordingly the university leadership focus on other routine activities and bureaucratic issues. As a result the status of the linkage between the two entities is very low. In general the status of linkage between college of Engineering & Technology and industry in MTU & WU from research point of view shows that there is a need of regular discussions between industries and university leadership, because the status of their linkage is weak and is not supported well by university as well as industry top managements.

Hence the study believe that this research paper result shall add values to fill the research gaps in literature on the status, determining factors and promotional measures related to UILK&TT effectives.

5.2. Recommendation

1. Universities top management should give more attention and more budgets to provide teaching and research based on demand from Industries.

2. Universities should take the motive to organize regular seminars and workshops with industries and other relevant stakeholders to publicize their research outputs.

3. Industries should understand the importance of university linkage and should be willing to collaborate.

4. Industries should be major funding sources for university research.

5. The government, as the current major source of funding for R&D works, should allocate more budgets for R&D works in universities.

6. Government has to initiate different funding programmes and interface organizations to facilitate R&D works and to fill the observed gaps with regards to research laboratories and UIL works.

At last, the university has to reform its incentive mechanism for researchers. University academicians should also have to conduct demand driven and quality researches to the industries in order to gain industries' trust. Industrialists should also support the academicians

those who engaged in industry related tasks by offering financial and other supports. The University-Industry linkage and technology transfer office should decentralize as college wise University-Industry Linkage and technology transfer office with a coordination level.

Acknowledgement

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