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Research Article

# University-industry linkages: A bibliometric analysis and systematic literature review

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## ABSTRACT

University-Industry Linkages (UILs) have consistently garnered significant attention and acceptance because stakeholders believe that collaboration between academia and industry is crucial for innovation-driven economic growth and their concern that university research should be relevant to and accessible by industry. A heterogeneity of ideas exists in the field UILs due to its multidisciplinary nature. To portray the frontiers, status, categorization, trends, and future direction of the UILs research, present study had carried out a large-scale bibliometric analysis of the literature on UILs from 1980 to 2022. Furthermore, we present a systematic review of the 'selected' documents on UILs highlighted in bibliometric analysis to have a detailed and holistic understanding of the field. Finally, we have pointed out gaps existent in present literature, which provide direction to potential future research on UILs.

## 1. INTRODUCTION

University-industry linkages (UILs) can be defined as interactions between all parts of the higher education system and industrializing economy (Ankrah et al., 2013). Since the early 1980s, a new type of policy discussion regarding higher education has emerged, redefining the role of universities. They are now expected to produce practical and socially relevant research. This shift has led to the adoption of a "third mission" for universities: contributing to economic growth (Bano & Taylor, 2015; Yang et al., 2016). This phenomenon was discussed using different tags and terminologies like "Mode-2" knowledge production, "Triple Helix", "entrepreneurial universities" (Etzkowitz & Leydesdorff, 2000; Etzkowitz & Dzisah, 2008), and "academic capitalism" (Etzkowitz, 2012).

University-industry linkages are a crucial aspect of this policy shift and have become integral to contemporary higher education. These linkages have gained attention due to stakeholders' belief that collaboration between academia and industry can be pivotal for innovation (Ambos et al., 2008), and policymakers' concerns that university research should be relevant to and accessible by industry (Tether & Tajar, 2008). Numerous researchers (e.g., Hansen & Lehmann, 2006; Feng et al., 2011) argue that collaborations between universities, businesses, and civil society are essential for fostering economic growth. Lately, a



significant increase has been witnessed in industry linkages around the world (Gertner et al., 2011). This rise can be attributed to multilateral pressures on industry and universities (Giuliani & Arza, 2009). The industry is facing rapid technological change, quick product obsolescence, and ferocious global competition (Wright et al., 2008). Whereas universities are also experiencing pressures to produce practical and solution-oriented knowledge, ever-rising operating costs, and decreasing public funding. These challenges have put an immense resource burden on universities to seek partnerships with industry to stay competitive through knowledge exchange (Perkmann et al., 2013). Furthermore, UILs are considered a primary instrument in open innovation to enhance the capacity of an organization. University-industry linkages enable firms and universities to leverage each other's complementary skills, which can lead to cost savings, bridging skills and knowledge gaps, and enhancing research outcomes (Ishengoma & Vaaland, 2016; Vaaland & Ishengoma, 2016).

Despite the rise in research on university-industry linkages, the body of knowledge is still quite unstructured and fragmented. A comprehensive bibliometric review is required to identify, categorize, and analyze the literature on UILs (Filippetti, & Savona, 2017). The systematic literature review of Ankrah et al., (2013) is the sole and inadequate attempt to comprehend and synthesize the research on UILs.

Therefore, this study aims, first, to carry out a bibliometric analysis of university-industry linkages research to map influential aspects, trending topics, major authors, and journals. Furthermore, it reveals the main streams in the literature and highlights the future research agenda. Second, to conduct a systematic literature review of the literature highlighted in bibliometric analysis, in order have a deep understanding of the subject and identification of definite gaps in literature, which may be considered for future research. To meet this objective, we have sampled 213 research papers from the Elsevier Scopus database ranging from 1980 to 2022. Our sample includes all types of research papers (review, theoretical, and empirical studies). Multiple softwares (RStudio, VOSviewer, and Excel) were used to analyze the data and depict the most active scientific actors in terms of countries, institutions, sources, documents, and authors. Subsequently, the sampled 213 research papers, which were identified in bibliometric analysis were shortlisted according to fit and finally we have left with 28 papers for in-depth systematic literature review.

## **2. METHODOLOGY**

The present study has used bibliometric analysis to quantitatively portray the frontiers of literature on university-industry linkages along with sequential systematic literature review to provide concrete understanding of the subject and future research agenda. The bibliometric method together with content analysis is gaining the confidence of scholars (Koskinen et al., 2008). Systematic literature review studies and meta-analytic review studies are increasingly adding bibliometric analysis to ensure greater reliability and validity (Martínez-Climent et al., 2018). Bibliometric analysis promising tool to find out the status, trends, frontiers, and future direction of the research in a given field. This is a pioneer bibliometric analysis in the field of university-industry linkages which is also using a subsequent literature review.

## 2.1. STUDY DESIGN

The study design is comprised of three parts; the first part explains the sample selection process, the second part describes the contents of bibliometric analysis, and last (third) explains the procedure systematic literature review.

### 2.1.1. Sample selection process:

The study sample was selected through a three-step process. In the first step, we have chosen the database to extract sample papers. In this study, the Scopus database, which is owned by Elsevier, was chosen to look for sampled papers. Due to the vast coverage, the Scopus database is largely being used in bibliometric studies (e.g. Feng et al., 2017; Parlina et al., 2020). In the second step, we have decided on the keywords to be used for the search. We have used a single but universal keyword “university-industry linkages\*”, appearing in any sequence in the research paper’s title, and/or abstract, and/or keywords. In the last step, screening criteria were determined and implemented. All types of papers (articles, book chapters, conference papers, review papers, conference reviews, editorials) published over 42 years (1980 to 2022) in the English language were included in the sample. The above-mentioned keyword together with the screening criteria yielded 213 documents for analysis.

### 2.1.2. Bibliometric analysis:

Bibliometric analysis was performed in two parts: performing analysis and science mapping (Fig. 1). The performance analysis reflects the annual publication and citation, most productive and cited authors, institutions, and journals. Similarly, science mapping presents trending topics, a thematic map, word cloud, co-citation, co-authorship, and co-occurrence analysis.

### 2.1.3. Systematic literature review:

To have an in depth understand of the recent trends in UILs literature, the present study has reviewed 213 documents identified in the bibliometric analysis. These 213 documents were shortlisted according to fit and finally we have left with 28 papers for in-depth review. These include six position papers, proposing some sort of conceptual understanding and two review papers which outline the themes in the literature. The remaining 20 papers are empirical papers, which numerically measure some aspects.

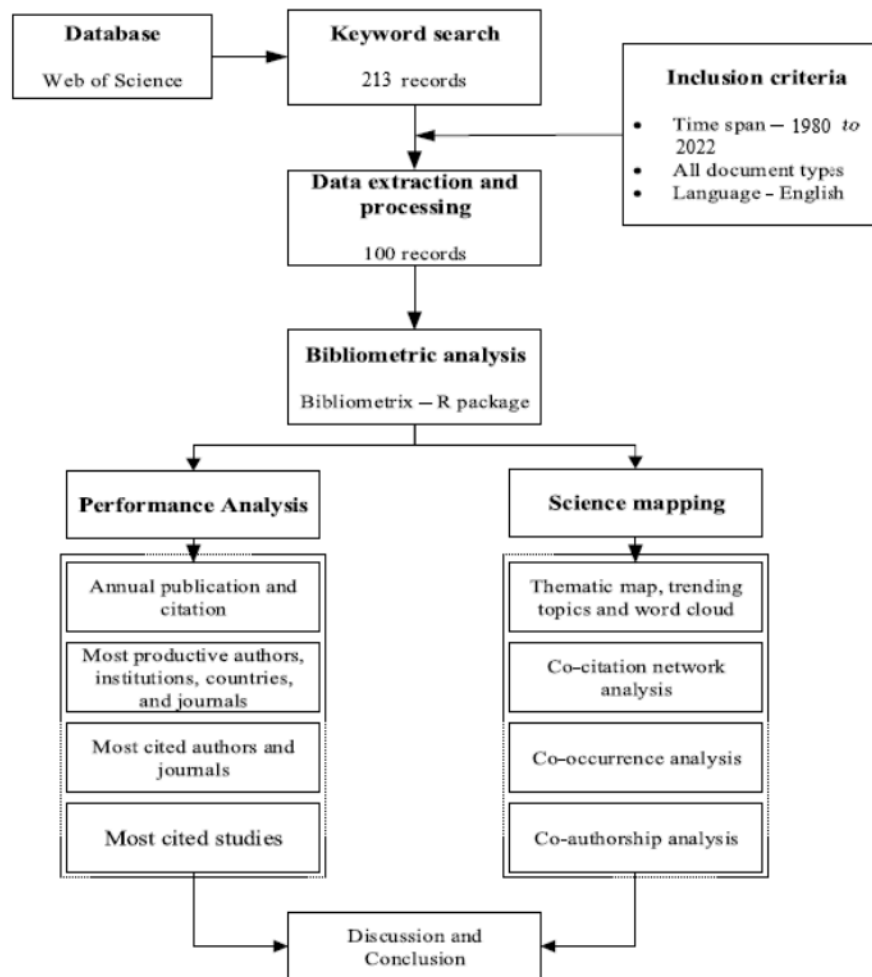


Fig. 1. Bibliometric Analysis Process Diagram

### 3. TOOLS OF ANALYSIS:

RStudio, VOSviewer, and Excel are three bibliometric analysis tools, which were used in the present study. RStudio is commonly used to generate bibliographic data from the dataset, whereas network and content analysis was carried out while using VOSviewer. VOSviewer creates and presents a pictorial view of bibliometric networks. These pictorial views are often referred to as maps, which are used to perform various network analyses including co-citations, co-occurrence, and coauthorship. Similarly, such networks of relationships can be built up for authors, sources, countries, and keywords. Moreover, VOSviewer was also applied to carry out the bibliographic coupling. Microsoft Excel supplements RStudio, as the former is convenient in developing informative, editable, and eye-catching graphs and tables.

### 4. RESULTS AND DISCUSSION:

#### 4.1. DESCRIPTIVE INFORMATION

In the present study, we have extracted 213 documents from Elsevier's Scopus database ( $n = 213$ ) spreading over 42 years starting from 1980 to 2022 on university-industry linkages.

These documents include books, articles, book chapters, conference papers, conference reviews, editorials, and short surveys. Firstly, table 1 provides the overall information about the data. The average annual growth of the data is 5.08 % and with an average document age and citation of 8.95 and 31.03 respectively, and the references count is 10032. Secondly, it tells us about the number of keywords Plus (ID) (695) and Author's Keywords (DE) (541). Thirdly, it reveals that there is a total of 432 authors and 56 are single-authored documents and the average co-authorship per document is 2.45. Finally, the types of documents are listed, out of a total of 213 documents, 160 are articles, 29 conference papers, and 7 book chapters.

**Table 1. Descriptive Statistics**

Description	Results
<i>Main Information About Data</i>	
Timespan	1980 to 2022
Sources (Journals, Books, etc)	126
Documents	213
Annual Growth Rate %	5.080
Document Average Age	8.950
Average citations per doc	31.030
References	10032
<i>Document Contents</i>	
Keywords Plus (ID)	695
Author's Keywords (DE)	541
<i>Authors</i>	
Authors	432
Authors of single-authored docs	50
<i>Authors Collaboration</i>	
Single-authored docs	56
Co-Authors per Doc	2.450
International co-authorships %	37.090
<i>Document Types</i>	
Books	2
Article	160
Book chapter	9
Conference paper	28
Conference review	3
Editorial	3
Review	7
Short survey	1

#### 4.2. PERFORMANCE ANALYSIS FINDINGS:

Fig. 2(a) graphically and Fig. 2(b) pictorially shows the frequently used words in the domain of University-Industry Linkages research and endorse the keyword selection used in present. Similarly, Fig. 3(a), Fig. 3(b) and Fig. 3(c) depicts the most relevant resources, their impact and dynamism respectively. Journal of technology transfer and research policy are two leading journals who have highest number of publications (16) with an impact of more than 10 H, and greater dynamism reflected by highest of occurrences in recent years.

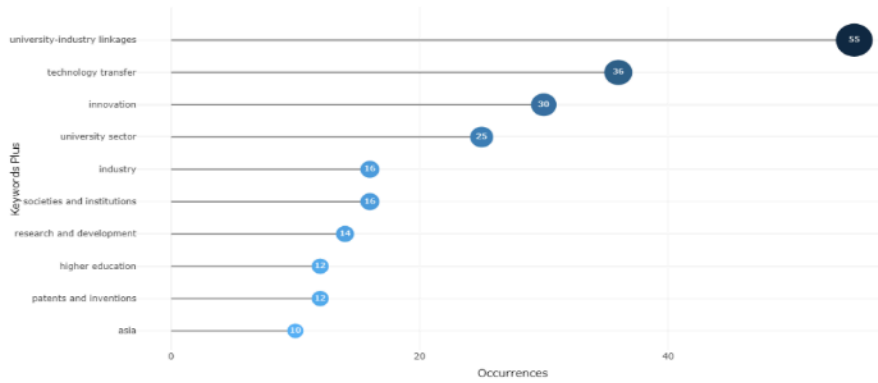


Fig. 2. (a): Most Frequent Words



Fig. 2. (b): Most Frequent Words (Pictorial View)

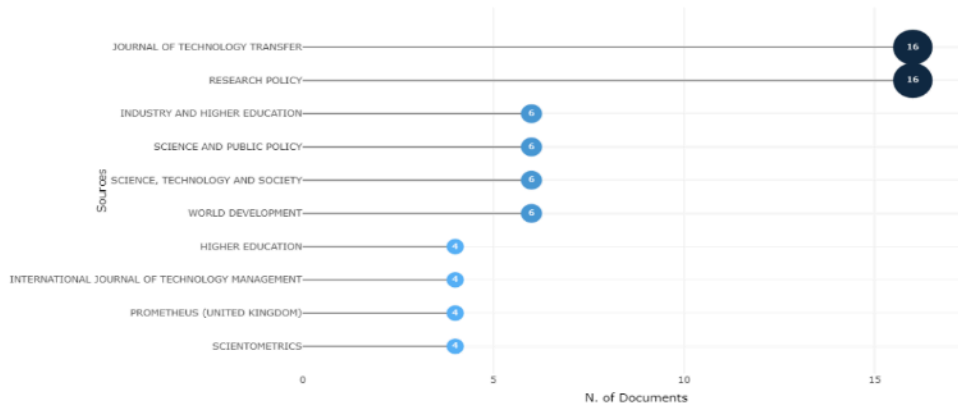


Fig. 3. (a): Most Relevant Resources

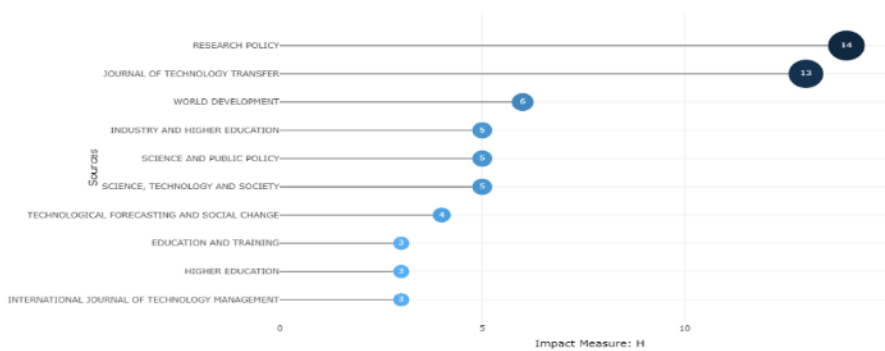
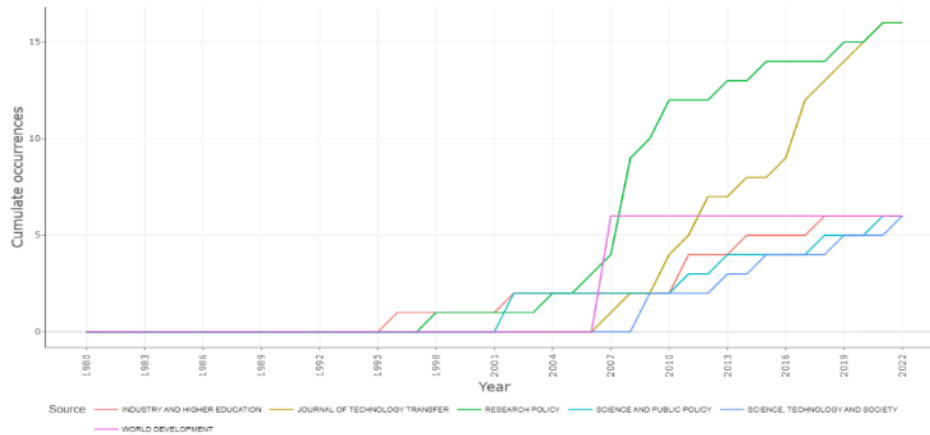


Fig. 3. (b): Local Impact Resources



**Fig. 3. (c): Resources Dynamics**

Table 2, 3, and 4 carry the names of most relevant authors, their relevant impact along with relevant affiliations. Table 2 shows that Mascarini, S. has the highest number of articles i.e., 6 followed by Garcia, R. having 5 publications with an article fractionalization of 1.25 and 1.05 respectively. Table 3 shows that in recent years Johnston, A. and Ashraf, M.S. have the highest local impact in for h and g index. Table 4 reveals the affiliations of authors with their institutions; 8 authors come from both School of Management and Economics, Italy and Addis Ababa University, Ethiopia, followed by Münster university of applied sciences, Germany with 7 affiliates.

**Table 2. Most Relevant Authors**

Authors	Articles	Articles Fractionalized
MASCARINI S	6	1.250
GARCIA R	5	1.050
PLEWA C	5	1.420
ETZKOWITZ H	4	4.000
BAAKEN T	4	1.080
COSTA A	4	0.800
JOHNSTON A	4	2.500
KORFF N	4	1.000
ZAVALE NC	4	2.500
ARAUJO V	3	0.600

**Table 3. Relevant Local Impact**

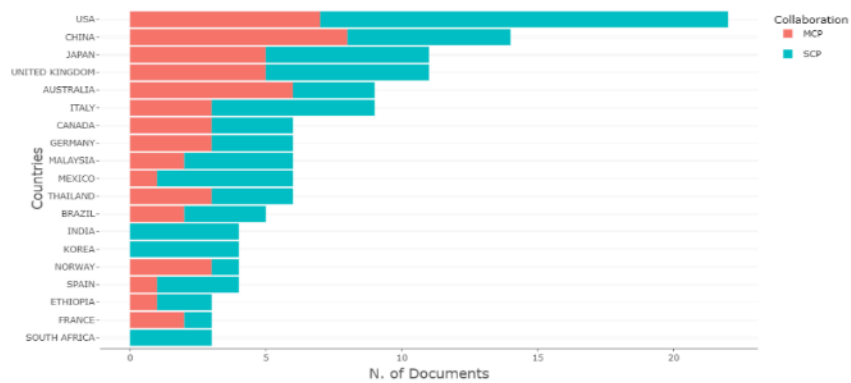
Element	h_index	g_index	m_index	TC	NP	PY_start
BAAKEN T	3	3	0.167	223	3	2005
JOHNSTON A	3	4	0.500	72	4	2017
KORFF N	3	3	0.300	177	3	2013
PLEWA C	3	4	0.167	224	4	2005
WU W	3	3	0.188	173	3	2007
YUSUF S	3	3	0.188	224	3	2007
ZAVALE NC	3	4	0.429	46	4	2016
ARAUJO V	2	3	0.250	37	3	2015
ARZA V	2	2	0.143	169	2	2009
ASHRAF MS	2	2	0.400	18	2	2018



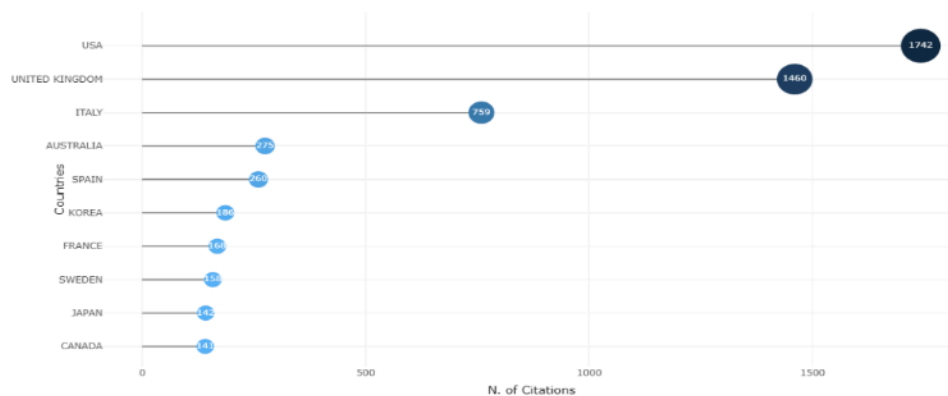
**Table 4. Most Relevant Affiliations**

Affiliation	Articles
Addis Ababa University	8
School of Management and Economics	8
Münster University of Applied Sciences	7
University of Engineering and Technology	7
Seoul National University	6
Tsinghua University	6
Hefei University of Technology	5
Polytechnic School of University of São Paulo	5
Universiti Teknologi Mara	5
University of Campinas	5

Fig. 4 lists the most productive countries in terms of corresponding authors. In this regard the USA is the leading country having more than 20 corresponding authors. The figure also reveals that most of authors belongs to the developed world i.e., USA, China, Japan, Australia, UK, Germany, and Canada. MCP refers to multiple country publications, while SCP refers to the single country publications ratio. Similarly, in Fig. 5, the most cited countries predominately belong to the developed world. Table 5 list down the globally most cited documents. The top of the list is article titled “University–industry linkages in the UK: What are the factors underlying the variety of interactions with industry?” by D’Este and Patel. This article has 861 times and its followed by the seminal work of Henry Etzkowitz and Chunyan Zhou on Triple Helix, which has 724 citations. The Triple Helix paradigm provides a theoretical foundation to University- Industry Linkages research.



**Fig. 4. Corresponding Author's Country**

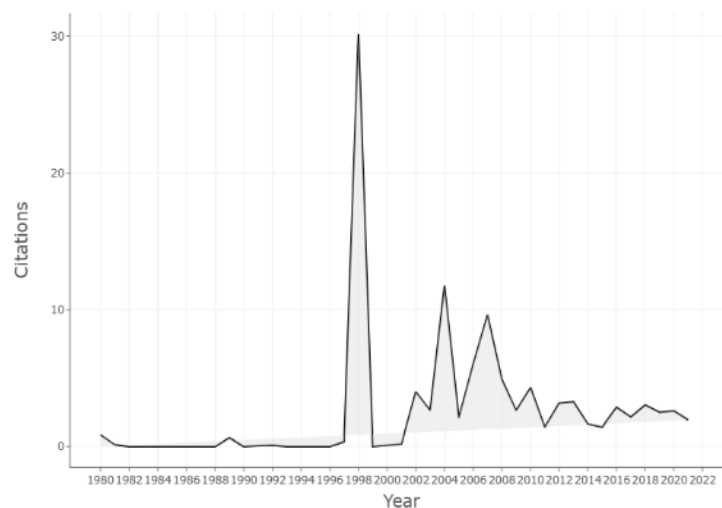


**Fig. 5. Mostly Cited Country**

**Table 5. Most Global Cited Documents**

Paper	DOI	Total Citations	TC per Year	Normalized TC
D'ESTE P, 2007, RES POLICY	10.1016/j.respol.2007.05.002	861	53.810	5.970
ETZKOWITZ H, 1998, RES POLICY	10.1016/S0048-7333(98)00093-6	724	28.960	1.000
BALCONI M, 2004, RES POLICY	10.1016/S0048-7333(03)00108-2	347	18.260	1.640
WRIGHT M, 2008, RES POLICY	10.1016/j.respol.2008.04.021	308	20.530	4.490
ETZKOWITZ H, 2002, SCI PUBLIC POLICY	10.3152/147154302781781056	215	10.240	2.690
EOM B-Y, 2010, RES POLICY	10.1016/j.respol.2010.01.015	160	12.310	3.100
GIULIANI E, 2009, RES POLICY	10.1016/j.respol.2009.02.006	148	10.570	4.330
YUSUF S, 2008, RES POLICY	10.1016/j.respol.2008.04.011	146	9.730	2.130
OLDS K, 2007, WORLD DEV	10.1016/j.worlddev.2006.05.014	144	9.000	1.000
LÖÖF H, 2008, J TECHNOL TRANSF	10.1007/s10961-006-9001-3	138	9.200	2.010

Fig. 6 illustrates the average citation per year, which is an indication of academic activity in a knowledge domain. The citation peaked during the years 1996 to 2000. It was the time when a new policy related discussion related to higher education was emerged, which emphasized that universities should link their research with industry to do applied and socially relevant research.

**Fig. 6. Average Citation Per Year**

### 4.3. SCIENCE FINDINGS:

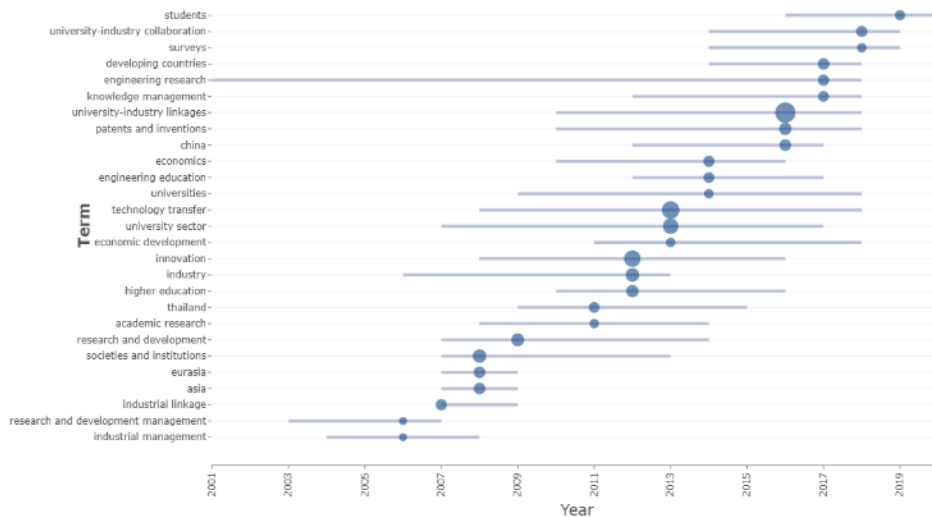
Fig. 7 presents the output of a three-field plot feature of bibliometric analysis. This shows the relationship among the topics researched, authors, and keywords. It was developed to describe the popular research topics and keywords and corresponding authors. As University-Industry Linkages is a diverse field; having multiple facets, the three-field plot gives us an insight to popular topics and their authors. In Fig. 8, the TreeMap highlights the combination of possible keywords, representing University-Industry Linkages. Similarly, Fig. 9 points out that words; university-industry linkages and technology transfer, have high occurrence in recent years.



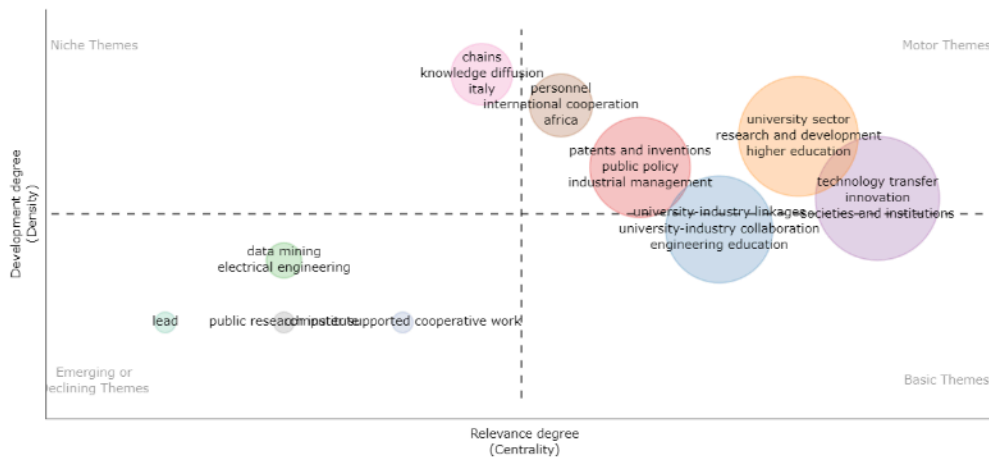
Fig. 10 bolsters trend topics, it can be witnessed that, university-industry linkages in context of student, survey studies, and studies developing countries are trending in current years. Likewise Fig. 11, shows thematic map, which has centrality (x-axis) and density (y-axis). Various themes emerge in all four quadrants of the thematic map. For instance, knowledge diffusion is a Niche theme, university-industry linkages and development is a motor theme, electrical engineering is a declining/emerging theme, and university-industry linkages in engineering education is basic theme.

**5. CONCLUSION- BIBLIOMETRIC ANALYSIS:**

Bibliometric analysis has given us insights about annual publication and citation, most productive and cited authors, institutions, and journals, trending topics, a thematic map, word cloud, co-citation, co-authorship, and co-occurrence analysis. Hence, it marked the boundaries of University-Industry Linkages field of research and given the reader a bird eye view. The information extracted from bibliometric analysis was further used in systematic literature view (Section -6) to reach definite conclusions about future research agenda.



**Fig. 10. Trend Topics**



**Fig. 11. Thematic Map**

## 6. SYSTEMATIC LITERATURE REVIEW (SLR):

Table 6. SLR of UILs Studies

Author(s) and Year	Nature of Study	Type of Paper	Variables (IV, DV, Med., Mod.)	Methodology	Country	Main Findings
Filippetti and Savona (2017)	Descriptive	Position paper	-	Literature review/survey	-	Coined an 'enlarged concept of academic engagements' by adding new dimension. Also highlighted the role of 'individual characteristics and firms' barriers in academic engagement.
Ishengoma and Vaaland (2016)	Explanatory	Empirical paper	UILs (IV), Perceived employability (DV)	Closed ended questionnaire, 404 respondents, who are students, faculty members and employees,	Tanzania	UIL activities were widely regarded as significantly enhancing student employability.
Vaaland and Ishengoma (2016)	Explanatory	Empirical paper	UILs (IV), Innovation (DV)	Structured interview, 404 respondents, who are students, faculty members and employees,	Tanzania	There is significant difference among three groups' perception about role of three forms of UILs activities in bringing innovation.
Zavale and Macamo (2016)	Descriptive	Empirical paper	-	Descriptive statistics were used to describe features and stage of UILs in Mozambique	Mozambique	In Mozambique, UILs are weak and largely informal, with academics primarily engaging with companies through the DUI-innovation model and the exchange of embodied knowledge, such as ideas shared in informal meetings, internships or employment opportunities for students, and consultancies for academics. This contrasts with the exchange of disembodied knowledge, like patents and technology prototypes, which are embedded in the R&D and STI-innovation model.
Kleibert (2015)	Descriptive	Empirical paper	-	40 qualitative in-depth interviews with foreign	Philippine	The interview results reveal that most collaboration is initiated

Author(s) and Year	Nature of Study	Type of Paper	Variables (IV, DV, Med., Mod.)	Methodology	Country	Main Findings
				investors and higher education institutions.		by large call-centre companies and focuses on entry-level skills development for their operations.
Garcia, Araujo, Mascarini, Santos and Costa (2015)	Explanatory	Empirical paper	Geographic distance (IV) UIIs (DV)	Secondary data from Directory of Research Groups	Brazil	Proximity has positive relation with UIIs. UIIs at long geographic distance will only be established, if firms are large and research group(s) are prominent.
Sutthijakra and Intarakumnerd (2015)	Descriptive	Position paper	-	20 semi-structure, in-depth interviews of intermediaries' management, university researchers and industrial companies.	Thailand	a) Intermediaries play consulting, brokering, mediating and resources providing roles in UIIs. b) They help to enhance interactions between universities and industry, convert informal relationships into formal ones, and cultivate potential human resources. c) They can do above if they have following capabilities: network, coordination, knowledge-building and management
Hemmert, Bstieler and Okamuro (2014)	Explanatory	Empirical paper	Tie strength, Partner reputation, and Contractual safeguards (IV), Trust (DV), Champion behavior (Med.)	1) Seven-point Likert scales were used to gather data from 78 respondents (students, teachers and employees) 2) Bivariate correlations, means and standard deviations of variables, regression analysis,	US, Japan, and South Korea	All independent variables significantly effect dependent variable and champion behaviour mediates the IV-DV relationship
Laguador and Ramos (2014)	Descriptive	Empirical paper	-	A closed ended questionnaire was used to collect data	Philippines	The finding reveals that employers want to see in their prospective employee not only

Author(s) and Year	Nature of Study	Type of Paper	Variables (IV, DV, Med., Mod.)	Methodology	Country	Main Findings
				from 14 employers about the desired graduate skills in terms of cognitive, affective and psychomotor domain.		occupational competence but also positive attitude and personality
Herstad, Aslesen and Ebersberger (2014)	Explanatory	Empirical paper	Knowledge bases, Cumulative ness, Appropriability, and Opportunity (IV) International involvement, and Global configuration (DV)	Secondary data and regression analysis	Norway	All independent variables significantly effect dependent variables
Perkmann et al. (2013)	Descriptive	Review Paper	-	Initially identified 436 research papers and later reviewed 36 securitized relevant papers published between 1980 to 2011.	-	Difference between academic engagement and commercialization. Identification of individual, organizational and institutional factors affecting academic engagement.
Ankrah et al., (2013)	Descriptive	Empirical Paper	-	Exploratory qualitative in-depth case study. Five Faraday Partnerships were used as cases. Multiple data sources (interviews, archival data from the Partnerships and Internet)	United Kingdom	The results show that the motives of (and outcomes for) university and industry actors correspond despite their differing work environments

Author(s) and Year	Nature of Study	Type of Paper	Variables (IV, DV, Med., Mod.)	Methodology	Country	Main Findings
Lind, Styhre, and Aaboen (2013)	Exploratory	Position Paper	-	An explorative study of three research centres at a technical university in Sweden, using in-depth interviews	Sweden	It suggests four types of university-industry collaborations: distanced, translational, specified and developed collaboration.
Grimpe and Hussinger (2013)	Descriptive	Empirical Paper	-	Secondary data of 20 German manufacturing obtained from Mannheim Innovation Panel (MIP), was used for statistical analysis	Germany	The results indicate a complementary relationship between formal and informal knowledge and technology transfer modes.
Freitas, Geunac, and Rossie (2013a)	Explanatory	Empirical Paper	Size, Absorptive Capacity, Technology Openness, Export, Multinational, Outsourcing (IV) Governance (DV)	Multinomial logit estimation econometric model was used to test the relationships	Italy	The econometric estimates indicate that small firms engaged in technology and open innovation strategies tend to rely more on personal contractual interactions, whereas large firms that vertically integrate R&D activities primarily use institutional interactions.
Hong and Sung Su (2013)	Explanatory	Empirical Paper	Geographic distance and organizational proximity, institutional proximity, social proximity and university prestige. (IV) UILs (DV)	Multiple secondary data sources were used to test the hypothesized relationship	China	The results show that geographic distance is indeed an obstructive factor in achieving university. This negative effect can be minimized by other dimensions of proximity. The most notable finding is that central ministries and local governments serve as two key sources of institutional pressure or encouragement for university-industry collaborations, regardless of geographic distance.
Plewa et al. (2013)	Descriptive	Position paper	-	Qualitative. Thirty in-depth interviews of managers	Australia, Germany and Netherlands	Proposes an evolutionary framework for university-industry linkages, identifying communication,



Author(s) and Year	Nature of Study	Type of Paper	Variables (IV, DV, Med., Mod.)	Methodology	Country	Main Findings
Guan and Zhao (2013)	Explanatory	Empirical Paper	Clustering and reach (IV) Patent value (DV)	Quantitative. Secondary data using weighted patent value (WPV) as a proxy index of the invention's innovation performance	China	understanding, trust, and people as the fundamental drivers of UILs. This paper demonstrates that members participating in alliance networks characterized by both high clustering and extensive reach are likely to exhibit greater work productivity and value (WPV) in knowledge creation compared to members in networks lacking these features.
Casper (2013)	Explanatory	Empirical Paper	Social networking of inventors (IV) Commercialization (DV)	Secondary data from 1980 to 2005 about biotechnology related US Patents was used.	USA	The study reveals that the organization of social ties within regional economies can impact university commercialization.
Mihyo (2013)	Descriptive	Position paper	-	Through literature, the problems in UILs in Africa was highlighted and recommendation were made.	Southern Africa	It highlights the barriers in UILs in Southern Africa and recommends the policy measures to overcome these.
Freitas, Marquesc and de Paula e Silva (2013b)	Explanatory	Empirical Paper	University-Industry Collaboration (IV) Innovation (DV)	Semi structured face to face interview from 24 research groups	Brazil	In emerging industries, the role of UILs on innovation is low as compared to mature industries.
Teixeira and Mota (2012)	Descriptive	Review paper	-	Bibliometric techniques	-	1) Topics such as 'Academic Spin-offs,' 'Scientific and Technological Policies,' and 'Knowledge Transfer Channels' are in decline. 2) 'Characteristics of Universities, Firms, and Scientists,' along with 'Regional Spillovers,' are experiencing significant growth, while 'Measures and Indicators' is emerging as a prominent topic.

Author(s) and Year	Nature of Study	Type of Paper	Variables (IV, DV, Med., Mod.)	Methodology	Country	Main Findings
						3) There is a clear shift toward 'empirical' research. 4) The intellectual foundations of the U-I literature are distinctly multidisciplinary. 5) The influence of the U-I literature is predominantly focused on the industrialized world and is most impactful within the research area of innovation and technology.
Ramos-Vielba and Fernández-Esquinas (2012)	Descriptive	Position Paper	-	Face to face survey with 765 head of research teams	-	In most universities, the focus of their collaborative efforts is more on tacit knowledge than on intellectual property rights.
Frasquet, Calderón, and Cervera (2012)	Explanatory	Empirical Paper	Communication (IV) University Industry Collaboration (DV) Trust, Satisfaction, Functional Conflict and Commitment (Med.)	In depth interviews and structured questionnaire were used to collect data from 322 managers of companies who are dealing with internships.	Spain	Communication is a fundamental element in relationships, positively influencing relationship satisfaction, trust, and the constructive handling of conflicts. Moreover, trust and commitment enhance the level of collaboration between firms and universities.
Muscio, Quaglione, and Scarpinato, (2012).	Explanatory	Empirical Paper	Proximity to Industrial District (ID) (IV) University Industry Collaboration (private university funding) (DV)	Secondary data was used to test the hypothesis	China	The results indicate that proximity to districts (ID) fosters the formation of collaboration agreements.
Hamdan, Yusof, Omar, Abdullah, Nasrudin, and Abullah (2011)	Explanatory	Empirical paper	UILs of University Technology MARA (IV) Regional economic development (DV)	Questionnaire measuring University Technology MARA UILs framework were circulated on Klang Valley	Malaysia	There is positive relationship between UILs and economic growth.

Author(s) and Year	Nature of Study	Type of Paper	Variables (IV, DV, Med., Mod.)	Methodology	Country	Main Findings
				region. 83 responses received. Descriptive starts were used to analyze the data.		

## 7. FUTURE RESEARCH AGENDA:

The bibliometric analysis and systematic literature review presented in Table 6 reveal several key trends:

First, there is a noticeable increase in empirical studies, reflecting growing interest among researchers in evaluating university-industry linkages (UILs) in terms of their frequency, intensity, and efficiency. Recent studies have primarily been descriptive and exploratory, focusing on the nature, type, and characteristics of UILs. This study, however, aims to measure the efficiency of UILs by assessing their impact on graduate employability. Second, the UILs literature predominantly reflects studies from industrialized nations, where universities have strong research and development infrastructures, skilled personnel, and financial resources. Although there is a rising interest in UILs in developing countries, as evidenced by increasing studies from the African region, there remains a gap in research focusing on the impact of UILs on the employability of graduates in countries like Pakistan. Third, UILs research is largely concentrated in the fields of science, innovation, and technology, with limited investigations from the humanities disciplines.

Fourth, topics such as 'academic spin-offs,' 'scientific and technological policies,' and 'knowledge transfer channels' are seeing reduced interest from researchers. Fifth, there is growing attention on exploring the 'characteristics of universities, firms, and scientists,' as well as 'regional spillovers.' The development of 'measures and indicators' for UILs is emerging as a significant topic, crucial for understanding causation. This study employs a quantitative approach, using primary data from closed-ended questionnaires to examine the proposed causal relationships. Sixth, explanatory studies focus on cause-and-effect relationships. Among the 15 explanatory studies reviewed, dependent variables such as innovation, trust, international involvement, global configuration, governance, patent value, quality of research, commercialization, and economic growth were explored. However, none specifically addressed the impact of UILs on perceived graduate employability, except for one study by Ishengoma and Vaaland (2016), which did not focus exclusively on this aspect. Independent variables examined include geographic distance, organizational proximity, institutional proximity, social proximity, university prestige, and communication. Seventh, research into the benefits and motivations for UILs is diminishing, as their significance is already well recognized. Similarly, barriers to UILs are well understood, making further exploration less attractive.

Lastly, most studies on UILs rely on theories such as the Triple Helix, Mode 2 knowledge production, and National Systems of Innovation, which provide a macro-level understanding of the phenomenon, including national and institutional outcomes like economic growth and international involvement. However, there is limited focus on the impact of UILs at the individual level, particularly on graduates. Future research should address these gaps to further enrich the current understanding of university-industry linkages.

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