M_4_2: University-Business Collaboration: An Overview and Some Experiences

Responsible Partner: P8
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Learning Objectives

- **Objective 1:** Learners are provided with the cconceptual discussion of university -business collaboration

- **Objective 2:** Learners are provided with empirical findings of examination of the links between university-industry collaboration (UIC) predictors (inputs) and the results of UIC cooperation (outputs).

- **Objective 3:** Analyzing Examples of university-business collaborations related to Iran and selected foreign countries.

- **Objective 4:** Motivating the academic staff to acquire key competences and skills in order to learn business plan preparation, commercialization, entrepreneurship, etc.

Content of the Topic:

The main content of the topic (4-6 themes):

- The course will involve the assessment of theoretical analysis on effects of main determinants on university-business collaboration.
- The course introduces key skills of business plans/policies for inclusion of pedagogical approaches in university curricula (some evidence).
- The course applies empirical method such as the partial least squares structural equation modelling (PLS-SEM), to explore the links between variables (To be done during the course).

Several Examples in Practice:

- Successful Collaboration between universities and Industries worldwide,
- Collaborations between international universities and Songdo International Business District (Songdo IBD),
- ECO Science Foundation (ECOSF) as a Catalyst for Science and Technology for Sustainable Development in the ECO (Economic Cooperation Organization) Region,
- Close Cooperation between Isfahan Universities and Isfahan Chamber of Commerce
- Isfahan Science and Technology Town and its collaboration with business (start-ups/accelerators/knowledge-based economic firms),
- A joint training program between University of Isfahan, Technical University of Munich and Mobarekeh Isfahan Steel Complex.

Theoretical Discussion on University -Business Relations: Importance of cooperation

- **Scientific relations** are growing as a percentage of all scientific activities.
- **Researchers** from most countries are taking part in cooperation and benefiting from this activity.
- UBRs take a number of forms:
  - **Sharing research data,**
  - **Joint experimentation,**
  - **Conferences and other meetings,**
  - **Building of databases, standards-setting,**
  - **Equipment sharing**

Theoretical Discussion on University -Business Collaboration

- Universities are playing a critical actor in innovation systems of both developed and developing countries.
- In the context of developing countries, universities can play an important role as an indigenous knowledge source.
- Fruitful university-industry linkages (UILs) help local firms to import, modify, and diffuse technology.
- Universities can improve their academic capabilities if they interact with the private sector.

What does university–industry linkages (UILs) mean?

- Studies and government reports have emphasized the importance of developing links between universities and industry. Although the purposes of such collaborations may be similar across higher education, the forms, extent, challenges, and risks are context specific.

- University–industry partnerships is defined as: '**Trusting, committed and interactive relationships between university and industry entities enabling the diffusion of creativity, ideas, skills and people with the aim of creating mutual value over time**' (Plewa and Quester, 2008) .

UILs have a number of key benefits and advantages:

UILs leading to:

- Development of new study programs (Forsyth et al., 2009; Plewa et al., 2015).
- Increase research productivity and enhanced opportunities for faculty and students to participate in research (Laursen et al., 2011; Turk-Bicakci and Brint, 2005).
- Advances in innovation and technology.
- Establish new funding streams for universities and enhancing student employability (Thune, 2011; Bernarte, 2014).
- Politically benefit institutions ‘such as the enhancement of reputation or institutional prestige and responsiveness to government initiatives’ (Prigge, 2005).

UILs leading to:

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- Improve the quality and relevance of higher education.
- Enhance students' future employability.
- Improve the quality and relevance of the education provided.
- Career fairs, career advisement activities, apprenticeships, internships, recruitment programs, and investment or equipment loans.
- Faculty consultancies, employers serving on university advisory boards, and lifelong learning activities. (Brandt et al., 2009).

Benefits of UILs

- Most importantly, UILs help faculty gain access to:
- Scarce research resources, creating new opportunities for faculty research,
- Greater research productivity, and
- Increased academic publications (Harman, 2010).

More Benefits of University -business collaboration .....Continue

- Research collaborations may involve joint research projects, the provision of funding by industry for specific university research
- The establishment of research parks and the leveraging of the research capacity of universities and industry
- A wider range of UILs' activities also include:

  developing new educational programs,

  mentoring,

  supervising students and

  skills and competency development.

Challenges on University -Business Collaboration

- There are indeed practical difficulties, cultural differences between universities and industry, disputes over intellectual property rights, and conflicts of interest.
- There should be absence of incentives to encourage faculty participation in partnership initiatives (Siegel et al., 2003; Karlsson et al., 2007).
- In some universities, lack of expertise or skill in establishing and maintaining contacts with industries can hinder the development of collaborations (Basit et al., 2015).
- Scholars may face differing organizational cultures and environments, universities' unrealistic expectations, and HEI bureaucracy (Siegel et al., 2003).

Challenges of University -business collaboration
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- Other challenges to UILs involve conflicts of interest over research priorities; allocation of personnel, financial, and material resources; and communication and secrecy.
- Prigge (2005) argues that UIL risks for HEIs include a shift from basic research to applied research and product development, compromises in academic integrity, constraints on the open and timely dissemination of research results, narrowing of research topics, pre-empting research and teaching preparation time, and encouraging the migration of faculty to partner organizations.
- Industry-funded research can result in conflicts between UIL researchers as well as tensions between university departments (Harman, 1999).

Examples in Practice

Successful Collaboration Between Universities and Industries

International Experiences:

- From 1995 to 2000, M.I.T. obtained over 100 patents per year.
- In 1999, 20 % of M.I.T. research was funded by industry.
- In collaboration with industries, different licenses of patents were awarded to the universities: *the Cohen-Boyer patent on recombinant DNA (Stanford University, University of California San Francisco), the Axel patent on gene expression (Columbia University), the patents on Warfarin and vitamin D (University of Wisconsin), the patent on the cis-platinum antitumor agent (Michigan State University), the Hemophilus vaccine patent (University of Rochester) and the Taxol synthesis patent (Florida State University).*

Successful Collaboration Between universities and Industries Continue….

Start-up Companies

- University licensing has led to the establishment of an impressive number of new companies.
- M.I.T. currently is setting up commercial licensing agreements at a rate of 80–100 per year with a total of about 600 active licenses. Of the new licenses granted by M.I.T each year, over 20 are new companies formed to develop the MIT-derived technology.
- Since 1987, more than 200 new companies have been founded. They are most successful when the inventors actively participate in the company, e.g. the professor acting on the Scientific Advisory Board; the students becoming employees and/or executives of the new company. In many cases, the new company with core technology will license its early products to various other companies with larger financial holdings (Demain, 2001).

Sampling of MIT's Start-up Companies

Company	Field
Acusphere	Contrast Imaging Agents
Akamai	Internet Server Technology
Alkermes	Drug Delivery
America Superconductor	Superconductors
Arris Pharmaceutical	Biotechnology (Rational Drug Design)
Cambridge Heart	Heart Monitoring
Curl	Web Language Software
EXA Software	Parallel Computing
Integrating Computing Engines	Supercomputers
Interneuron	Pharmaceutical (Neuroactive)
Kinematix	Physical Rehabilitation
Lab Connections	Chemical Laboratory Equipment
Matritech	Cancer Diagnostics
Metabolix	Biodegradable Polymers
Micrion	Equipment for Semiconductor Chip Repair
Neurometrix	Neural Diagnostics
Pharmaceutical Peptides	Pharmaceuticals
R.S.A. (merged with Security Dynamics)	Computer Security
Reprogenesis	Tissue Repair
Soligen	Machine Tools & Molds (3D Printing)
Somatix (Merged with Genzyme)	Biotechnology (Gene Therapy)
Sontra	Ultrasound-Based Drug Delivery
Therics	Drug Delivery-3D Printing

The International Food Safety Training Laboratory: A Partnership that Improves the Safety of Food Globally September 2011 – Present

- The International Food Safety Training Laboratory (IFSTL) is a partnership between the **University of Maryland and the Waters Corporation**.
- Signed in 2010, this alliance led to the creation of a training facility dedicated to analytical methods for food safety in microbiology and chemistry where subject matter experts from the U.S. FDA, USDA, EPA and academics from the University collaboratively deliver hands-on training (UIDP, 2014).
- This resource has benefited food laboratory professionals from many countries in its 18 months of operation and contributed significantly to the FDA's international capacity building plan aiming at strengthening laboratory capacity domestically and internationally to improve food safety globally. U.S. consumers have benefited since much of the food consumed in the U.S. is now imported and improving food safety in other countries benefits U.S. market.

The International Food Safety Training Laboratory: A Partnership that Improves the Safety of Food Globally September 2011 – Present

Continue …

Outcomes:

- Almost two years following opening, the IFSTL has made great achievements directly aligned to its mission. We have trained professionals from Guatemala, Peru, Mexico, the Dominican Republic, Honduras, Chile, Pakistan, China, Philippines, Indonesia, Malaysia and the United-States.
- Students from the University have been hired as teaching assistants, and a graduate student was hired as a full-time instructor.
- Feedback from the trainees indicates that the Laboratory contributes to improving laboratory capacity in food safety and also a better understanding of the regulatory framework in the United States, which helps develop food safety systems abroad.

Caltech Boeing Strategic Agreement 2004 – Present

- Caltech is a world-renowned educational institution with a long history of fulfilling the needs of industries, governments and academia. Boeing is the world's leading aerospace company, providing products and services to over 150 countries (UIDP, 2014).
- In order to focus basic scientific research, Boeing has signed overarching, long-term research agreements with nine of the world's top research universities in specific critical technology areas.
- For Caltech, this is "systems integration" technology. Caltech provides world class leading edge research, technology and graduates, enabling the basis for advanced innovation leadership and allowing Boeing to benefit from a long-term relationship, access to the university research, as well as top students.

SONGDO INTERNATIONAL BUSINESS DISTRICT (SIBD) IN INCHEON, SOUTH KOREA: A MODERN RELATIONSHIP BETWEEN UNIVERSITIES AND BUSINESS

A master-planned development within a free economic zone in Incheon, 40 miles (64 kilometers) outside Seoul.

- WSP-SIBD education sector experts have provided engineering and advisory services to hundreds of universities and colleges.
- WSP-SIBD delivers on all aspects of campus life: from parking garages, parks and landscapes, to specialized research laboratories and library facilities, to the student accommodation, lecture, and dining halls.
- WSP-SIBD services for post-secondary institutions include, structural engineering, buildings services engineering, lighting design, acoustics, sustainability consulting, and project management.
- Projects like the University of British Columbia's Library in Vancouver, the new campuses for Goethe University in Frankfurt, the Guildhall School of Music and Drama in London and the Manhattanville campus of Columbia University in New York demonstrate our ability to deliver expertise across the globe.

ECOSF Pursues the goal of promoting research and technological development for sustainable development and economic growth in the ECO Region through following key areas:

ECOSF
ECO SCIENCE FOUNDATION

ECOSF as a Catalyst for Science and Technology for Sustainable Development in the ECO Region

Development of Human Resource Capacity for Science, Technology and Innovation and Science Education in the ECO Region

Strengthening Institutional Capacity in Scientific Research and Technological development among its Members

Scientific, Technological Research Collaboration among the Memebr States

Exchange (Dissemination) of Infromation on S&T Research and Development through Workshops, Conference & Meetings

Augment Human Resource Capacity Science, Technology and Innovation (STI) Sectors

Program	Key Milestones	Impact
Inquiry Based STEM Education	Trained over 1,000 Science Teachers in the ECO region – around 650 of Pakistani Teachers, 200 in Iran & 150 in other ECO Countries.	Enhanced interests in science subjects and learning outcomes – over 200 K students benefited
Capacity Building Program ECOSF Priority Areas – Climate Change, Energy, Water, Health and Food Security	Organized over 200 conferences, workshops and training programs. Provided training opportunities to over 2,000 S&T workforces in the ECO Region. Around 1470 of Pakistani workforce	Strengthened S&T workforce and enhanced capacity to address and contribute to the critical and emerging challenges of the ECO region.
Engineering Qualification Standardization, Accreditation and Professional System **(EQSAPS)**	Improved and developed Standards of Engineering Qualifications in the Central Asian states with help of UNESCO and Pakistan Engineering Council (PEC) in conformity with FEIAP and WA guidelines	Rallied mobility of Engineers of the Central Asian States with other ECO Member Countries.
Belt & Road **Science Education Program**	Enabled participation of the Students of the ECO region in Belt and Road (B&R) Teenager Maker Camps | CASTIC | Developed Science Curriculum based on Fusion of Civilizations	Expanded exchange, network and value-added capacity of young student in core scientific areas: AI, Machine Learning, Climate Change, & Food Security
BTBU-ECOSF Joint Training Center on Science, Technology and Innovation	Developed cross-industry and trans-disciplinary international training program to build essential human resource capital relating to infrastructural development among participating countries.	Trained Workforce in Critical Areas of Infrastructure Development, Special Economic Zones, Low Carbon Development and Electric Mobility

Innovation Center of Esfahan Chamber of Commerce, Industries, Mines and Agriculture (ECCIMA) and University

Innovation Center of Esfahan Chamber of Commerce, Industries, Mines and Agriculture (ECCIMA) and University

Innovation Center of ECCIMA & University has been established in order to:

- Run the knowledge transfer in economic enterprises,
- Identify and diagnose the existing problems in industry, and to
- Solve the problems using the academic and scientific potentials of the universities in Isfahan.

ECCIMA and University

- Establishment and development of research and development (R&D) offices of economic enterprises in universities,
- Using the experiences of industry owners in universities and demand-driven academic activities and research,
- Compiling the educational content required by industry in the university are the main goals of this center.

Products of Innovation Center of ECCIMA & University

1

(POUYESH)Scan

Talent identification of students in a combining work and study process

2

(PAYESH)Monitoring

Research consulting, problem solving and technology transfer

3

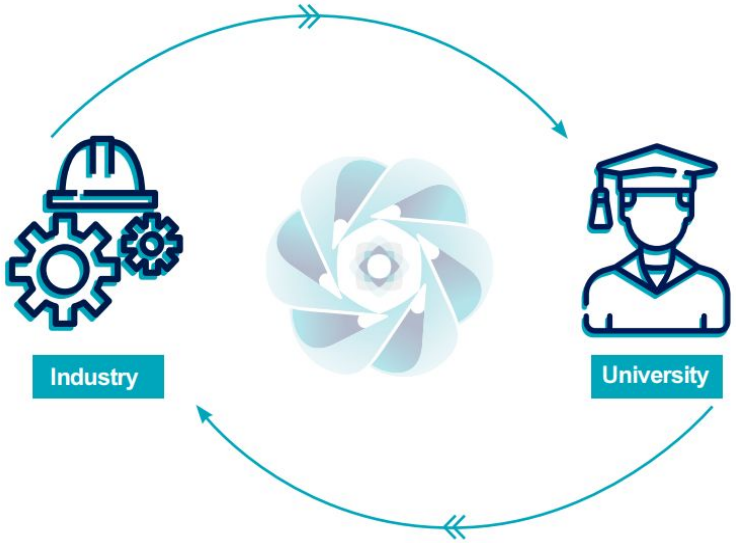
(ROUYESH)Rise

Solve industrial challenges through startup projects

4

(TABESH)Radiation

Exchange and utilization of laboratory facilities through a network



POUYESH (Scan)

Talent identification of students in a combining work and study process

– Easy and free evaluation and interview of job applicants

– Specialized training of the work force required by the economic enterprise along with the education

– Benefit from skill–based training courses for trainees with 80 ٪ discount

PAYESH (Monitoring)

Research consulting, problem solving and technology transfer

– Providing free thematic consultations

– Design a process or product

– Reviewing and modifying organizational or productive structures or eliminating possible defects in equipment

– Production of products

– Participation in technology transfer and utilization of work force and equipment

ROUYESH (Rise)

Identification of investment opportunities and industry participation in knowledge–based and startup projects

Meeting the technological needs of industries and economic enterprises that are the member of ECCIMA through:

– Incubators and accelerators in specialized areas and access to commercialization programs and etc.

– Support for startups

TABESH (Radiation

Exchange and utilization of laboratory facilities through a network

Reduction of the costs related to the equipment and laboratories as well as the optimal use of the facilities through:

– Sharing the official, educational, and production space.

– Sharing and networking equipment, laboratories and work–shops of universities

Specialized Departments of Innovation Center of ECCIMA & University

Isfahan Science and Technology Town (ISTT) and its Collaboration with Business

- ISTT is home of the UNESCO Center for Technology Incubator and Science Park Development (IRIS).
- ISTT has become a pioneering model for the management of technology incubators and science parks across the country.
- ISTT is an environment in which research centers, manufacturing and service companies, and R&D centers of governmental organizations have conglomerated into a vast technology town.

ISFAHAN
SCIENCE & TECHNOLOGY TOWN
(ISTT)

Isfahan Science and Technology Town (ISTT) and its Collaboration with Business

- ISTT provides an environment for commercializing technology and attracting domestic and foreign investment.
- **The ISTT activities include:**

- Organizing research and development facilities,

- Guidance to the scientific community on strategic research areas,

- Planning and creating the e field for the application and commercialization of research results, and

- Creating scientific and research space to attract scholars and specialists both at home and abroad.

ISFAHAN
SCIENCE & TECHNOLOGY TOWN
(ISTT)

A Joint Training Program on Industrial Digitalization (Industrial Revolution 4)

- Collaboration between University of Isfahan, International Universities and Mobarkeh Isfahan Steel Complex (MISC),
- MISC is the largest steel maker of MENA region, and one of the largest industrial complexes operating in Iran.

- International University partners:

Technical University of München, Germany

University of Freiburg, Germany

Zurich University of Applied Sciences

München University of Applied Sciences

University of Isfahan

مجتمع فولاد مبارکه

A Joint Training Program on Industrial Digitalization (Industrial Revolution 4)

Objectives of the Program:

-Leadership promotion at different organizational levels to understand the principles and concepts of digital evolution,

- Acquiring the required managerial and technical skills to define the system requirements for the implementation of digital transformation technologies,

- Preparation to participate in the implementation of digital transformation technologies,

- Creating digital values in business environment by participants,

- … .

Empirical Evidence

Effects of S&T Indicators on Bilateral Trade Relations

✔***Framework***: *A Trade Gravity,* $T_{ij} = f(Y_i, Y_j, N_i, N_j, DIS_{ij}, S\&T_l)$

✔**Time Period**: 1995 – 2020

✔**Cross Sections**: 20 Exporting Goods Groups,

✔**Estimation Method**: Panel GLS

Panel Regression Model of Bilateral Trade Model (Iran-Vietnam):

$$LT_{ijt} = \beta_0 + \beta_1 LGDP_{it} * LGDP_{jt} + \beta_2 LEX_{it} + \beta_3 LEX_{jt} + \beta_4 DIS_{ijt} + \beta_5 S\&T_{lit} + \beta_6 \beta_5 S\&T_{ljt} + U_{ijt}$$

where LT_{ijt} denotes log of exports from country *i* to country *j* at time *t*. $LGDP_{it} * LGDP_{jt}$ is the product of the (log of) GDPs per capita (GDPit p. cap.×GDPjt p. cap.) of country *i* and country *j* in time *t*. LEX_{it} and LEX_{jt} denote respectively the exchange rates of county i and country j at time *t*. In addition, DIS_{ij} indicates the distance between two countries. $S\&T_{lit}$ *and* $S\&T_{ljt}$ show the S&T proxy for country i and j, respectively.

S&T Indicators as Trade Determinants?

Case 1: Research and development expenditure (% of GDP)

Case 2: Researchers in R&D (per million people)

Case 3: Scientific and technical journal articles

Case 4: Patent applications, residents

Case 5: Technicians in R&D (per million people)

Estimated Results for Iran-Vietnam Bilateral Trade (1995-2019)

Variable	Case 1	Case 2	Case 3	Case 4	Case 5
Cons.	7.89 [0.054]	2.567 [0.468]	.221 [0.977]	28.85 [0.000]	7.94 [0.228]
$LGDP_{it}*LGDP_{jt}$	.19 [0.006]	.0992 [0.133]	-.176 [0.014]	-.0059 [0.924]	.24 [0.009]
LEX_{it}	1.53 [0.028]	4.677 [0.000]	5.44 [0.001]	-1.343 [0.05]	-.965 [0.775]
LEX_{jt}	-.56 [0.000]	1.76 [0.000]	-1.369 [0.000]	-.842 [0.000]	2.64 [0.414]
DIS_{ijt}	-.00092 [0.000]	-.001 [0.000]	-.0006 [0.006]	-.001 [0.000]	-.00175 [0.000]
$S\&T_{1it}$	.688 [0.000]	-	-	-	-
$S\&T_{1jt}$	1.36 [0.000]	-	-	-	-
$S\&T_{2it}$	-	.0003 [0.013]	-	-	-
$S\&T_{2jt}$	-	.00023 [0.069]	-	-	-
$S\&T_{3it}$	-	-	.00001 [000]	-	-
$S\&T_{3jt}$	-	-	4.87e-06 [0.329]	-	-
$S\&T_{4it}$	-	-	-	6.73e-06 [0.019]	-
$S\&T_{4jt}$	-	-	-	.000019 [0.071]	-
$S\&T_{5it}$	-	-	-	-	5.56e-06 [0.000]
$S\&T_{5jt}$	-	-	-	-	.00096 [0.000]
Diagnostic Tests	Waldchi2=2910.66 LRchi2=43.97	Waldchi2=3240.34 LRchi2=16.08	Wald chi2=2405.42 LRchi2=46.17	Wald chi2=2770.20 LRchi2=42.88	Wald chi2=3168.61 LRchi2=13.21

Concluding Remark

Our findings have confirmed the importance of **science** and **technology** in the Iran and Vietnam cooperation to improve the connectivity of economic relations among them.

Iran has opportunities and potentials to improve its economic capacities through implementing S&T cooperation.

Thank you for your attention