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ULBS

Universitatea "Lucian Blaga" din Sibiu

Recommendations on University-Enterprise Cooperation

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1. Main aspects of University – Business Cooperation inside PEESA III Project

At the 6th Topic "Development of research and innovative capacities": PEESA III contribution is to facilitate the work on the integration of:

1. student-centered educational needs,
2. student-driven flexible learning paths,
3. context-aware collaborative recommendations for engineering degree programme efficiency,
4. intelligent quality management,
5. *adaptive university-enterprise cooperation incentives enabling efficient and sustained engineering education, thereby enhancing the research and innovation capacities in the field of higher education in Southern Africa*.

Category D: 6th Topic "Knowledge triangle, innovation (reinforcing links between education, research and business)": PEESA III contribution is to ensure visits to PEESA III Programme and Partner countries' industrial partners with discussion on university – enterprise cooperation as well as regional governments.

The overall wider aim, to which the PEESA III project will contribute, is to continue to promote university capacity building in the field of engineering education within higher education in South Africa. The university capacity is built via the inhancement of both institutional as well as human (educator) capacity (as its structural elements). For this purpose, the PEESA III overall aim is broken into the following objectives:

1. To jointly develop three (3) Master Degree in engineering study programmes based on flexible learning paths (blended, distance, on-line) and *university-enterprise cooperation*.
2. Mutual recognition of the jointly developed three (3) Master Degree in engineering study programmes based on flexible learning paths (blended, distance, on-line) and *university-enterprise co-operation*.
   KPIs:
   - Agreements on mutual recognition: 6 agreements (Group 1: between VUT and HSW, FUAS,LBUS; Group 2: between CPUT and HSW, FUAS, LBUS)
   - Employability opportunities of engineering students in PEESA III South Africa's partner universities: 1pt increase on a 5-points Likert scale (+20%)
3. Self-evaluation reports for EUR-ACE Accreditation of three (3) MA programmes on Energy Efficiency developed and implemented at two (2) South African partners (CPUT and VUT) within the Edulink's PEESA project (2013-2017).
4. To promote gender equality in engineering education in South Africa.

Consequently, PEESA III will ensure a variety of opportunities for social interaction and human-computer interaction such as flexible learning paths, *meetings with regional government*, PEESA III Board meetings, *university-enterprise co-operation*, etc. The periods between PEESA III meetings will ensure the opportunities for mainly human-computer interaction. In turn, the PEESA III Project Meetings will afford the opportunities for social interaction. During PEESA III, each PEESA III partner university will hold one (1) PEESA III Project Meeting. In total nine (9) PEESA III Project Meetings will be held. Each of the PEESA III Project Meetings will include:

- *Excursions to industrial partners with discussion university – enterprise cooperation*
- *Meeting and discussion with regional government*
- Presentation of EUR-ACE standards to staff members of host institution in South Africa, (to be prepared by ASIIN) and presentation of Education in Southern Africa at European partner institutions.
- *Presentation of examples of good practice from programme institutions* (use of ICT, flexible learning path, key compenences eg. entrepreneurship, start-ups, social competence, *university – enterprise cooperation*)
- Presentation and discussion about good practice in Women in Engineering
- Discussion about topics concerning the PEESA III project
- Dissemination activities.

The methodology for the implementation of the PEESA III project will consists of three (3) phases. Each phase of the PEESA III project is carried out in 12 months or one (1) year.

Phase 1 (Month 1-12) will focus on

- Development of three (3) Master Degree in engineering study programmes (energy, electrical, mechanical, etc) based on flexible learning paths (blended, distance, on-line) and *university-enterprise co-operation*;
- Introduction of EUR-ACE standards
- Introduction of gender equality
- Dissemination Event

Phase 2 (Month 13-24) will include

- South Africa's formal accreditation process of the three (3) developed MA Degree in engineering study programmes and their harmonisation if required
- -Mutual Recognition of the three (3) developed MA Degree in engineering study programmes: six (6) Agreements of mutual recognition (Group 1: between VUT and HSW, FUAS, LBUS; Group 2: between CPUT and HSW, FUAS, LBUS)
- Introduction of the application for EUR-ACE accreditation
- Promotion of gender equality
- Dissemination Event

Phase 3 (Month 25-36) will concentrate on

- the implementation of three (3) MA Degree in engineering study programmes (energy, electrical, mechanical, etc) based on flexible learning paths (blended, distance, on-line) and university-enterprise co-operation as well as mutually recognised by the PEESA III partner universities
- The completion of the application for EUR-ACE accreditation
- Facilitation of gender equality
- Dissemination Event

The main project's expected impact is university capacity buidling in engineering education at partner universities and within higher education in Southern Africa. In the boundaries of the PEESA III project, all participating partner universities will take a step to modernise existing and create new Master Degree in engineering study programmes (energy, electrical, mechanical, etc) based on flexible learning paths (blended, distance, on-line) and university-enterprise co-operation as well as mutually recognised by the PEESA III partner universities. This would help to increase the number of qualified staff at the universities and graduated engineers and entrepreneurs, to promote local entrepreneurship in various sectors in SMEs, in view of their critical role in job creation and poverty reduction. This will raise innovation, productivity and growth, and therefore create more businesses, jobs and wealth.

The expected impact of the project would be a lasting university-enterprise cooperation, on the one hand, at participating partner universities and, on the other hand, between Europe and South Africa. That introduce innovative social partnerships in critical areas such as skills development and job creation for youths. Strong partnerships with the manufacturing sectors would reduce skills mismatches in the labor market and an inefficient tertiary education. That also boost growth and create employment opportunities in technology oriented areas.

The project intends to create a broader network of university-enterprise cooperation where interested stakeholders from universities, industry and business will be able to get and stay in contact for further developments. Joint degree study programme (as one of the intended project continuity parameters) would promote effective collaboration.

All the outputs of the project will be available for wider community as well as for all stakeholders by means of project website. Publications will promote information about the project activities for wider audience. So the investments into effective collaboration after the project end would stipulate benefits for all consortium organisation.

The project will contribute to collaboration with a wide range of stakeholders: government agencies, professional association, employers, alumni, students etc. *On the one hand, this collaboration is beneficial for capacity building in the field of higher education in improving quality of engineering education, on the other, it helps to promote the attractiveness of engineering education. Therefore after the project ends the collaboration with stakeholders will be even more developed. The stakeholders will be invited to monitor and evaluate the progress of the proposed programmes in engineering education in South Africa by providing valuable feedback on their quality and effectiveness. Stakeholders' opinion will be of a major importance in developing engineering degree study programme and monitoring its quality. Stakeholders will be invited as experts to programme quality assessment committees and they will be stimulated to add value to the programmes by providing places for field based practice, offering employment opportunities for graduates, financially supporting best students* etc.

Potential students will be reached by advertising engineering degree study programme during "open days" at universities, collaboration events at secondary schools etc. Brochures, published to advertise the engineering degree programme will be distributed to all interested parties. The contacts will be established with employers who would invest in the in-service training of employees by choosing flexible learning path in engineering degree programmes.

2. Recommendations on University-Enterprise Cooperation

Recommendations are based on the data and context obtained during enterprise visits organised within PEESA III for South Africa's partners.

Recommendations will deliver hints and tips aimed at suggesting educators means to enhance university-enterprise co-operation.

Recommendations provided will be adjusted to the specific conditions of partner universities.

The following modelling methodologies will be considered for context-aware recommendations: pattern recognition, collaborative filtering, deep learning for sequence learning and forecasting, etc.

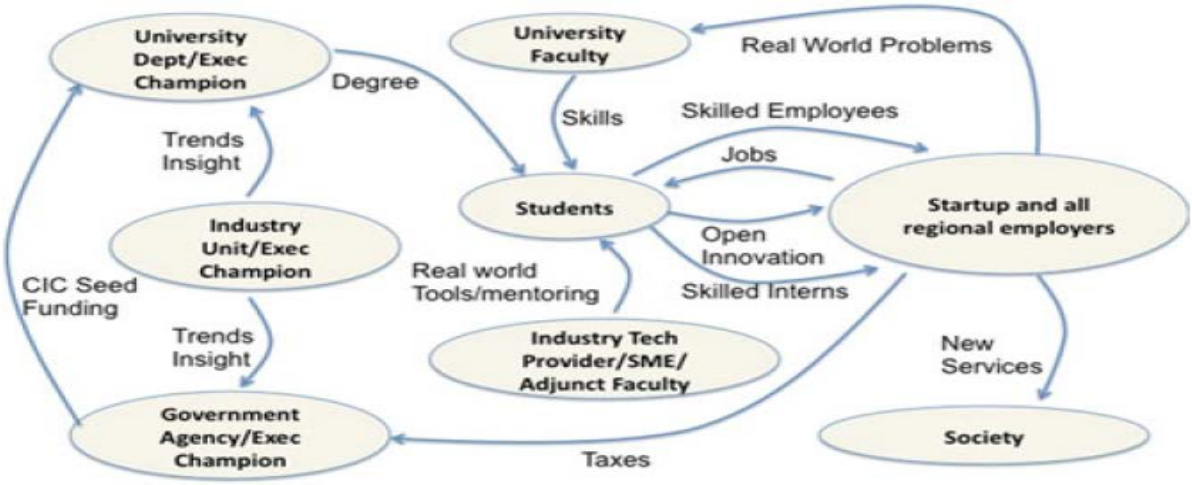
Recommendation models will be also updated based on the participants' feedback.

3. University – Business Cooperation Models

It is well known that the universities' main role is to serve the public interest, through education and research, and to participate in the spreading of knowledge and support of industry.
The interdisciplinary research that brings researchers from university to work on real problems (with industrial, economic or societal applicability) with real users exploring real cases, raises the quality and impact of basic research and lowers the barriers to technology transfer.

The collaboration between universities and industry is recognized as a driver of innovation through knowledge exchange.

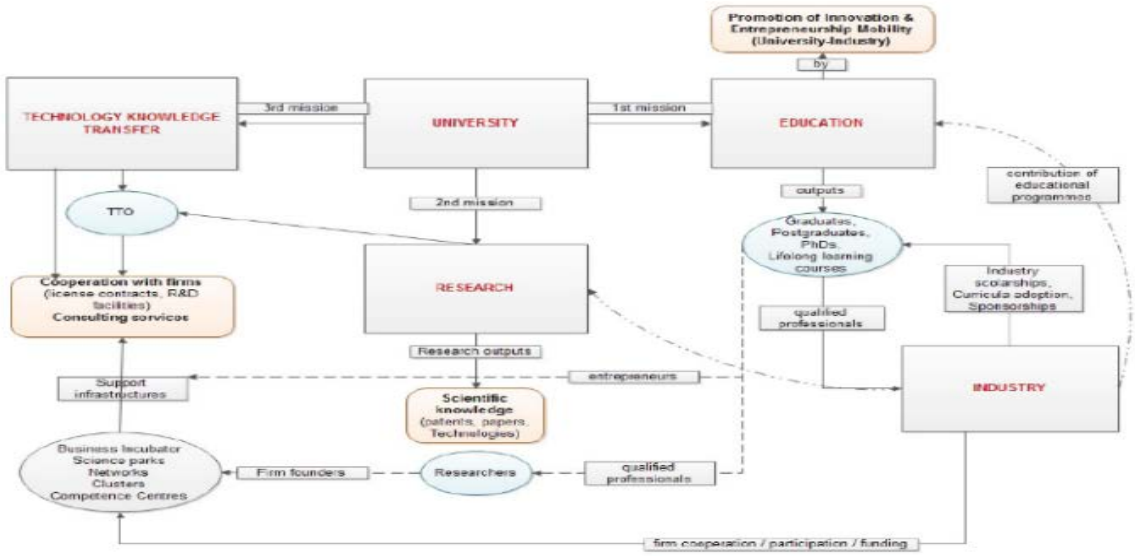
3.1. CIC collaborative value model



Simplified CIC collaborative value model (Ouyang et al., 2017)

Collaborative Innovation Centers (CIC) is a type of service system at the intersection of academia, industry and government alike that collaborate on high-skill job growth and economic development, regional focused.

3.2. University with three strategic priorities

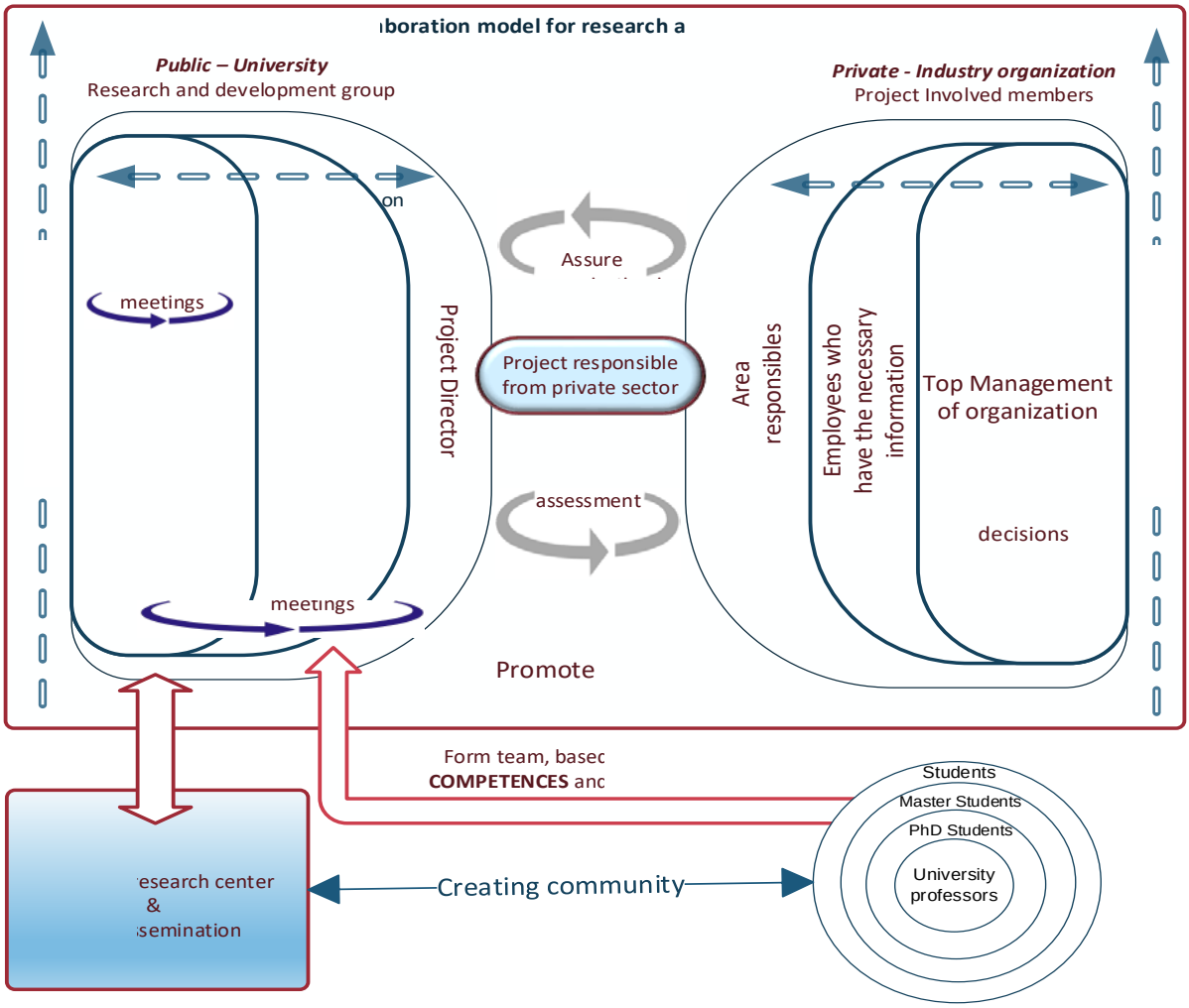


Model of university with three strategic priorities (Kalnins, 2015)

The model proposed by Kalnins and Jarohnovich incorporates three strategic priorities for University: *education, research and technology knowledge transfer*. The education and research are normal development axes for Universities that are their main purpose since their creation. The 3rd mission is creating a bridge between university and the private sector through cooperation with firms and the technology transfer.

3.3. Collaborative Model for R&D collaborative project

The research realized in academic environments is often hard to be translated into marketable products. The overcome this, the bridge partnerships between university and industry are implemented. With this approach, the transfer of knowledge will be made in both directions; first, the academic human capital will learn how to create a product that needs to incorporate customer's demands and that will be available in the market. On the other side, the industry will benefit from academic research, accessing a different pool of knowledge and experience. This dual flow of *practical sense and formal research* is seen on the external side of the model. Collaboration can be ensured by defining a goal that is accepted by both camps; accomplishing this, several groups / teams of people create a diverse team working in the same direction, with same purpose. A collaborative model that can be applied to projects developed by Universities in association with the private sector is proposed in figure bellow.



Collaborative Model for R&D collaborative project (Kifor et al., 2017)

The collaborative model enhances the free idea and advice exchange with the University Research Center/ the group of top researchers through their involvement in the kick-off project phase and the important milestones. By doing so, they can evaluate and guide the project status and can bring new ideas as the project goes on.

The University Group is led by the project director. The communication between members is a bidirectional one, maximizing the level of creativity; being a research project, the creativity is the key to project success.

This group is proposed to be divided in three (complementary) specializations: research team, technical team and project director.

- The research team is responsible for review the state of the art, use their expertise in order to introduce domain knowledge in the design process and developing of the products, creating the specifications, architecture and models to be analysed; both data processing and analysis. Members are more focused on developing the models and assure the customer needs.
- The technical team is responsible for the development and realization of the final product. Mapping unstructured data gathered from industrial partner in software parameters is another duty of technical team. The research needs to be validated and enhanced, thus the development is necessary. Members are focused on developing the final product. A critical issue faced by technical team in such Bridge Grants is the privacy problem, and what the companies, proposing to apply the product developed by academic research, give up when they make their data available. Sometimes to provide a better accuracy of results larger datasets are required. On the other side, this information is quite private and cannot be exposed to large audience (people), confidentiality agreements being closed between the involved parts (the company and their employees). In such cases the technical team need to do additional work in order to may use the data but in the same time to keep the confidentiality.
- The project director assures the correct management of project activities and tracks the progress.

The **industry Group** is proposed to be formed by:

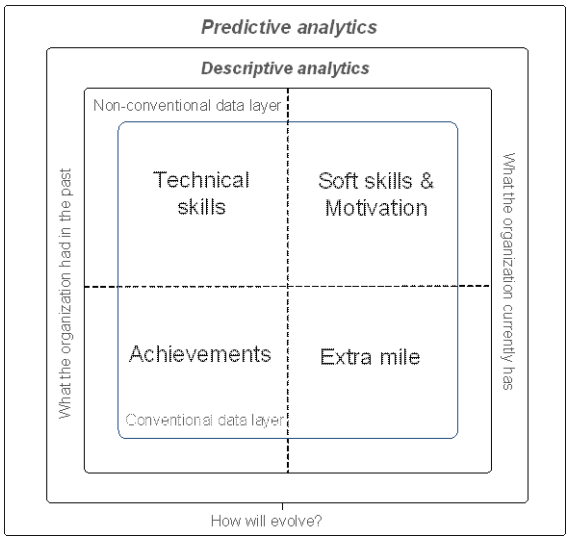
- Area responsible: member of organization, involved or responsible for area where data / knowledge is needed (for example in presented project Human Capital).
- High management of organization are the members that can have the final decisions regarding the project.
- Employees who have the necessary information - members that own the knowledge or that will further use the output of research.

The project responsible (from private sector) has two main duties; first is assuring the communication between the two groups, through his direct involvement. The second one is being part of the technical project team, thereby providing an agile approach that ensures that the partner's requirements are incorporated into the technical solution. Questions from both groups are also handled by him, he has the overview on all project goals and activities.

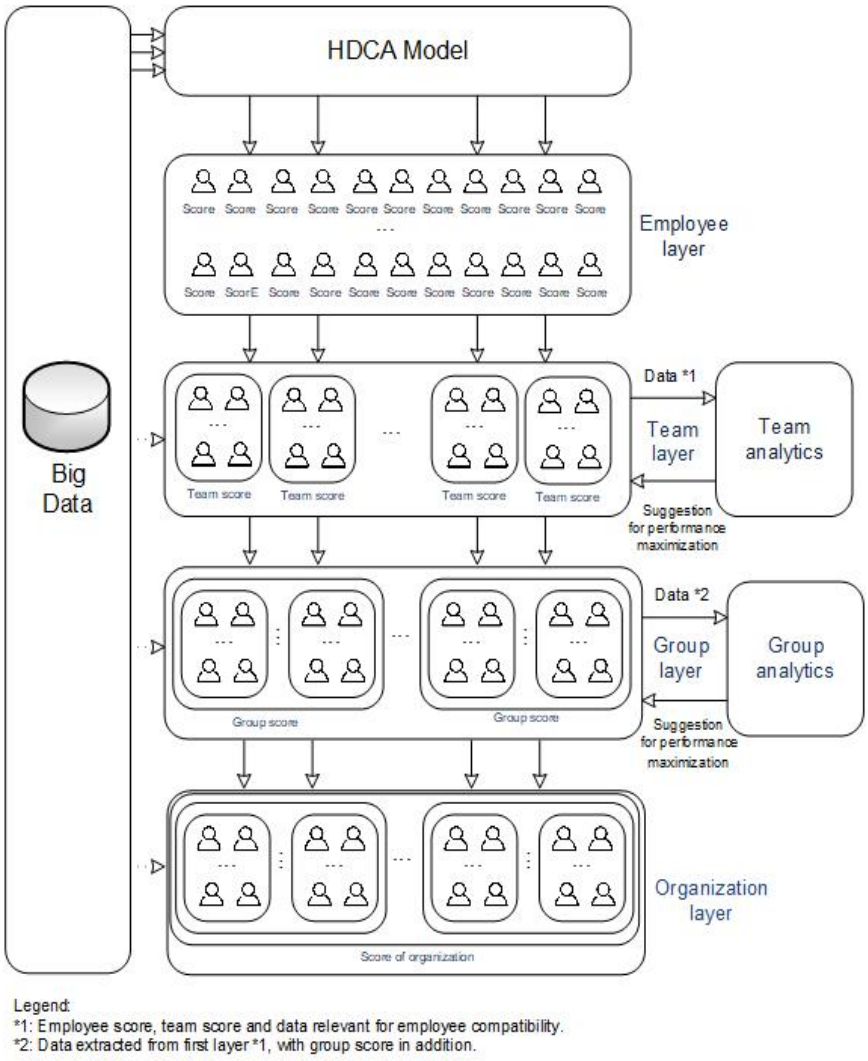
The members of presented project are: 3 university professors, 2 PhD students, 2 master students, 1 project responsible from economic agent side,1 responsible from Human Resource department, management of organization.

3.4. Human Capital Evaluation and exploitation model based on Big Data technologies

Human Capital is not quantified and appropriately exploited in the companies in order to notice in some *evolutions, trends or problems that might encounter.*



The raw data gathered from the organization is transformed in key performance indicators (KPIs), seen from multiple perspectives: Technical skills, Soft skills & Motivation, Achievements and extra involvement of employees.

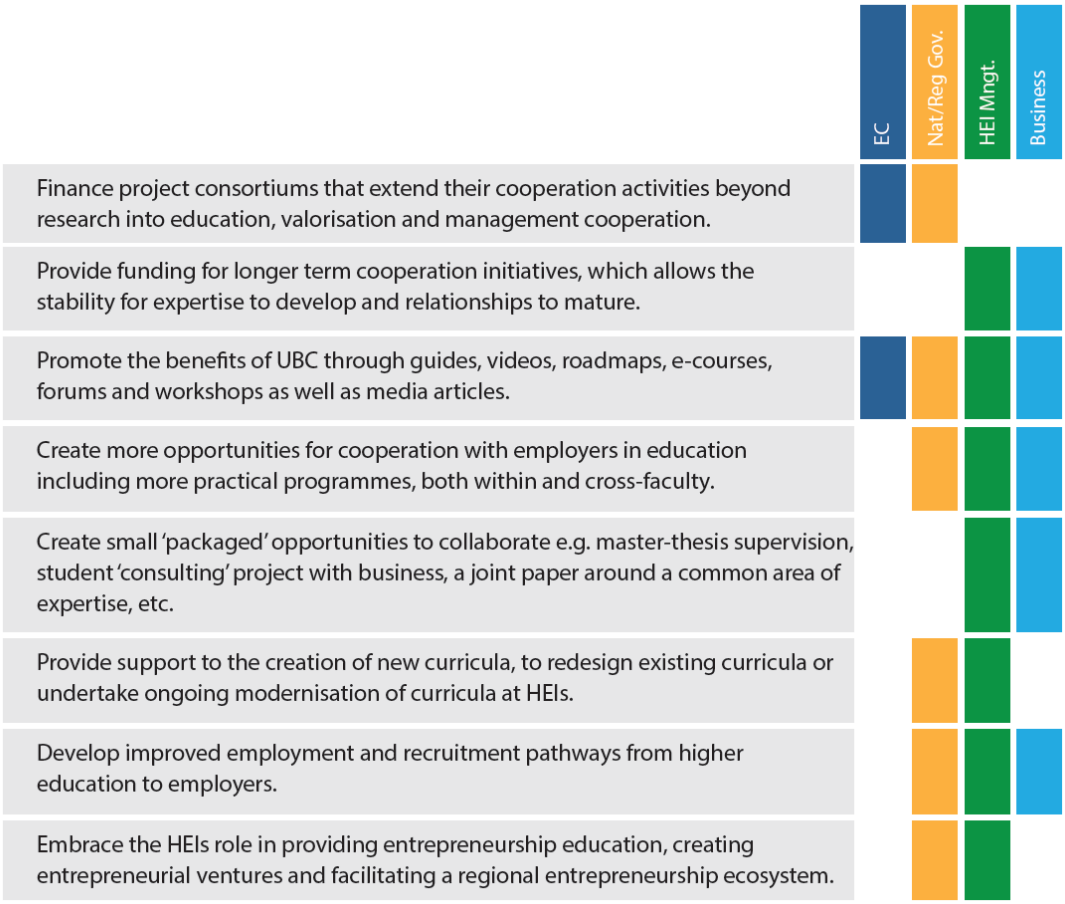


Predictive Analysis using Big Data (BDPA) involves the tools and methodologies used by organizations in various ways to improve their operational and strategic capabilities (Hazen, B et al., 2016) and finally to bring a positive financial impact.
An analytics platform is a unified solution designed to process large amount of data and extract useful information. The RDBMS - relational database management systems - are inadequate on providing contextual insights from the stored data, therefore new technologies needs to be used for storing and managing of data. Research was made in finding a scalable and fast-pacing architecture.

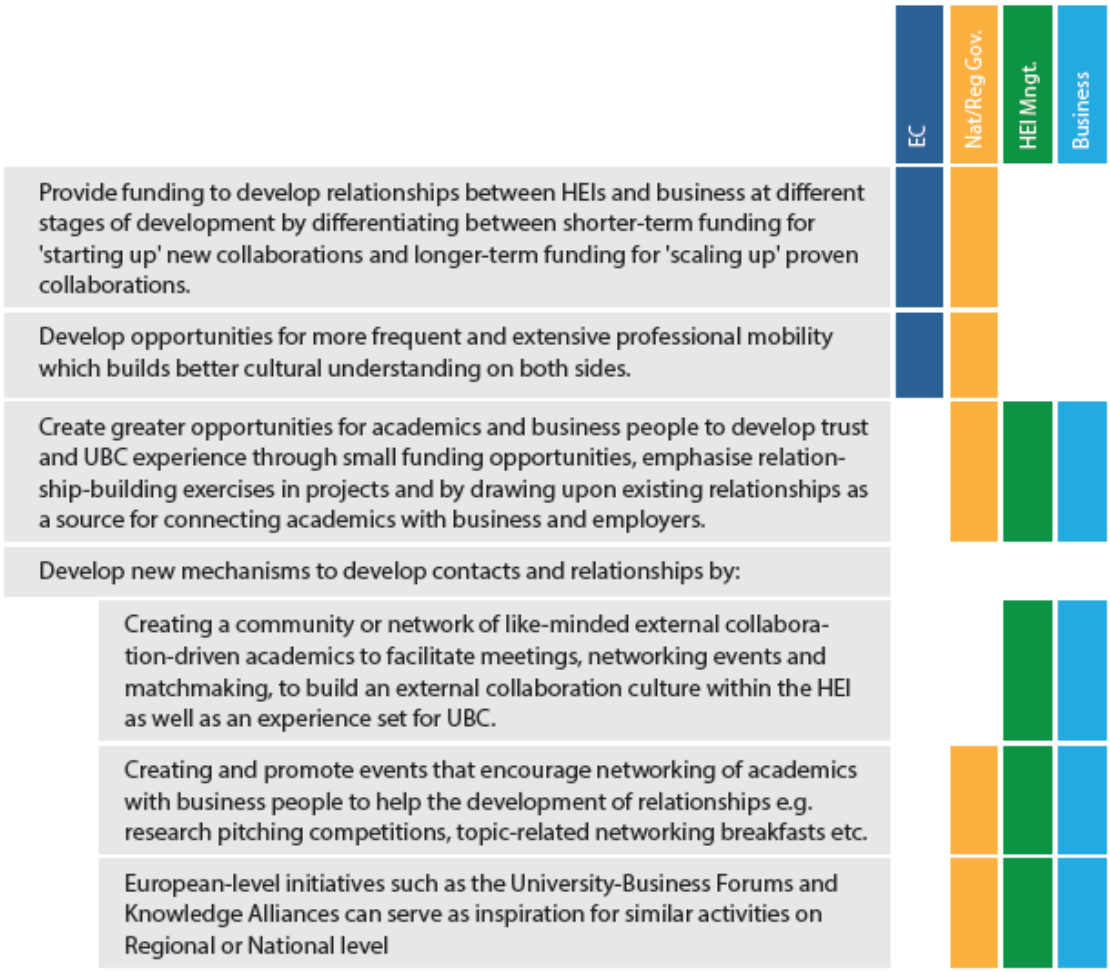
4. The State Of University-Business Cooperation In Europe – European Commission Report, 2018

This report presents the findings of the project "The State of University-Business Cooperation in Europe". The project has been conducted during 2016 and 2017 by a consortium led by the Science-to-Business Marketing Research Centre, Germany for the DG Education and Culture, European Commission. The aim of the project was to get a more profound, comprehensive and up to date understanding of the state of University Business Cooperation (UBC) in Europe, from the perspective of both the higher education institutions (HEIs) and the business sector. The project explored the state of play of UBC in different countries, examining the form and extent of main drivers and barriers for the different stakeholders, regulatory frameworks and the type and extent of existing measures supporting UBC at a national level.

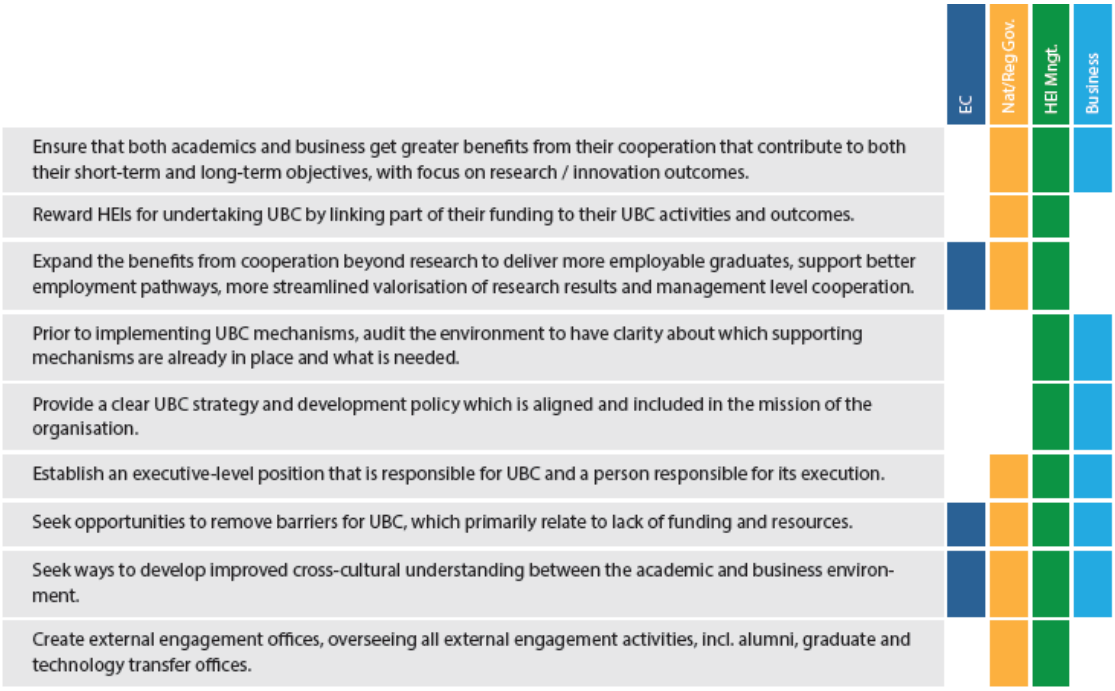
In order to broaden the understanding of UBC and widen its development, governments (EU and national / regional), HEIs and businesses can:



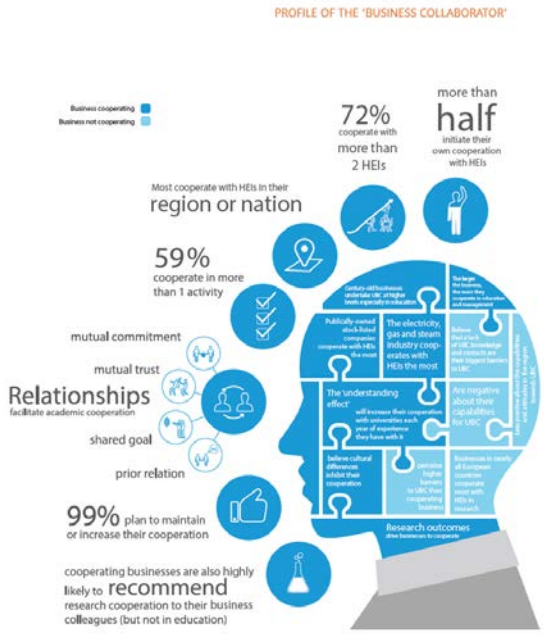
In order to improve personal relationships, governments, HEIs and businesses can:

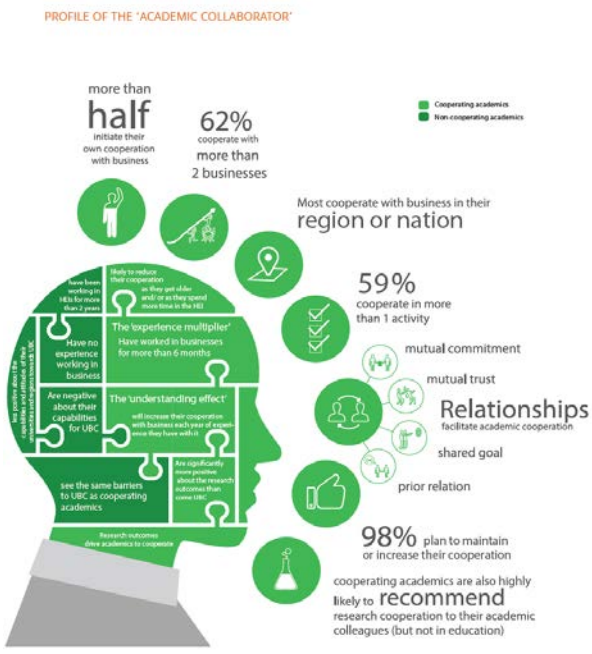


In order to increase the strategic commitment to UBC, governments, HEIs and business should:



The results showed that, given the right circumstances, UBC can be a highly positive activity for all parties involved. Particularly, businesses are starting to realize the benefits of partnering or working with higher education institutions (HEIs) as a source of future-oriented innovation as well as talent development that can build a competitive advantage. There is a evidence that HEIs are being increasingly seen as a source of talent, entrepreneurship and a lead player in regional development.





5. Synthesis of the analysis regarding the collaboration of universities with the business environment at the partner universities in South Africa

	TUT	CPUT	VUT	DUT	
Industry Advisory Board		**X**	**√** Advisory Boards and Steering Committees	**X** Co-op Unit	
Research Centers	**X**	**X**		**X**	*Model of university with three strategic priorities (Kalnins, 2015)* *Technology Knowledge Transfer – Research Centers Collaborative Model for R&D collaborative project(Kifor et al., 2017)*
Partnership	**X** MoUs / MoAs	**X**	X Competitions / Awards	**X**	
Community Engagement	**X**	**X**			
Laboratory / Equipment	**X**		**X**		*Model of university with three strategic priorities (Kalnins, 2015)* *Technology Knowledge Transfer – Support Infrastructure*
Strategic Alliances	**X**	**X** Industry Stakeholder Forum	**X** Vaal Triangle	**X**	*Model of university with three strategic priorities (Kalnins, 2015)* *The 3rd mission is creating a bridge between university and the private sector.*
Curricula Development		**X**	**X**	**X** Faculty-led initiatives	*Model of university with three strategic priorities (Kalnins, 2015)* *Education – Curricula Adaptation*
Entrepreneurship / Social entrepreneurship				**X**	
Practice	**X** Visiting WIL placement /support	**√** Visiting Internship	**X** Work Integrated Learning (WIL)	**√** WIL Partnership	*Simplified CIC collaborative value model (Ouyang et al., 2017)* Collaborative Innovation Centers (CIC)

TUT	CPUT	VUT	DUT
Strategic Alliances Memorandum of Understanding (MoUs) Memorandum of Associations (MoAs) Laboratory Equipment Community Engagement Company Visiting	Projects in: - Research - Community Engagement Industry Advisory Board Industry Stakeholder Forum Curricula Development	Work Integrated Learning (WIL) Competition / Avards Cooperation Vaal Triangle	Research Centers Co-operation Education Unit International Education & Partnership Faculty-led initiatives Entrepreneurship Desk-Midlands Advisory Board Social Entrepreneurship
Industry Partners for: Sasol Solar Challenge • No 4 overall in 2018, having completed 2 397 km from Pretoria to Stellenbosch • No 1 among the South African teams Green Technologies	Industry Partners for: Eco beam and sandbag construction Aquaponic Gardens	Industry Partners: Arcelor Mittal Sasol Samancor	Industry Partners for: CSE Social Enterprises Incubates NEW BEGINNINGS in RURAL ULUNDI Mthashana TVET and Kohwa Holdings – developing large scale commercial farming with students

Founding resources for research or practice projects implemented in South Africa Universities in collaboration with the business environment

	TUT	CPUT	VUT	DUT
National Research Foundation (NRF)		X		
National Skills Found		X		
The Sector Education and Training Authorities (SETA) Funding	X			X
The Department Of Higher Education And Training (DHET)				X
Department of Science and Technology		X		
Department of Environmental Affairs		X		
Technology Innovation Agency (TIA)		X		
Small Enterprise Development Agency (SEDA)	X			
Electricity Supply Commission (ESKOM)	X	X		
WACE Advancing Cooperative & Work Integrated Education				X
Companies	X	X	X	X

National Research Foundation (NRF)
National Skills Fund
The Sector Education and Training Authorities (SETA) Funding
The Department Of Higher Education And Training (DHET)

Department of Science and Technology
Department of Environmental Affairs
Technology Innovation Agency (TIA)
Small Enterprise Development Agency (SEDA)
Electricity Supply Commission (ESKOM)
WACE Advancing Cooperative & Work-Integrated Education

Specific elements

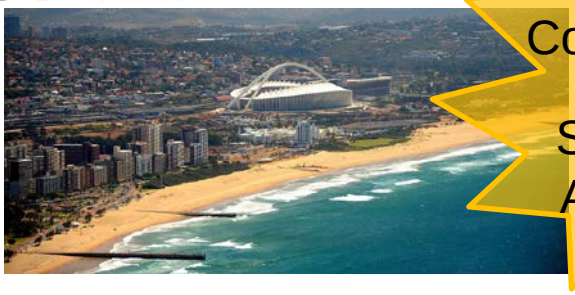
Tshwane University of Technology
We empower people

Strategic Alliances
External Funds
Laboratory / Equipment
Community Engagement

Cape Peninsula University of Technology

Research Projects
Community Engagement Projects
Industry Advisory Board
Qualifications – Curriculum Development

Work Integrated Learning (WIL)
Competitions / Awards
Vaal Triangle



Research Centres
Co-operative Education Unit
Centre for
Social Entrepreneurship
Advisory Boards

Conclusions regarding the collaboration between universities and business environment at South Africa partners

There are several common issues that can be highlighted at all partners.

1. Practice – all the universities (in a form or other)
   - Visiting
   - Work Integrated Learning (WIL)
   - Internship
   - Practice Partnership
2. Partnership – all the universities (in a form or other)
   - Memorandum of Understanding
   - Memorandum of Association
   - Competition and Awards Sponsorship
3. Strategic Alliances – all the universities (in a form or other)
   - Industry Stakeholder Forum
   - Vaal Triangle

There are several common issues that can be highlighted in several partners.

1. Industry Advisory Board – three universities (CPUT, VUT, DUT)
   In variation forms

2. Research Centers - three universities (TUT, CPUT, DUT)

3. Curricula Development - three universities (CPUT, VUT, DUT)
   In variation forms

	South Africa			Europe			
	Nat. Gov.	HEI Mngt.	Business	EC	Nat. Gov.	HEI Mngt.	Business
Finance project consortiums that extend their cooperation activities beyond research into education, valorization and management cooperation.							
Provide funding for longer term cooperation initiatives, which allows the stability for expertise to develop and relationships to mature.							
Promote the benefits of UBC through guides, videos, roadmaps, e-courses, forums and workshops as well as media articles.							
Create more opportunities for cooperation with employers in education including more practical programmes, both within and cross-faculty.							
Create small 'packaged' opportunities to collaborate e.g. master-thesis supervision, student 'consulting' project with business, a joint paper around a common area of expertise, etc.							
Provide support to the creation of new curricula, to redesign existing curricula or undertake ongoing modernization of curricula at HEIs.							
Develop improved employment and recruitment pathways from higher education to employers.							
Embrace the HEIs role in providing entrepreneurship education, creating entrepreneurial ventures and facilitating a regional entrepreneurship ecosystem.							
Provide funding to develop relationships between HEIs and business at different stages of development by differentiating between shorter-term funding for 'starting up' new collaborations and longer-term funding for 'scaling up' proven collaborations.							
Create greater opportunities for academics and business people to develop trust and UBC experience through small funding opportunities, emphasize relation-ship-building							

exercises in projects and by drawing upon existing relationships as a source for connecting academics with business and employers.							
Develop mechanisms and processes for more effective conversion of cooperative projects into research outcomes which benefit academics and business including a clear definition of desired outputs at the start of the project as well as funding for the conversion of results into outcomes.							
Ensure that both academics and business get greater benefits from their cooperation that contribute to both their short-term and long-term objectives, with focus on research / innovation outcomes.							
Provide a clear UBC strategy and development policy which is aligned and included in the mission of the organization.							

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