



CREATION OF A SUSTAINABLE MODEL FOR BUILDING AND MAINTAINING A RELATIONSHIP BETWEEN UNIVERSITIES AND ENTREPRENEURS

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Abstract. *Purpose* – the article aims to analyse the best practices in industry-university collaboration and based on theoretical background and practical experiences of universities to provide a framework for building a sustainable industry-university collaboration model, which indicates processes and steps as well as an example of Riga Technical University on how to create and maintain such collaboration. *Research question* – how to structure the activities for setting up the collaboration with industry based on the desired collaboration intensity. *Hypothesis* – universities can effectively organise collaboration with industry if they understand what the specific achievable results they want to achieve are.

Research methodology – based on literature analysis, best practice and problems analysis of universities and Riga Technical University case analysis of university-industry collaboration, a model for improving collaboration with industry is proposed.

Findings – to establish an effective and productive university-industry collaboration university must apply a structured approach of communication and collaboration of all internal parties involved in the process, what can be done by using the SADI Model for Building a Relationship between Universities and Entrepreneurs. For successful implementation of the university's strategy of collaboration with industry-university must define the achievable results for such collaboration and apply the SADI Model at the appropriate intensity level – basic, medium or high level.

Research limitations – such a model hasn't been fully implemented, so the full spectrum of all activities and their performance hasn't been tested yet, as the implementation of it requires the involvement of multiple university departments. As well a limited approbation of the model is done since it is tested within Riga Technical University.

Practical implications – the model can be used in different intensity levels according to the university's strategical aims and desired achievable results from the collaboration with the industry.

Originality/Value – the article supplements previous research done in the field of university-industry collaboration, providing an approach “SADI Model for Building a Relationship between Universities and Entrepreneurs” on how to structure and organise the collaboration with industry within the university as well as provides structured approach on how to define activities to be implemented by university based on the desired outcomes from such collaboration.

Keywords: collaboration model, strategy, university-industry interaction.

JEL Classification: I2, L2, M1, M3.

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Introduction

Quality and range of offers provided by university play a huge role in children and their parents' choice for their future professional development. Improved quality comes with higher financial costs which cannot always be covered by the university itself; therefore an essential step in universities' development is to attract both financial and non-financial support from industry and to create a strong bond with industry thus improving university's research and graduate career options. Another vital aspect is the influence of higher education on national economics. Contribution to national economics is made with study process when specialists are being prepared who will later become taxpayers and business owners. Also, these specialists will bring their country's name into the world with their research and valorisation activities, which will allow both public and private structures to introduce innovations and new products (Zeps, 2016). Universities of Great Britain, the United States of America and other countries calculate their influence on national economies. For example, in Great Britain universities in the period between 2010–2011 have contributed up to 3.3 billion pounds into national economics (Northam, 2012). This contribution is made of business consultations, commercialisation of new technologies, training and consulting on various problems and other services which can be performed by the university's teaching staff and researchers.

Summing up, it can be seen that relationship between universities and entrepreneurs is essential not only for universities gaining additional financial support for the development and attracting specialists to the study process, and entrepreneurs who will gain qualified workforce that helps them become not only more competitive but also to the national economics (Mascarenhas et al., 2018). Previous researches in Spain, France and Portugal show that out of 375 entrepreneurs who have made interest in cooperation with universities, only 10% ended up cooperating with them (Fernández-López et al., 2019). Looking at Latvia, all possible cooperation directions are not defined together. Also, one of the project's "Research of alternative models for improving study process and industry cooperation" conclusions is that there is lack of systematical approach on cooperation with entrepreneurs, and one of the possible solutions is to create unified model and methods for cooperation between universities and entrepreneurs (Dubickis et al., 2017).

1. Analysis of the best world practice in industry-university collaboration

Direct or indirect cooperation between industry and universities is implemented continuously. To create a model of collaboration, the authors have explored compiled information on the world-wide practices of university-industry collaboration and its types, as well as factors that promote and delay the development of collaboration.

Building a relationship between industry and universities begins with several meetings, mutual acquaintance, and mutual idea development. The more specific the meetings and negotiations are, and the less of extensive discussions, the better the results, however, the company's interest to cooperate should be in focus (Puura & Varrak, 2016). It is crucial though to promote the process thoughtfully and without haste to achieve mutual trust, and not to ask for support during the first dialogue – it allows both sides to achieve better results, and if necessary to provide support based on successful collaboration to the date.

Table 1. University-industry relation types (source: Perkmann & Walsh, 2007)

University-Industry Relation Type	Description
Research Partnerships	Mutual organisational arrangements for collaboration in the area of research and development
Research Services	The company orders activities, including contract research and consultations
Commercialisation of Ownership	Issuing university's intellectual property (patents) to companies
Scientific Publications	Use of codified scientific knowledge in the industry
Academic Entrepreneurship	Development and commercialisation of academic researchers' developed technologies by founding companies (alone or together with partners)
Transfer of Human Resources	Training mechanisms of different content (for example, study options at the university for the company's personnel, internship opportunities for last-year students and graduates in companies, permanent scientist transfer to companies)
Informal Interaction	Social networking and building relationship at conferences etc.

Perkmann and Walsh (2007) in their study on university-business relations and open innovation have defined seven types (see Table 1) thereof, by which the authors of the publication performed further analysis of world-wide known good examples.

1.1. Collaboration in research

As mentioned above, Perkmann and Walsh (2007) thoroughly distributed various forms of collaboration in research, and that shows its popularity and relevance. Knockaert (Knockaert et al., 2011, p. 783) also points out that modern entrepreneurs show an increasing interest in university open research results, which, in turn, provides universities with an opportunity to commercialise their research in the business environment. For example, according to studies on knowledge transfer in Europe (Arundel et al., 2013), commercial collaboration is the most popular activity in European universities and highly concentrated in biomedical research. It is only possible in cases when universities' studies represent the area's interests and are topical if an obstacle as determined in the research by Kozlinska (2012) does not apply – the gap between academical environment and real life. If the studies are too abstract, their implementation requires an inadequately sizeable financial contribution, and are too risky to be implemented under real-life conditions; entrepreneurs most likely will not be interested in these. In order to transfer the knowledge successfully, both sides need to consider each other as an equal partner, allowing to experiment and to unleash curiosity. Rasmussen and Wright (2015), Nielsen and Cappelen (2014) Bruneel (Bruneel et al., 2009, p. 860) notes the different understanding of time limitations is one of the obstacles – university's research projects are generally long-term, while companies mostly want to see immediate results There is a contradiction here: on the one hand, the entrepreneurs want high-quality research, which will contribute to development of the company, on the other hand – they want to perform this in the shortest terms and to get immediate results not providing with the reasonable period.

From the business perspective, knowledge is considered to be a competitive advantage which may be maintained or created from scratch, so the knowledge and other intellectual property play a more significant role than physical assets (Knockaert et al., 2011, p. 783; Quinn et al., 2005, p. 82). University researchers in collaboration with companies achieve better results compared to business-unrelated studies because they forced to step out of their comfort zone and solve actual business environment challenges and problems (Nielsen & Cappelen, 2014). Collaboration with entrepreneurs is motivating for researchers as well because it provides an excellent opportunity to add to their research programs. A similar conclusion was reached by Schiller and Liefner, mentioning the following as the most common motivational factors to university's researchers: gain of additional income, and almost as much – again of specific knowledge and experience. Only 40% of the surveyed researchers pointed out additional funding for academic tasks and objectives as a motivating factor for collaboration as a result of commercialisation (Schiller & Liefner, 2007, p. 552). It can be concluded that a student's involvement in studies or commercially looking for business opportunities in most cases is not the primary factor (Nielsen & Cappelen, 2014). The reason for this could be the students' insufficient knowledge and not well-thought collaboration forms, the inability of researchers and university's tutors to find the student's place during the research, companies mistrusting the abilities of the students. Direct collaboration between students and entrepreneurs is much less joint than industry-university collaboration, and to the authors' point of view, the problem can be solved by creating awareness of each party's role and abilities (Nielsen & Cappelen, 2014). Lee put forward the hypothesis that taking into consideration researchers' gained advantages and benefits from the research programs, it was likely to be a relationship between these incentives and research results (Lee, 2000, p. 112). The higher the chance is for researchers to improve their qualifications and reputation, the better their work will be.

Rohrbeck, Arnold and several other authors' studies (American Council in Higher Education, 2001, p. 27; Rohrbeck & Arnold, 2006, p. 4) show that there are other obstacles to collaboration in the field of research. In the survey of Thailand's companies and universities by Shiller B.V. (Mildahn & Shiller, 2006, p. 36), representatives of universities referred to the reluctance of collaboration from the entrepreneurs and lack of available industry partners to the research activity. In the authors' opinion, these claims clearly show a lack of reliability and communication, as the entrepreneurs marked the same reasons for lack of collaboration. Representatives of the companies also mentioned universities' in a comprehensive understanding of the companies' policy as an obstacle of collaboration. In these cases, the main question is: what the company's development objectives are and what the current situation in the industry is, as it is possible that stagnation started, and none of the parties is interested in the collaboration.

Many universities of the world have well-designed models for cooperation with entrepreneurs in the area of research in order to avoid the abovementioned communication problems. An excellent example of this is Aarhus University in Denmark, offering researchers three types of collaboration (see Table 2).

Table 2. Aarhus University offered collaborative research forms for companies (Aarhus University, 2018)

Collaboration Type	Explanation
Jointly Funded Research	In this collaboration model, both parties shall make a financial contribution to the research project. It provides an opportunity for the company to invest a smaller amount of funds, but at the same time it also means that both parties shall have the right to joint project results, and the university will be able to publish the results of the research.
Ordered Research	The university offers research services under the market conditions. It means higher costs to the company, but it provides a greater impact on the results of the study, and the university may refuse/waive the right to publish it.
Industry PhD course and industry post-doctoral programs	Industry PhD student programs is a 3-year research project involving a PhD student, the university and the company. The company employs and finances a particular student within the scope of the study for the whole period. Post-doctoral program differs with time limits (depends on the project duration), and in this case, a research institution (institute, department, etc.) and the company are involved.

The “ADAPTER” platform was set up in Estonia, a neighbouring country of Latvia, and deals with the mentioned problems of communication between companies and universities. Its primary function is to bring together entrepreneurs with the most appropriate researchers from 12 largest universities in order to carry out joint projects. Moreover, in several areas students have an opportunity to apply for co-financing in the implementation of the projects (ADAPTER, n.d.). This platform facilitates the long search process for the research project in which companies are usually spending much time and human resources.

1.2. Academic entrepreneurship

Perkmann and Walsh (2007) also distinguished academic entrepreneurship when researchers together with partners or alone found companies by commercialising technologies, and transfer intellectual property to companies by creating patents.

The academic business field is very well-developed; more and more researchers' discoveries are the basis for establishments of new companies. Mascarenhas, based on the available literature on business universities (Mascarenhas et al., 2017) since 1990 to the present day, distinguished three groups: business universities that focus on changes in academic paradigms, examples; academic entrepreneurship which refers to commercialisation of knowledge, and technology-based enterprises or spin-offs.

Knowledge sharing and building relationships with the business community, as well as opportunities to participate in business activities in business incubators (companies' mentors, solving of real-life situations and company problems, etc.) during the studies and free access to start-up formation etc. are the driving forces to re-profile high-schools into business universities and ensure higher education sustainability (Bikse et al., 2016; Stal et al., 2016; Organisation for Economic Co-operation and Development [OECD], 2012). Today more and more universities shall endeavour to comply with these and other factors in order to ensure the development of business-driven higher education, and it is only a matter of time

that this model is implemented at the majority of universities of the world, irrespectively of their primary focus.

Table 3 shows that there are many types of academic businesses, and entrepreneur involvement in it is inevitable. Based on the Hurst (1995) ideas of the organisation's eco-cycle and entrepreneurship, Brennan and McGowan (Brennan and McGowan, 2006, p. 148) evaluated each category establishing the company's goal through activities in each of these areas. The corporate initiative is a search for opportunities; innovation is a search for something new, while the strategic renewal is a search for advantage.

Table 3. Academic business types (source: Sharma & Chrisman, 1999, p. 20)

Academic Business Category	Examples of Academic Business
Corporative Initiatives	Internal: business research, spin-in companies, science parks External: joint initiatives, spin-out companies
Innovation	E-training, patents, design rights, copyright, licensing, industry communication offices
Strategic Renewal	Consulting, the teaching of corporate processes, knowledge transfer scheme, technology transfer, research groups, research student monitoring

Whatever the development phase the company is positioned in, in order to maintain and improve their competitiveness, the abovementioned facilities should be sought at all times. The extent to which academic business cooperation between companies and universities should be implemented is based on several factors – legislation, the motivation of both parties, access to funding, and others. University's researchers are professionals in the field, however, faced with a great deal of bureaucracy and complex documentation may lose interest in the further development of the research. For example, in Thailand, the collaboration between state universities and the industry is hampered by different bureaucratic restrictions, weak researchers' incentive schemes, and lack of commercialisation system (Mildahn & Shiller, 2006, p. 32). A large number of companies do not want to be involved in joint projects because there is no certainty about intellectual property distribution (Kozlinska, 2012). Also, in this case, the solution could be communication between the parties and the creation of a unified system.

Establishment of university's spin-off companies has become a popular way to earn with the research and to implement technology transfer. It leads to a growing interest from the scientific community and students who work in research and study academic research commercialisation (Baldini, 2010, p. 864). Using an idea or fragment from a current study, students, together with researchers or independently establish completely new independent companies. In Italy, for example, one study concluded that university's rational and monetary policy plays a significant role in the extent of researcher's activity in spin-off development and that the most significant disincentive factor is university's over-restrictive rules in respect of contracts for research and consultation activities (Muscio et al., 2016, p. 1386). Similar as in other research projects, it is shown that much simpler and more easily understood administration policy reduces the administrative burden for researchers, and does not hinder business activities.

1.3. Collaboration in transfer of human resources

The different forms of cooperation are referred to in transferring of human resources field; besides, they can create a benefit unilaterally, and in most cases for both sides. Economic operators should be able to provide support for practical skills for both undergraduate students, as well as those who have already graduated (Perkmann & Walsh, 2007). Tener indicated that his internship program for companies is as a significant collaboration strengthening form in which everyone wins – students who obtain real-life experience under mentors' competent supervision, and universities and businessmen who subsequently acquire well-prepared employees (Tener, 1996, p. 159). In this cooperation, students have the opportunity not only to watch how the company operates but also to work together with the industry's professionals and to learn from their experience. Direct collaboration relationship between students and entrepreneurs is precious with spending time together so that the students may use theoretical knowledge in practice under the real working environment conditions (Nielsen & Cappelen, 2014).

Many companies worldwide have developed their internship programs. For example, Accenture Company at its branches throughout the world admits several hundreds of students every year for a six months long internship program, providing initial training, and later allowing them to work together with other employees in teams for different customer projects (Accenture, 2018). Besides, this internship practice is pre-paid, which provides the students with an excellent opportunity to obtain real knowledge and also receive financial support to cover daily costs.

Companies which are not so big often engage in programs offered by other companies or implemented in cooperation with other enterprises in the sector. Thus, for example, a Silicone Valley internship program was founded, which involves information technology companies and start-up companies. This internship provides students with a 1-year internship in one of the Silicone Valley companies, as well as additional benefits. Students are provided with a visa, covered travel expenses, as well as financial aid of 60000 \$ per year ensured by the Valley's companies (Silicon Valley Internship Programme, 2016).

Human Resources universities, in turn, can provide training on various topics for the company's employees which would improve their qualification creating a contribution to the operation of the company. Quinn states that nowadays, the value of knowledge has increased from cognitive skills to knowledge which encourages creativity (Quinn et al., 2005, p. 80). However, it shows that there is a paradox because usually, companies provide more resources for the development of employee cognitive skills than skills that would provide higher value (Nielsen & Cappelen, 2014).

1.4. An industry advisory committee

Besides the examples in Table 1, unless it is not considered as a transfer of human resources, the authors have found another essential type of industry-university collaboration relationship – industry advisory committees which in the majority of cases are formed at every university. In order to achieve good results, all those involved should understand the relevance of the expected results. It is imperative to maintain mutual, accumulated for years trust and

respect between the industry and the university management (Tener, 1996, p. 159). Tener argues that for each institution of higher education it is essential, therefore, to establish a strategy, where mission, vision and goals thereof are unanimous to all parties – the faculties, the management and representatives of the industry, and it can be achieved in the strategic management process (Tener, 1996, p. 159). Industry advisers participate in this process, and regular communication about the university's strategic objectives and the status of its execution, tendencies in the industry should reduce previously defined problems, particularly, in research cooperation.

For example, every department at the University of Sydney has its own Advisory Board. Such companies represent information Technology Faculty Board as Google, Microsoft Australia, Amazon, PwC, and provides an insight to faculties and the university's management on to the abovementioned industry development, as well as on skills that will be necessary in the future, offer internships for the students and resolution of real-life problems during a study process, help researchers to understand priorities and industry needs, etc. (The University of Sydney, 2018). Similarly, faculties of the University of Wisconsin-Madison have industry representatives at Management Boards, that in addition to the abovementioned assist the management not only with putting priorities in order to improve research and study quality but also with strengthening relationship with alumni and the industry (College of Engineering University of Wisconsin-Madison, 2018).

1.5. Informal interaction

Informal industry-university collaboration can be very different, for example, at conferences, congresses, industry fairs, etc. These interactions sometimes regarded as equally or even more important than the formal ones. (Siegel et al., 2003, p. 41; D'Este & Patel, 2007, p. 1297) One of the most common types around the world is alumni associations. In the US, for example, graduate organisations are top-rated and it should be considered as a strategically important asset by the university management (Martin et al., 2015). Participants of these organisations are often middle or senior managers of large companies and can provide both financial and human resources support to the universities. The University of Bristol compiled data on their graduates, and 20% of the graduates started their own companies of which a large part supports the university (University of Bristol, 2017).

As it can be seen from Table 4, the USA higher education institutions, where alumni organisations are particularly active, in 2017 have attracted by 14.5% greater amount of donations directly from the graduates compared to 2016, which contributed to more than one-quarter of all the donations to the universities (Council for Aid to Education, 2018). Taking into consideration that these are private donations, this is a very high level. In the USA top-10 universities, the most significant number of donations were from their alumni based on data of the years 2013 to 2015, on average 53% of all graduates have made donations to their universities (Powell, 2016). It should be taken into consideration that donations by alumni do not include donations from the foundations to universities, and which in many cases are founded by alumni. Thus, for example, the University of Bristol in Britain at the end of 2017 received the most significant donation so far of 10 million pounds from a graduate who established the foundation; this money will make it possible to build an entirely new student

Table 4. Voluntary support received by universities in the USA in 2016 and 2017, its sources and purposes (Council for Aid to Education, 2018)

	2016	2017		
	Amount Raised, mil. \$	% of Total	Amount Raised, mil. \$	% of Total
<i>Total Support, \$</i>	<i>41.000</i>	<i>100</i>	<i>43.600</i>	<i>100</i>
Source				
Alumni	9.930	24.2	11.370	26.1
Other Individuals	7.520	18.3	7.860	18.0
Companies	6.600	16.1	6.600	15.1
Funds/Foundations	12.450	30.4	13.130	30.1
Other Organizations	4.500	11.0	4.640	10.6
Purpose				
Current Projects	25.150	61.3	25.800	59.2
Capital Purposes	15.850	38.7	17.800	40.8

city (University of Bristol, 2017). The following indicators show a very well-developed donation culture and a high sense of belonging to the university among the graduates. Alumni networks are crucial during the studies when former students help current students with consultation, advice, exchange of experience, and also after graduation where contact networks and collaboration opportunities are formed for both business and other fields.

1.6. Financial aid

Table 4 does not contain the widespread form of companies' financial support to higher education institutions and their projects. Matching gifts is particularly popular in the USA, which means duplicated or higher allocated funds from the companies in cases when their employees donate to a university project, grant or other purposes. The companies within the initiative have established a donation amount increasing factor or ratio, as well as maximum possible value. For example, Google donation ratio is 1:1, and the amount of one donation co-payment differs from 60 \$ to 6000 \$. Thus, in the research by Karlan, Dean and John about donations made in 2015 it was indicated that the possibility to increase the amount of donation increased the possibility of individual's decision to donate by 22%, while the co-payment ratio did not affect this decision significantly (Karlan & List, 2007). This kind of a system among the employees increases the sense of belonging to their company, as well as promotes the development of joint donation culture.

Table 4 shows that, while in recent years, it has slightly decreased; however, about 16% of the USA universities receive donations from entrepreneurs. As mentioned a forehead, it is very likely that in many cases funds donated by companies are delivered to universities through various foundations, which are very common in the USA, that in many cases are established by the companies or university graduates. Donations from such foundations account for a significant proportion of the total donation amount.

2. Model of building cooperation between universities and enterprises

At the end of the 20th century, Etzkowitz and Leydesdorff (Stanford University, n.d.) formed the Triple Helix Concept, which is the concept of relations between universities, companies and the government. It describes the role of each party, focusing on the development of innovations and economic potential in cooperation, not only on a specific activity, which is to be performed by each of the parties. The authors suggest a model called SADI (Setting strategic priorities, Analysis of activities and promotion of responsible persons, defining “to do” activities model, Implementation and monitoring activities) that defines building relations with businesses by universities and colleges (see Figure 1). The model has been made based on problems and barriers found in literature analysis of world practice in university-industry collaboration, most famous of them – lack of communication (parties do not understand each other’s needs and goals), and no guidelines for such interaction, and Riga Technical University case analysis.

2.1. Defining strategic priorities

The first step in using this model should be choosing strategically important priorities in collaboration with entrepreneurs by the university’s highest administration. Defining available resources and selecting ones suitable for promoting cooperation is of no lesser importance. The next step is defining the desired results to be achieved that the authors propose on three levels (Table 5).

Within the basic level of relations, an enterprise concludes a general cooperation agreement with a university. Referring to such an agreement can make further cooperation process more accessible and the enterprise’s highest management would not need to review

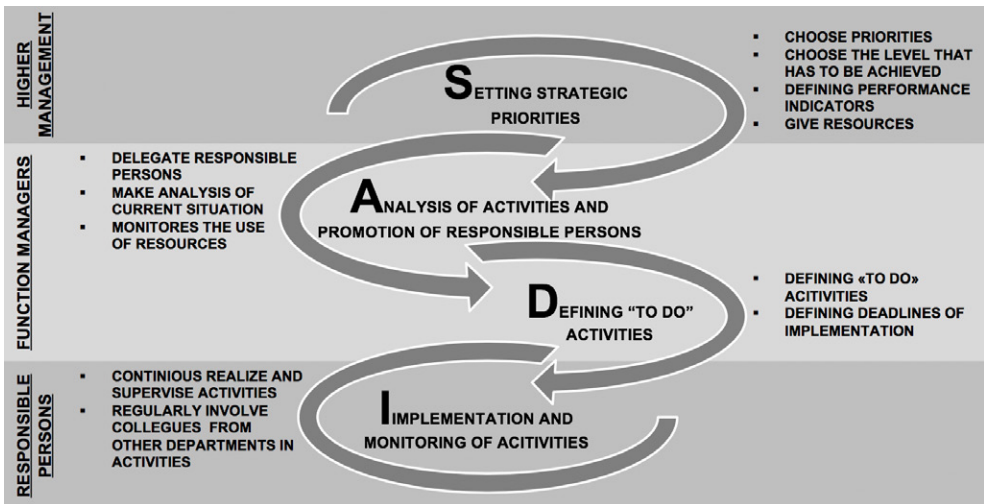


Figure 1. SADI Model for Building a Relationship between Universities and Entrepreneurs (created by the authors)

Table 5. Levels of the model for building a relationship between universities and entrepreneurs and achievable results in each of them (created by the authors)

Type of model	Achievable results
Basic level	A comprehensive cooperation agreement, periodic, irregular receiving support for college projects and providing various services to business.
Medium level	Building enhanced structured collaboration, facilitating communication between entrepreneurs and educational institutions and offering broader cooperation possibilities and gains from them.
Higher-level	Forming enhanced, structured relations for achieving equal involvement of both sides and co-working in achieving the common goals.

the performance or support of the joint projects. If necessary, the university contacts the enterprise with a request of supporting a particular project or activity whereas the enterprise contacts the university when it needs certain services – arranging personnel training, performing contract research or contract work, etc. On the basic level, cooperation is mostly one-way and the winner is mostly one of the parties (see Table 6) whereas the other party's involvement is rather minimal.

Medium level relations involve more enhanced and structured cooperation on the university's side which makes communication in addition to that more accessible for enterprises and offers broader possibilities for cooperation which is beneficial for both parties. Besides the activities included in the basic cooperation level such as concluding a general cooperation agreement, providing financial support for the university and providing services to businesses, on this level of cooperation the university carries out two important activities for improving the communication process – forming a database enabling any university representative to obtain information about the current communication with the respective company and to make comments as well as creating a platform on the website for topic exchange, proposing discussions, etc. To make providing support easier and more convenient for enterprises, on this level, the university establishes a fund, granting it a social benefit status, and, if possible, affords to pay scholarships to students. Already on the basic level, the universities involve students in providing services to enterprises in order to introduce students who are the most active in the respective areas and to give students a better understanding of the industry problems and updates.

The higher level of building relations, besides the things mentioned above, involves only activities to be performed by both parties together from which not only the respective parties but also general social benefits. These activities are analysis of the industry needs and integration thereof into the university's offer which would be beneficial not only for the respective enterprise but to the industry in general and also to the university's students who would have a possibility to acquire education matching the employment market requirements; this also involves carrying out joint initiatives and projects.

Table 6. Levels and activities of model for building a relationship between universities and entrepreneurs (created by the authors)

		Activity									
Type of model	The winner of the relationship (U-university, E-entrepreneur, S-society)	General cooperation agreement	Financial support	Providing services to businesses	Responsible persons	Forming a database	Creating a platform on the website	Involving students in providing services to enterprises	Establishing a fund	Analysis of the industry needs and integrating them into the university's offer	Joint initiatives and projects
Basic level	$E \rightarrow U, U \rightarrow E$										
Medium level	$E \rightarrow U, U \rightarrow E, U \leftrightarrow E$										
Higher-level	$U \leftrightarrow E, U + E \rightarrow S$										

2.2. Analysis of activities and appointing officers in charge

The next step already is within the competence of the university's functional administrators. Functional administrators should appoint the responsible officers who will carry out the activities. Functional administrators should also define which of the activities specified in the model have already been carried out, how often and to what extent. It should be defined at which level the university currently is and what it lacks to achieve it to the full measure. Functional administrators should also define how many resources improvement of each activity would take.

2.3. Setting forth activities to be carried out

The competence of the university's functional administrators also involves defining activities that should be carried out and timing of performing these activities for the responsible employees, based on the activities defined at the previous stage already been performed and needed to be improved and the ones that should be implemented from the beginning. This timing should be set according to the rates of performance established by the highest administration. For instance, RTU highest administration can set as an achievable goal forming a reviewable database with all agreements signed with entrepreneurs, and the contents thereof within six months. The functional administrators can appoint the employees who will be responsible for processing information.

2.4. Implementation and supervision of activities

Every university that decides to form relations with entrepreneurs according to this model, depending on the achievable level set by the highest administration, has a possibility to

choose to what extent each activity mentioned in Table 6 can be carried out. The decision is taken based on available resources and possibilities.

Further, each section or activity to be implemented is described more detailed.

2.5. Signing a collaboration agreement

The university signs general collaboration agreements with new partners defining the rights and the duties of each party and specifying possible areas of cooperation:

- regular and systematic involvement of the entrepreneur's representatives in the university study process, which can be:
 - guest lectures on the topics known by specialists in the course of the study process and teaching separate study courses;
 - participation in improving study programs, proposing areas that need to be improved and solutions, including specific topics;
 - visits to enterprises within and outside the study course;
 - offering diploma paper themes for the last-year students;
 - participation of the enterprise representatives in diploma papers' evaluation boards;
- the regular and systematic provision of internship to students during obligatory study internship and qualification internships, also to the interested persons who wish to take internships on their own during the time free from lectures;
- granting scholarships to the best students in the area, thus motivating students to higher achievements;
- granting financial and property support to university projects within the possibilities;
- cooperation in research, working on solving problems typical for the area, improving the process efficiency, etc;
- enterprise priority rights to the knowledge generated by the university and technologies in a specific area, etc;
- rights of using the university's infrastructure;
- possibilities of using the premises of the enterprise and the university;
- participation of the enterprise's representative in the convention of counsellors, commenting about the decisions and proposals of the administration, giving advice on more efficient work of the university;
- involvement of the enterprise's employees who have graduated from the relevant university in the university alumni association, offering them respective discounts for attending the university activities, for the services provided by the university, etc.

2.6. Raising funds

Irregular and periodic provision of financial support by enterprises to the university for carrying out various activities and projects which are usually conducted on the basis of the concluded advertisement, sponsoring and other agreements, prepared by separate structural units or student organisations. Support is requested from time to time, and sometimes it is necessary within a rather short term, which does not guarantee that the enterprise will provide it promptly, even if the financing is available since preparation and negotiation of documents sometimes takes time.

2.7. Providing services

Providing services by a university to entrepreneurs; that is not collaboration by nature, but a unilateral service for payment. Universities can offer various contract researches and contract works to enterprises within the competence of the universities, arrange courses for enterprise's employees, offer premises for rent for the enterprise needs, arrange conferences or post announcements of the enterprise.

2.8. Appointing the persons (groups of persons) in charge

The university's administration appoints one full-time employee in charge of maintaining relations and cooperation with entrepreneurs. This person should possess knowledge of communication and marketing to be able to elaborate reviewable, attractive cooperation offers to businesses as well as to professionally communicate these offers to entrepreneurs. This person should be also pro-active and possess excellent communication skills, be proficient in languages in order to be able to communicate both with the domestic and international entrepreneurs and prospective partners, to participate in various technical exhibitions, conferences and seminars, to present the university's achievements, topical projects, to share examples of good practice, etc. This person should also know the structure of the university, the competence and the possibilities of each structural unit in order to get the entrepreneur and the contact person representing the university together in case of specific questions and to continue negotiations on a more detailed level.

Besides the chief person in charge of cooperation with entrepreneurs, the responsible persons in charge of a particular field from each structural unit and faculty of the university should be appointed. The number of these persons depends on the size of the university and the number of its structural units that can offer cooperation possibilities to entrepreneurs.

2.9. Creating a database

The responsible person, together with the rest of the representatives of structural units creates a database administering all activities and communication with entrepreneurs. A similar example in the business environment is the model *Customer Relationship Management*, however, in the case of the university, the direct purpose of the database is not selling but maintaining the relationship. The main sections that should be included in such a database are as follows:

- information on cooperation agreements with entrepreneurs signed and valid by the moment of creating the database and information on:
 - cooperation lines defined therein;
 - current communication and cooperation activities (and their results) and the persons in charge of these duties – contact persons from the university;
 - contact persons from the enterprise;
 - enterprise budget planning schedule if available, enabling to request support at the right moment in case financial support is needed;
- acquired and summarised information from each structural unit of the university on the enterprise, with which:

- any cooperation over the recent years (what type and what the results were);
- unsuccessful cooperation over the recent years (reasons why);
- acquired and summarised information from each structural unit of the university on enterprises that are included in the list of desirable partners, but for some reason have not yet been contacted.

2.10. Creating a platform

The university places a separate platform or section “FOR ENTREPRENEURS” in a place that is easy to see where:

- information on the university is available, and its competence features – what makes it different from other schools are particularly highlighted;
- descriptions of the offered study programs, including information on the schedule – information on subjects that students acquire each semester, information about internships time and length, approximate amount of lectures during each of the courses are available, enabling the entrepreneur as a prospective employer to plan and to contact particular students of particular study programs and to be informed on what they already have acquired and how much time should be devoted to work or internship;
- all possibilities of cooperation with enterprises offered by the university (in research, study process, topical projects, for which support is needed, lists of accessible infrastructures, etc) are described;
- contacts for each of the options mentioned in the previous clause are specified, ensuring the possibility of immediate contacting the responsible person when necessary;
- for each of the possibilities above of cooperation, good examples or examples of co-operation performed with others by the present moment are mentioned;
- discussion on topical themes of the industry are regularly proposed, success stories are published, entrepreneurs are informed on the newest researches, discoveries, etc.

The created platform must be regularly updated, supplemented by new information, success stories, project analyses, reports, usage of finances received by the moment, etc.

2.11. Creating a fund

The university creates a fund with a social benefit status for promoting the university development that can administer receiving donations from entrepreneurs, making provision of financing less costly and more convenient. Majority of higher education institutions in Latvia are state budget institutions where the process of purchase of things necessary for carrying out projects is prolonged. In order to make the performance of different projects less time-consuming, usage of donations received by funds does not have limitations meaning that project performers – responsible representatives of the universities – can purchase services and goods easier, and thus save time which would be necessary for negotiations. The fund can also acquire rights to pay scholarships to students and academic personnel which is an attractive manner of cooperation for entrepreneurs. Various motivating competitions for scholarships and awards provide an opportunity for an enterprise to direct this support as a donation as well as to make the company is known among students – prospective employees.

2.12. Analysis of industry needs and its integration into the offer

Taking into account rapid technology advancement, more and more companies need specialists possessing inter-disciplinary knowledge such as a business analyst with IT knowledge or an entrepreneur with excellent analytic skills and high creative skills at the same time. This is an activity where both employers – entrepreneurs and higher education institutions – should get involved in, and from this, not only the involved party but society in general, including other businesses and current and prospective students would benefit.

The university analyses the needs of the industry and the needed skills and qualifications of prospective employees and enhances the current study programs, creates new programs, interdisciplinary programs, etc., to ensure graduating specialists meet the market requirements. Taking into account the estimated excess of specialists in humanities in the near years, it is topical to create programs with an option of re-qualification for current students as well as to ensure a possibility to replenish this knowledge for those students who have already graduated these disciplines in order to successfully work in the areas where shortage of specialists is more significant, particularly in engineering science, and to prevent the acquired knowledge from becoming unused.

2.13. Joint initiatives and projects

For solving problems topical for the industry, universities, together with entrepreneurs, set forth new initiatives nationwide, elaborate joint projects, programs, etc. Such projects can be competitions and projects for motivating the current and prospective students and joint opinion articles in media, recommendations to management for solving industry problems, etc. In this activity, generating joint ideas and solutions is also very important.

3. Riga Technical University experience or steps towards implementation of the model

In the case with Riga Technical University (hereinafter – RTU) collaboration with the industry – forms of collaboration, shape, defined priorities and goals, as well as their financial support instruments – can be analysed from the point of valorisation. Sustainable valorisation is one of the current university's purposes under the terms of the third-generation (3G) university along with the first two goals: high-quality studies and outstanding research (under the terms of the second-generation (2G) university). The goal of the university's sustainable valorisation is effective to transfer of technologies and innovative development environment that encourages the establishment of new technology companies and product development.

RTU strategy includes the critical settings for RTU development for the period from 2014 to 2020, as well as determines performed activities and sharing responsibility for the performance of assignments. In order to achieve the objectives set, the strategy defines specific performance indicators. The leading indicators of sustainable valorisation are an annual number of patents, revenue from sold patents or licenses, the number of contracts with economic operators and other cooperation institutions, revenue from contracts with economic operators and other cooperation institutions in proportion to the RTU budget for research and established

research-related companies. Once a year the annual objectives and tasks are defined with clear performance indicators at each unit level. Based on these regulations, the implementation of RTU strategy is provided and the annual report on the results is performed.

3.1. Involvement of external partners under improvement of collaboration process of Riga Technical University

During the regular exchange of opinions, the parties' vision of university development is determined. Working methods are applied under cooperation partners group – surveys, focus groups, panel discussions, seminars, forums, individual negotiations, discussions and other types of both direct and indirect cooperation is used to determine partners opinion and vision of higher education institutions cooperate with each of the groups. Representatives from the industry participate in final exam committees, study programs are composed taking into consideration recommendations from the industry and social partners. Representatives from the industry work at the university faculties and conventions or advisory committees. To ensure publicity and promote opportunities for collaboration, seminars, conferences, exhibitions, workshops, etc., as well as companies' visits to the university and lecturer visits to the companies are organised.

The available collaboration network is used by the university to improve and effectively apply existing knowledge, as well as to promote creativity and novelty. Consequently, RTU collaborates with the industry in different ways and forms, in order to cover the broadest possible range of partners and in order to implement the RTU vision by 2020 to become the leading scientific and innovative university in the Baltic states. Latvian and foreign companies place orders and finance contract works for researches, expertise, consultations, development of new materials and technologies, assessment of technological solutions, product development, training of personnel, etc. Collaboration projects are carried out – partnership in European Union industrial research projects and participation in clusters and centres of excellence programs and research projects ordered by industry representatives, as well as in national research programs. Technologies are being transferred and licensed, expertise, design development, prototyping and testing is performed. University provides support for business start-up and spin-off start-ups, product promotion to the market. There are internships provided by companies and student research work following the companies' orders. RTU Development Fund together with companies performs scholarship competitions, for example, practical skills promotion grants. Each year approximately 100 companies participate in the Career Days. The Career Center places job advertisements on its website.

While applying regular and systematic monitoring and evaluating the execution of achieved indicators and set objectives, RTU has become a university with the most significant research contractor attraction of the industry in Latvia. In 2018, 106 contracts with economic operators and other cooperation institutions were signed, 281 scholarship contests were carried out by supporting 776 scholarship holders to the total amount scholarships of 848,789 EUR, which for the most part has been received from companies as funding. RTU is the first university in Latvia that has managed to establish industrial doctoral program – new forms of cooperation with the industry, offering a promotion thesis studies in compliance with the company's interests and needs which correlate to scientific research directions.

3.2. Riga Technical University challenges in collaboration with the industry and implementation of collaboration model

Despite the diversity and achievements of the collaboration as mentioned above types, RTU still faces with numerous challenges during the collaboration process with the industry, also discovered while analysing literature on the international practice – lack of capacity, a different understanding of time limitations, prioritisation challenges, costs, previous collaboration experience, stereotypes and administrative obstacles. Development of collaboration with the industry is affected by fragmented research infrastructure in Latvia and lack of research potential – insufficient funding for product development, different development levels of companies, limited ability of Latvian companies to finance contract work; companies do not form research and development units with highly qualified specialists, development of new products is performed in parent companies; if there are any, or are delegated to the research institutes of RTU, the infrastructure and competence is not always appropriate for prototyping companies.

An equally important problem in addition to the factors mentioned above is institutional fragmentation of collaboration development and provision of services. Namely, all these issues are addressed at totally independent units per their functions. Within the duties of vice-rector for science Innovation and Technology Transfer Center ensures intellectual property protection, promotes formation of innovation and new technologies friendly environment, cooperates with industry representatives and provides the best solutions for business development and scientific ideas commercialisation, while the Design factory is a platform for innovations and business with a well-equipped prototyping workshop, highly-qualified team of experts and scientific support for entrepreneurs, managers and students in order to create innovative ideas, products with high added value and various engineering solutions. Within the duties of vice-rector for Development the Business development department carries out promotion of lifelong education services, provision of training for corporate entities promotes cooperation with municipal institutions, while the Alumni department serves as an information centre for the university graduates, attracts finances (scholarships for students, etc.) and promotes RTU. Within the duties of vice-rector for Studies Career support and service department implements projects, supports the organization of guest lectures and seminars at the university. RTU Development Fund collaborates with different companies, organisations and individuals and offers scholarships for students, as well as attracts donations from companies and individuals for RTU project development.

As far as possible, all structural units communicate with each other and exchange information analysing and arranging co-operation partners, prioritising areas of cooperation, allocate responsibilities within the cooperation for common goals.

A perfect example is a collaboration between the Design factory and RTU Development Fund that successfully started a student innovation grant program – a platform for cooperation between the industry and the students by promoting mutual involvement, development and innovation. The Design Factory implements the contents of the program, but implementation into real life is possible due to the Development Fund which ensures involvement and co-financing attraction from companies along with the European Union funding.

To minimise the effect of the above-mentioned factors, it is necessary to focus on cooperation, reinforcement and development of the necessary resources and expertise. RTU is currently working on the creation of a coordinated and unified communication system. In order to facilitate cooperation between departments, institutes, scientists and departments involved in the technology transfer process and to coordinate commercialisation process collaboration between the interested parties Technology Transfer and Innovation Council was established. The Council will inform the parties participating in the commercialisation process of the companies’ demands and RTU’s offers, coordinates involved partners and helps RTU’s authorities to implement the commercialisation process and to develop collaboration with companies. RTU’s developed collaboration with the industry approach is shown in Figure 2. A joint offer eliminates fragmentation and as a result, the scope covers the higher number of parties involved, besides, providing the targeted offer.

Various industry representatives communicate with multiple RTU departments and representatives about industry needs and the university’s potential for collaboration to get the services they need. The university internally accumulates, processes and coordinates industry demand to provide partners with quality services in research, commercialisation of ownership, transfer of human resource and others. It is a way of providing a frequent external service and meeting industry demand – a single point of contact as a synergy between different university departments through joint coordination, collaboration, KPI’s and tasks set to achieve this goal.

Ideally, it would be necessary to ensure full service and a one-stop-shop for business people and scientists in one place. Experience, knowledge and information should be concentrated in one unit in order to create a new model for collaboration with the industry, not only based on the general sound practice principles but also on the current situation at the

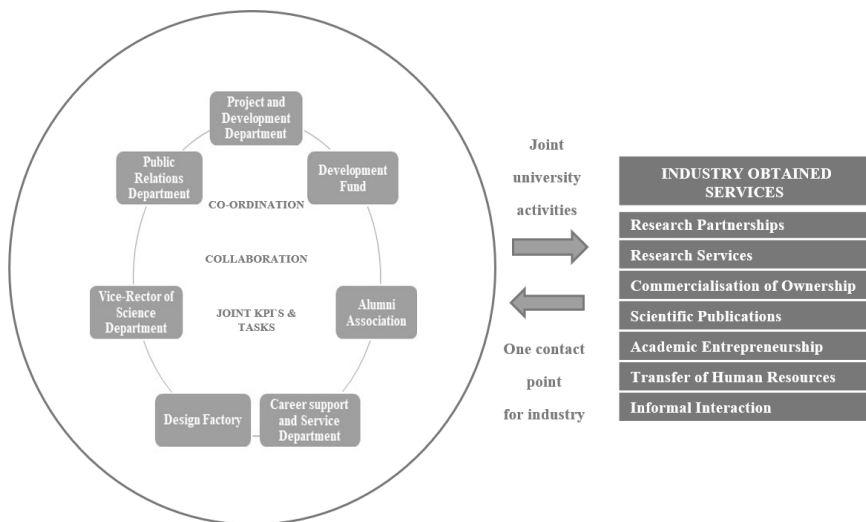


Figure 2. Model of RTU’s collaboration with industry (created by the authors)

university, including the full range of services and involvement of all interested parties. For the identification of all the steps, it would be necessary to start with a more straightforward process – practices, career support activities, etc., which initially do not require a substantial financial and human resources from the company; however, this cooperation creates mutual trust for further implementation of financially and personally more involved projects. When there is a reasonable basic one may be developed in other directions by offering coordinated diversity. As a result, there would be new services offered with a higher added value.

Conclusions

According to the literature analysis performed by the authors, the main problems in collaboration between entrepreneurs and universities is a) lack of structured communication with industry and internal communication between structures that implement collaboration and b) lack of a unified system for such cooperation at the same time categorising partners and activities aimed towards different partner target audiences, therefore authors have developed a model for enhancing cooperation and better relationship building.

To effectively organise the collaboration with industry authors have introduced SADI model. This approach allows the university to evaluate the current situation in collaboration with the industry and define, based on intended achievable results of such collaboration, what else should be done. Suggestions are provided on how university's management should apply a model to build a structure for cooperation with industry, create an appropriate organisational and university-wide coordination structure, plan cooperation activities and monitor them, thus achieving the creation of a stronger bond with industry and promoting trust.

Implementation and approbation of the model in one of the leading technical universities in the Baltics – Riga Technical University – proves that implementation of the model and its activities at the university can provide specific improvements, showing how to introduce the model slowly into the current complex system in order to improve communication with existing partners and develop new collaboration opportunities.

Further research

For further research, authors suggest creating a formula for financial calculations to determine achievable SADI model level. The formula should include indicators such as available financial resources, human resources (working hours, average salary level in-country etc.), amount of additional resources etc. Such calculations would allow the higher management of universities to understand their opportunities better and plan budget.

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