# Development of the System of Knowledge and Technology Transfer at Charles University

**- Case Study of Charles University Innovations Prague s.r.o.-**

MSc Entrepreneurial Engineering 2018-2020

# MASTER'S THESIS

CHARLES UNIVERSITY INNOVATIONS PRAGUE s.r.o.

4th-semester project
June 2nd 2020

AALBORG UNIVERSITY

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**AALBORG UNIVERSITY**
STUDENT REPORT

**Title:**
Master's Thesis: Development of the System of knowledge and technology transfer at Charles University - Case study of CUIP

**Theme:**
Entrepreneurial Practice

**Project Period:**
Spring Semester 2020

**Project Group:**

**Participant(s):**

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**Supervisor(s):**
Claus Andreas Foss Rosenstand

**Copies:** 1

**Page Numbers:** 79

**Date of Completion:**
June 2, 2020

**Abstract:**

The work comprised in this thesis is the result of the fourth-semester project, put together and described by a student of MSc Entrepreneurial Engineering at Aalborg University.
This report is a description of the steps taken and methods used by the student. The aim of this project is the development plan for *Charles University Innovations Prague (CUIP)*, which is a limited liability company dedicated to the technology transfer from a public university located in the capital city of the Czech Republic. The project focus is on finding a solution to the current economic issues of the case company by fitting into an innovation ecosystem.
Multiple tools and methods taught in courses in entrepreneurship and innovation are used in the report. The report also contains personal reflections on the case study and the methodology trained through the program.

# Contents

# Preface & Acknowledgement

This process report is written as a description of the process and outcome of the fourth-semester project in the study program of MSc Entrepreneurial Engineering at Aalborg University. This semester focuses on the implementation of the knowledge obtained in the three previous semesters, while it holds the overall theme of the Master's Thesis. The total credit is 30 ECTS.

The making of this project would not be possible without the help and guidance received. I would like to express my sincere gratitude to my supervisor Claus Andreas Foss Rosenstand for his valuable guidance, support and input throughout this project.

Heartfelt thanks to Otomar Sláma, Dr Matěj Machů, Dr Daniela Králíková and Dr Antonín Králík for their cognitive contributions and support, which included a lot of laughter, a pleasant working place, motivation incorporated in words or pastries and sweets, kindness and making me feel welcome in CUIP.

Deepest appreciation is due to Peter Rasmussen, who shared a truly interesting experience of his team at Technology Transfer at Aalborg University with me, and whose hour and a half dedication to me significantly inspired the outcome of this project. I am honestly grateful to Dr Aleš Vlk for facilitating me a new view on the innovation environment in Prague and possible prospects of CUIP. I am indebted to Renáta Králová for her contributions in identifying the needs of the innovation environment in Prague from the viewpoint of Prague's Municipality. My thanks go to Monika Frantová too.

In addition to this, many sincere thanks to the SuperWiseNet advisers for their valuable feedback and for challenging me for the best outcome.

Last, but not least, I would like to express my profound gratitude for the endless encouragement of my beloved family and friends, especially Christoffer Danst and Arthur Magnago Giuri, who are also the two most fun-to-be-with and inspiring classmates, and Ruth Habartová, and Rozi Stejskalová.

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Aalborg University, June 2, 2020

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# 1 Executive Summary

*Charles University Innovations Prague*, abbreviated as *CUIP*, is a wholly-owned subsidiary of the Czech oldest public university, Charles University, where the discoveries of 50 000 students and 4 500 academics have an enormous potential to benefit society and to become interesting business cases. *Centre for Knowledge and Technology Transfer* (i.e. *CKTT*) at Charles University identifies this potential, which is validated with customer-companies and commercialised by CUIP. The process of transmitting the R&D (Research and Development) results, which are achieved at the publicly funded academic workplace, to the commercial sector, and their subsequent use, is called *technology transfer* (i.e. commercialisation) (Štěch & Dvořák 2008).

CUIP is the first and only technology transfer subsidiary company with the limited liability of a public university in the Czech Republic. Hence, the customer-companies benefit from fast and flexible interaction with CUIP, in contrast to other Czech TTOs (Technology Transfer Offices), which are integrated to a university (e.g. CKTT) and whose responsiveness is delayed due to the university-dependent decision-making process. Moreover, the extended team of CUIP by two market-potential analysts from CKTT has very strong competencies in the two key value-contributions of any TTO according to Rasmussen (20/05/2020), the Head of the TTO at Aalborg University. In systematical identifying of the commercial potential of the R&D results and in translating them into an interesting business case for investors, companies, entrepreneurs (Rasmussen 20/05/2020). There are three forms of a TTO's output, which are proposed to a customer in the Czech Republic: licence of a patent or know-how (i.e. trade secret), patent, and spin-off in the less frequent cases (Sláma 2018). However, CUIP offers product prototype too, which dramatically increases the customer-perceived value of the intellectual property rights.

Currently, 98% of the CUIP revenues stream from the fixed fees, which are paid by Charles University (Sláma 26/05/2020). The dependence of CUIP on Charles University for the first 10 years of its existence is in line with the experience of the western countries (e.g. the United Kingdom, Israel) (Sláma 2018) and with the business plan of CUIP, which was composed before the establishment of the company in June 2018. Unfortunately, the effects of the *COVID-19* (i.e. epidemic disease, due to which many measures have been taken in March 2020 to prevent it from spreading in the Czech Republic) negatively influenced the budget of Charles University, whose cost-cutting procedure caused economic crisis of CUIP. Therefore, the interest and compassion drive the student of Entrepreneurial Engineering program to apply the study-related theories and practical experience to face this challenge.

The research seeks the solution to crisis of CUIP in the environment of the case company and in the experience of a TTO at Aalborg University. In particular, the environment of CUIP consists of Prague's innovative infrastructure, which characteristics are explored by the literature on innovation ecosystems (e.g. Adner (2012),Talmar (2018)); by analysing relevant survey results, which are shielded by public institutions (*The Regional Innovation Strategy of the City of Prague* by Municipality (2018), *Motives, Barriers, and Services regarding Technology Transfer in the Czech Republic – an Analysis of the TA CR Survey 2014* by Heilemann et al. (2014)); and by interviewing the innovation politics specialist from the Prague's Municipality and the founder of the most important Czech news portal on R&D. To amplify the practical output of the thesis and to confront all the concerns about chosen methodology and validity of collected data, the Head of the TTO at Aalborg University is thoroughly interviewed too. To understand the basis of crisis of CUIP, the structural, financial and business characteristics of CUIP are

investigated based on the documents form an archive of CUIP and based on interviews with the team members. The business of CUIP is framed by *Business Model Canvas* by Osterwalder & Pigneur (2010) to have a clear overview of revenue creation.

The essence of the crisis of CUIP is revealed to be the frozen hiring process, the frozen developing activities which should create revenues in the long run, the insolvency regarding spin-off company of CUIP and the insufficiency of man-hours to dedicate all the core activities of CUIP. The key characteristic of Prague's innovation infrastructure turns out to be its demand. The demand in Prague's innovative infrastructure is aimed to be addressed only in that case when the resolution can be provided by CUIP or inspire the business-development of the case company.

The research outcome consists of numerous suggestions to CUIP, some of which might also mitigate its crisis. The recommendations are the following.

Improve the website of CUIP to target a specific audience with a personalised content, which clearly addresses the cognitive needs.

Facilitate more internships for the current students of Charles University to build an understanding in future researchers, how are applied research and delivering value to society important. Promote commercialisation successes as great contributions to society to build respect for this activity. Organise a lot of activities at Charles University, which is encouraging the curiosity of students in applied research and entrepreneurship (e.g. Hackathons), or where students, researchers, serial-entrepreneurs and companies can gather and have stimuli to get cross-disciplinary knowledge. Build an open system, where anyone is invited and motivated to bring some sort of value.

Conduct further research on EU financial instruments (InnovFin Technology Transfer is not relevant) and apply for funds even without a team member with prior experience with it. The potential of getting needed resources exceeds the risk of poorly invested time.

Eliminate the unnecessary administrative steps in the technology transfer process to improve the experience of customer-companies of CUIP and researchers of Charles University; and monetize the know-how, if applicable. Validate the willingness of *Technology Agency of the Czech Republic* or other relevant organisation (e.g. a TTO within the network of Transfera.cz, CTU, etc.) to pay for the know-how to faster and less administration-heavy commercialisation procedure, once testing technology transfer process of CUIP works without the steps, which are assumed to be redundant.

Adapt the following vision statement: To become the technology transfer ecosystem leader within the region of Central Europe. The author of the project proclaims CUIP being capable to become the builder of the technology-transfer ecosystem in Central Europe or even further, in case of surviving the economic crisis and when striving for demand-driven business attitude, building the focus based on clearly defined values rather than models, delivering a great experience to researchers and customer-companies during any interaction, and inviting to the technology transfer process of CUIP as many valuable subjects to as possible.

Based on the inspiration from the interview with the Head of the TTO at Aalborg University, a key pieces of advice to the crisis of CUIP are as follows.

Increase the proportion of trade-secret licensing within the overall activities of CUIP. Savings on patent-related costs can be refunded by CKTT and used for operations. The potential advantages (e.g. of positioning within the Charles University as the company with a trusted network; the image of an initiator of a value-driven KPIs at Charles University; valuable learning in case of IP being stolen) exceed the disadvantages of risks related to non-protected IP.

Validate the willingness of industrial customers to pay for having the Director of CUIP,

alternatively other CUIP members, as member in a Board of Directors companies, which are newly established by the potential client. Later, decide how much revenues would be worth spending the man-hours of the team of CUIP on such a value proposition.

# 2 Technology Transfer

The thesis concerns the business development of the Charles University Innovation Prague s.r.o.[1] (hereafter CUIP), which is dedicated to the technology transfer and which is a subsidiary company of Charles University, the Czech oldest public university located in the capital city of the Czech Republic. Therefore, this chapter introduces the technology transfer and its broader context in the Czech Republic. A key part of this chapter is the description of the CUIP business, together with its challenges. Accordingly, the research question is formulated.

## 2.1 Definition

Technology transfer is explained by various literature sources differently. The term can be explained as "a purposeful process (with a limited duration) of dissemination of knowledge (created by a different organization) to innovate new or existing products and technologies" (Švejda & collective 2007, p. 70) or "any interaction between academia and commerce leading to technological and later commercial innovations" (Štěch & Dvořák 2008, p. 17). The purpose of the technology transfer, in such board meaning, is to balance demand and supply and to bridge the gap between the different levels of R&D findings of distinct nations or entities. (Švejda & collective 2007)

In this sense, technology transfer involves various forms ( e.g. white papers, conferences, non-commercial consultancies etc.). The most important form of relocating the know-how out of a university is the transfer of graduated students to their workplaces. Another recommended manner of the dissemination of academic findings is the joint research and development of academic and commercial partners. Nevertheless, all the mentioned ways of implementing academic knowledge in the commercial area are not classified as the technology transfer by Charles University. (Štěch & Dvořák 2008)

**The most suitable definition of the technology transfer for the thesis** is **"the transfer (= the transmission) of research and development results achieved at publicly funded academic workplaces to the commercial sector and their subsequent use"** (Štěch & Dvořák 2008, p. 17). Therefore, commercialization and technology transfer can be used as synonyms. Based on interaction model of academia and commerce, which is reflecting on the European legal reality and mentality, the three **forms of transferred technology** include **patenting** and later **sale of the licence or patent**; establishment of a **spin-off** company; and **direct commercialization** by the academic workplace (e.g. by offering a service). (Štěch & Dvořák 2008)

## 2.2 Typology

How can a university set a technology transfer organization? The most common setting is an **integral technology transfer office (TTO)**, which is a part of the university. In this case, the advantage is natural information flow and level of trust between the university and to the TTO. The disadvantage is the limited operational agility of a TTO due to the long decision-making process involving several levels of the academic hierarchy (Sláma 2018).

The second setting is the establishment of an **external technology transfer entity**. In this instance, the technology transfer entity benefits from a dynamic decision-making process,

[1] s.r.o. stands for Czech abbreviation of the limited liability company

which is independent of the parent institution. On the other hand, the technology transfer company might face difficulties with financing or with building trust with the university representatives. Such an entity is always under the university's concern of being redundant (Sláma 2018).

The third setting is represented by the joint centre, where more organizations ensure the commercialization process at the same time. This explanation is, however, not in the scope of the thesis.

## 2.3 Czech Technology Transfer

Four decades of social politics in the history of the Czech Republic influence society in different aspects. When it comes to entrepreneurship, the approach to it is not as positive as in the USA or Israel (the biggest players of technology transfer). Especially, the Czech academic community receives business-doing with mistrust. Not only the lack of trust in business would make it impossible to carry out the transfer process as in e.g. the USA, but also the major differences in the legal environment (Sláma 2018).

In the 1970s the universities in several European countries started to engage more in the activities, which are supporting the implementation of academic R&D in the industry (Sláma 2018). While the territory of the Czech Republic turned back to democratic principles in 1989 and as late as the beginning of the 1990s the new system for supporting the R&D (Research and Development) was founded. Since then, the government has been encouraging R&D by new laws, the establishment of public organizations (e.g. The Czech Science Foundation, the Technology Agency of the Czech Republic etc.), increasing financial investments into R&D (Blažka & collective 2014).

To boost the economic growth of the Czech Republic, the universities were pressured to involve in their "third mission", where "increased focus on innovation as a key driver for our societies is influencing every single university mission" (Jorgensen 2019). The third mission, the term frequently appearing in the Lisbon EU strategy accepted in 2000, means that apart from researching and teaching the university should also implement the academic R&D results in the society. So this third mission is the transfer of technology to the production, the services, and other economic sectors. In the context of European Union (EU) countries with similar legal systems as in the Czech Republic, there are three methods for technology transfer described in Section 2.1 (in bold letters).

## 2.4 Charles University Technology Transfer

In 2007 the Centre for Knowledge and Technology Transfer of the Charles University (hereafter CKTT) was established as an integrated part of the university. Its roles, which are connected to the commercialization process, including advising, formulating methodologies, educating, establishing partnerships, and building the innovative structures at Charles University (Štěch & Dvořák 2008).

More detailed, CKTT is providing the faculties advice in the field of IP (Intellectual Property) protection or law and it organizes a course and training regarding innovation and entrepreneurship. These and other activities are supporting the credibility of CKTT in the eyes of the staff of Charles University (Sláma 2018). Moreover, CKTT is building valuable connections with the universities in the Czech Republic and abroad, with the technology transfer offices, or ProTon Europe (a pan-European transfer organization) (Štěch & Dvořák 2008). CKTT is

achieving several successes, among which the most stands out the establishment of the network of 45 scouts (CPPT 2018). Scouts are trained in identifying business opportunities with commercial potentials.

However, there are some **drawbacks** regarding the integral setting of a technology transfer office. As mentioned in the Section 2.2, CKTT cannot react fast enough to accommodate the eventual requirements of third parties (e.g. investors, licence buyer etc.), due to the complex decision-making and authorizing process of Charles University. More importantly, when CKTT enters into commercial negotiation with an investor, the TTO represents the property of the whole Charles University. In the case of unfavourable court proceedings with the investor, the University can lose not only the financial resources allocated for the CKTT, but also the total University budget, buildings, and other property (Sláma 2018).

**As a reaction to the two major pitfalls of the integral setting of CKTT, Charles University decides to found a subsidiary company**, which is exclusively owned by the University (Sláma 2018).

## 2.5 CUIP

CUIP (Charles University Innovations Prague s.r.o.) is a wholly-owned subsidiary of the Charles University founded in June 2018. It is a research and knowledge dissemination organisation, whose primary goal is to widely disseminate results created at the Charles University. Another aim is to secure utilisation of IP of the Charles University in the field of R&D and its use for business, industrial, and other similar purposes, i.e. their commercialisation. CUIP can establish or buy shares in spin-off companies to commercially utilise IP of the Charles University. Within this field, CUIP closely cooperates with the internal technology transfer office, CKTT (CUIP 2020).

Based on recommendations and experience of the foreign partners, the internal transfer office CKTT and CUIP work in parallel. Once CKTT identifies the business opportunities with a commercialization potential within Charles University, the projects are forwarded to CUIP. Therefore, CUIP focuses on the final stage of the technology transfer process. The business opportunities are deeply analysed again, in terms of the competition, the market potential or the use cases. Once validating the commercial potential of the project, CUIP finds a partner for licensing or selling the IP or establishes a spin-off company.

Key activities of CUIP involve negotiating of licences or other arrangements, business planning, investment and facilitation of the external capital for university spin-offs and their establishment.

## 2.6 CUIP Challenge

In March 2020 the Czech Republic has to deal with the unfavourable development of the epidemiological situation in the incidence of the disease COVID-19. Thus, many emergency measures are taken by the Ministry of Health of the Czech Republic. One of the measures negatively influences the economic situation of Czech public universities, because of the income loss related to the exchange students. The parent institution of CUIP, Charles University, is critically impacted too. It is clear, the effects of the current crisis are becoming a big challenge for CUIP.

## 2.7 Project Proposal

The priority of this project is to compose an overall well-suited development plan for CUIP, which may contribute to resolving the current economic challenge caused by the incidence of the disease COVID-19. The thesis is not discussing the disease, but it questions how does the crisis relate to COVID-19 projected to the business of CUIP. Once identifying the biggest pain of CUIP caused by the crisis, I am interested in finding a solution in the fields of study of entrepreneurial engineering and innovation ecosystems.

Striking the balance between academic writing and political real-world constraints is not easy. Methods otherwise applicable in a startup environment can in this case study easily encounter legal barriers and be of zero use. What might be a brilliant solution for a technology transfer subsidiary company in Israel, can fail in the Czech Republic due to the cultural difference.

In conclusion, the project proposes a plan for passing through the crisis, eventually developing after the crisis is over, by implementing the theories introduced in the Entrepreneurial Engineering master programme. While conveying the project, the academic findings are going to be continuously shaped by real-world input and by considering the external environment of the case company through its innovation ecosystem.

## 2.8 Research Question

Based on the discussion with CUIP and the learning objectives of the student and curriculum the following RQ (Research Question) is formulated:

*How to help CUIP with my entrepreneurial-engineering experience to stay in business despite the effects of the (COVID-19) crisis, while continuing the operation of Prague's innovative infrastructure?*

# 3 Methodology

This chapter explains the publication design and the iterative path of composing it from the research design. The research design is demonstrated on the *Research Onion* model, which gives a complex understanding of the research preparation and how the data are collected throughout the project.

## 3.1 Structure

The RQ (see Section 2.8) implies a set of **WQs (Working Questions)**. This section introduces the WQs (in bold letters) and describes, how they are addressed. The structure of the thesis (i.e. publication design) is composed according to the order of the addressed WQs.

The first WQ1 is: **What characterises CUIP?** To answer the WQ1, the thesis examines the organizational structure, the financial characteristics, and mainly the business models of CUIP. The business models are evaluated based on the theory of Business Model Generation by Osterwalder & Pigneur (2010). Accordingly, the business model reveals the true value creation and the key components of the business. The cultural, legal, and historical background of technology transfer, which is the core of the business of CUIP, is described in the introduction chapter (see Chapter 2). The project concerns the use of Porter's Five Forces by Porter (1998), PESTEL analysis, or similar tools for examining the environment of CUIP because of specifics, which are resulting from being a support institution for a public institution. Therefore, the environment of the business is investigated further only from the perspective of Prague's innovative infrastructure.

The second WQ2 is: **What are the effects of the COVID-19 crises to CUIP?** To answer the WQ2, the representatives of CUIP are interviewed and an internal document of CUIP, which is reporting the crises situation.

The third WQ3 is: **What characterises an innovative infrastructure?** To answer the WQ3, the literature research on innovative infrastructure is conducted with the main aim to identify the key attributes of an innovative infrastructure, which are useful for a particular company. Applicability of innovative infrastructure for a company brings the research focus on innovation ecosystems.

The fourth WQ4 is: **What characterises Prague's innovative infrastructure?** To answer the WQ4, the findings from the WQ3 has to be incorporated. The Ecosystem's Pie Model by Talmar (2018) is put into practice to map the key participants of Prague's innovative infrastructure and estimate the motivation of delivering the value of technology transfer. The main data source for the model is the Regional innovation strategy of the City of Prague by Prague's **?**.

The fifth WQ5 is: **How to support Prague's innovative infrastructure?** To answer the WQ5, the qualitative data are collected through the interviews. Other key sources of information for replying the WQ5 analysis related to technology transfer and innovation conducted by public organisations. The aim is to identify the main issues of Prague's innovative infrastructure. The key determinant of data use-ability is whether the problem can be addressed by the existing value proposition of CUIP.

The sixth WQ6 is: **How to help CUIP to stay in business?** The thesis implements the Wide Lens theory by Adner (2012), according to which a company can benefit from its ecosystem only in case the company adds value to the ecosystem. Translating this principle to the case,

the following hypothesis is articulated: CUIP can solve its crises when solving the ecosystems issue. Once identifying the problem of Prague's innovative infrastructure that CUIP can solve with its existing value proposition, the solution is investigated further, if applicable. In such event, the WQ6 is answered. Other solutions are described based on observation of CUIP team.

The seventh WQ7 is: **How can I support with my EE (Entrepreneurial Engineering) experience?** To answer the WQ7, the EE literature is reviewed.

## 3.2 Research Design

Moving from research design to publication design is an especially challenging process when a real-world problem is examined. Problem-based learning is highly iterative, so collected knowledge and evidence reshapes several times throughout the project the writing style, content and the order of the writing sections. To produce a coherent and well augmented Master's thesis, the publication design (see Chapter 3) is different from the research design. The RQ (Research Question) is formulated first and results in WQs (Working Questions), which is a top-down approach. However, the bottom-up approach needs to be implemented too, because the RQ and WQs are interrelated. Hence, when processing a WQ, its formulation might change, and then accordingly also the RQ requires reformulation. The RQ represents the whole research design and the WQs its parts (see the final version of RQ and WQs in Section 2.8). The thesis implements the 'Research Onion' model by Saunders & Tosey (2013) to illustrates the stages of developing the research. The thesis implements the 'Research Onion' model by Saunders & Tosey (2013) to illustrates the stages of developing the research.

### 3.2.1 Research Onion

The generic 'Research Onion' model by Saunders & Tosey (2013) illustrates the stages that need to be covered in the research process. The purpose is to understand the core of the onion in relation to its outer layers, see Figure 3.1.

When applying the model to this project, the purpose of the model is to understand the relation between the usage of the primary and secondary source and the overall concept of the project. There are 6 layers which are described below, beginning with the outer layer:

- 1st layer - Philosophy: *Pragmatism*. The project research philosophy accepts the concepts to be relevant if they support the action of resolving the research question. Firstly, the problem concerned by the research question is identified and viewed within its broadest of the case company. This leads to research inquiry, which seeks to better understand and ultimately solve the problem. The pragmatic philosophy is chosen because the research findings are aimed to result in suggestions (or development plan) or business model change of the case company. Therefore, any research methods, approaches, strategies, which help come to the practical solutions for CUIP, are applied (Dudovskiy 2019).

- 2nd layer - Approach: *Inductive & Deductive*. Pragmatism allows both, inductive and deductive research approach. Any approach that can address the research question is used in the project (Dudovskiy 2019). Firstly, qualitative data are collected to grasp the essence of the crises and the ecosystem surrounding the case company, and the relevant theories. Accordingly, the initial part of the research uses the inductive approach to

build new findings. The findings serve to construct hypotheses, which need to be tested for answering the research question. In such event, the deductive research approach is applied to the project as well.

- 3rd layer - Strategies: To achieve the aim of the project - to help a case company from crises - the main strategy is a *Case study*. Therefore, literature sources are applied to the case of CUIP or its environment. How is the help from crises addressed? By understanding the Prague's innovative infrastructure. Hence, the data (about CUIP, the crises, the innovation infrastructure, and Prague's innovative infrastructure) needs to collect from observation and theory to generate solutions for CUIP. To ensure the viability of a solution, it has to be tested. A strategy proceeding in the described manner is called *Grounded Theory*. Using several strategies is in line with the overall research philosophy of the thesis because pragmatism applies any strategy useful for a practical outcome.
- 4th layer - Choices: *Multi-methods*. To answer the research question, the qualitative, as well as quantitative, information is used. However, the focus of the project stays on the qualitative. In this way, both types of data are analyzed, from the same qualitative viewpoint. This means that the emphasis is on the characteristics of the problems and needs of Prague's innovative infrastructure, when examining the topic, not on the number of the interviewees agreeing on a certain problem.
- 5th layer - Time horizons: *Cross-sectional*. Most of the observations are for a single point of time. However, the used literature sources may study aspects over a longer time frame. For instance, the Regional Innovation Strategy of the City of Prague by the Prague's Municipality (2018), which is a key information source for Chapter 6, concludes results out of analyses conducted from 2014 to 2017.
- 6th layer - Techniques and procedures: are described in Subsection 3.2.2.

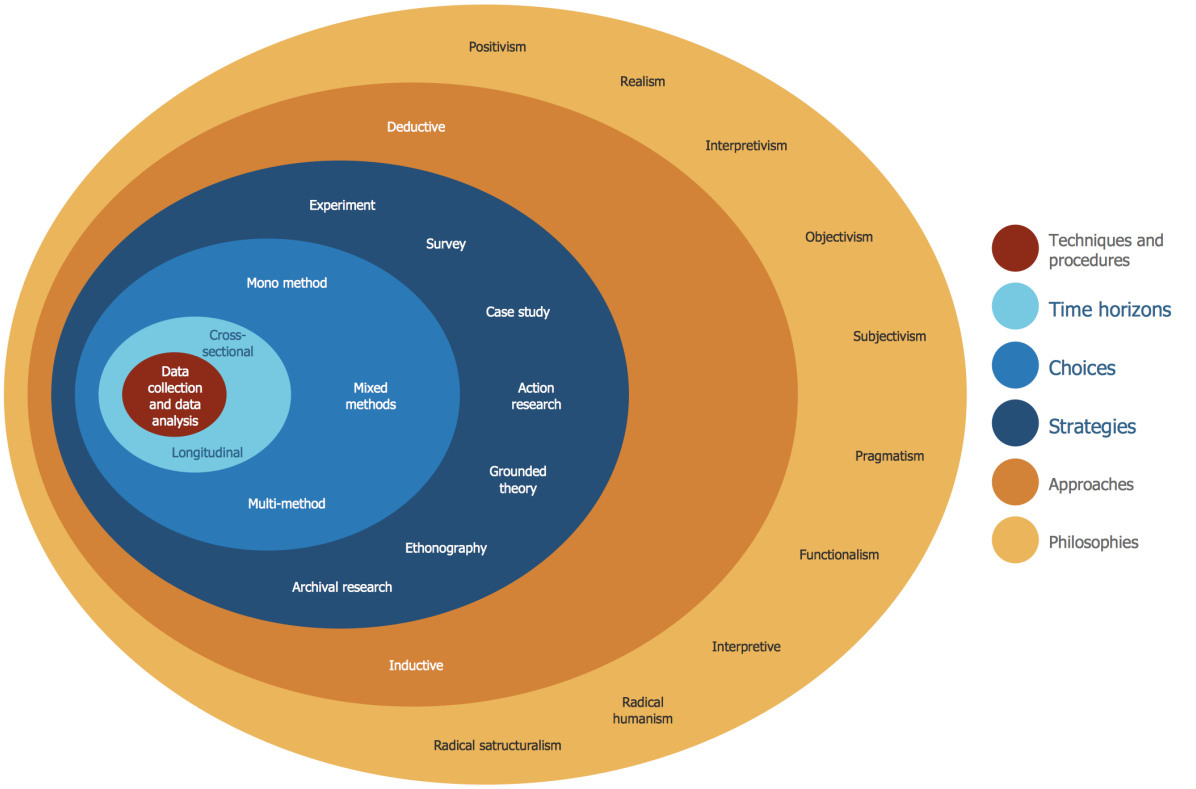


**Figure 3.1:** Research Onion. Source: https://www.conceptdraw.com/solution-park/management-stakeholder-onion-diagrams?utm_content=bufferb7d7c&utm_medium=social&utm_source=pinterest.com&utm_campaign=buffer

### 3.2.2 Data Collection

During the project work, several types of data sources are used for data collection. All these sources are referenced using the Harvard citation and are found in the Bibliography section of the report.

One of the techniques used for data collection is a literature study, where mainly Business Model Generation by Osterwalder & Pigneur (2010), The Wide Lens by Adner (2012), and The Lean Startup by Ries (2011) are used as an information base. These books are supported by articles and reports.

An important source of information about CUIP is internal materials including business plans of its spin-offs, annual reports, press releases etc.

#### Primary source of data

Apart from the secondary source of information, the project gathered a primary source of information. For a better overview, the consultants are listed below.

Consulting with the core team of CUIP proceeded constantly throughout the project. The following members of the case company represent an important information source regarding CUIP: Otomar Sláma, Director; Matěj Machů, Deputy director and Patent Attorney; and Daniela Králíková, Project Manager. In order to have the big picture of the technology transfer at Charles University, the relevant members of the key CUIP partner, CKTT, are interviewed

too. Particularly, Antonín Králík, Commercial potential annalist and Research specialist and Monika Frantová, Financial consultant.

In order to get insights about the innovation infrastructure in Prague Renáta Králová (innovation politics specialist from the Prague's Municipality) and Aleš Vlk (founder of vedavyzkum.cz, which is one of the most important Czech information sources about R&D) are interviewed. A key information source is the Regional Innovation Strategy of the City of Prague by Prague's Municipality (2018).

## 3.3 Conclusion

The main aim of the methodology is to elaborate on theories, tools, principles, which are chosen to answer the RQ of the thesis. The chosen philosophy gives research freedom in using anything, which is useful in coming to a practical solution. Figuring out the practical solution for CUIP is, however, is a very challenging goal. The reason is a political context of the case, legal restrictions limiting CUIP, time-limitations of the project, and my lack of experience with the relevant thesis topics, which turned out to be behind the entrepreneurial engineering curriculum.

# 4 | CUIP

*WQ1: What characterises CUIP?*

The following chapter is answering the WQ1 to highlight the main attributes of CUIP. To grasp such a compound question, it is divided into several sub-questions. How is CUIP structured? What motivates CUIP? Who stands behind CUIP? The Business Model Generation by Osterwalder & Pigneur (2010) is followed to frame also the following sub-questions. What value does CUIP propose and to whom? How are the revenues created? What are the main cost drivers? What are the key resources and activities? What partners contribute to delivering the value?

## 4.1 Organizational Structure

CUIP, the abbreviation of Charles University Innovations Prague, s.r.o., is a limited liability company. CUIP is a wholly-owned subsidiary of Charles University. Firms domicile is located in Ovocný trh 560/5, Praha 1; in the centre of the capital city of the Czech Republic. However, the operations are conducted from Petrská 1180/3, 110 00, Prague (see Fig. 4.1).


**Figure 4.1:** The office of CUIP. Source: Archive of CUIP. Modified.

The organizational structure (see Fig. 4.2) the General Assembly, the Governance Board, and the core team. The General Assembly represents the owner, Charles University, and can appoint the members of the Governance Board and the CEO of CUIP. The task of the Governance Board is to control the performance of the CEO, the fulfilment of the goal and purpose of CUIP. Most importantly, the Board looks after the use of the financial resources (www.justice.cz 2018).

The current team is formed by 5 members (see Section 4.1.3), who are experienced and knowledgeable in their field. The CEO mentors the Director and the Deputy Director, who take the key decisions. Moreover, the team includes the Project Manager and the In-house Lawyer. In case of need, the Research Analysts or the Financial Manager from the partner. More details about the team in Subsection 4.1.3.

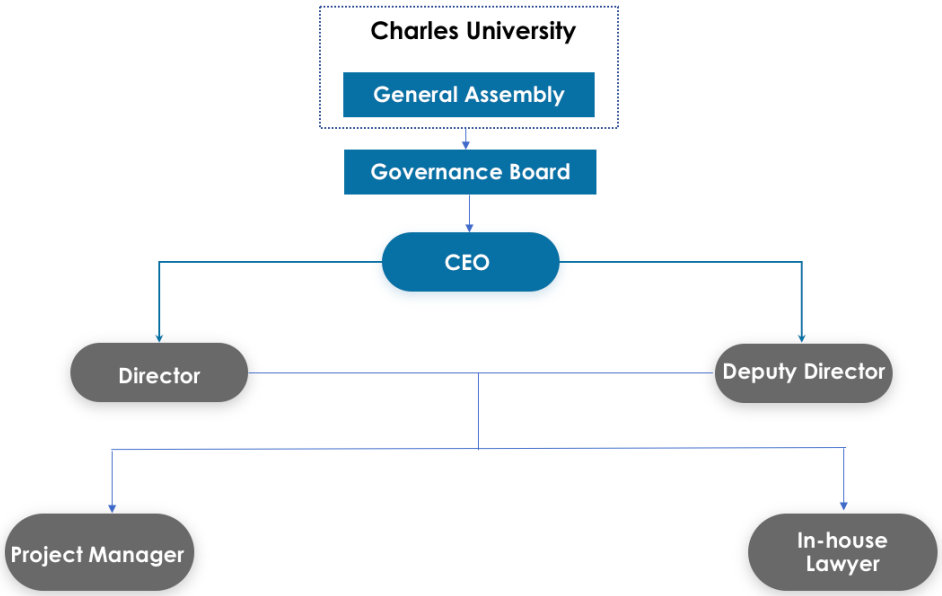


**Figure 4.2:** Organizational Structure of CUIP

### 4.1.1 Mission, Vision, and Goals

**Mission statement:** To transfer technology created at the Charles University (i.e. UK) to the real life. The author of the project suggests this **vision statement:** The vision of CUIP is to become the technology transfer ecosystem leader within the region of Central Europe. The statement is argued in Section 12.3.

**Goals:**

- for immediate future:
  - spreading the brand awareness inside and outside the Charles University
  - building more links with more external partners
  - building positive PR for CUIP and Charles University
  - expansion of the core team
  - involvement of external capital (further investment partners)
  - delivering the services in high quality
- long-term ones:
  - economic self-sufficiency
  - establishment and development of other spin-off companies
  - profitability

first exits from previously co-funded companies.

**The objectives for the beginning of 2020:** As a part of the developing plan of CUIP, an Innovation Account Manager should be hired at the beginning of April 2020. Moreover, because of the planned extensions of the office, also a construction engineer and a financial manager have to be employed too in April 2020 too.

### 4.1.2 Relationship between CKTT and CUIP

**Company history:** Charles University has a Centre for Knowledge and Technology Transfer (CKTT) as a part of the university since 2007. However, the legal structure of a university is not convenient for commercial operations (see Section 2.4). Therefore, CUIP was founded in 2018.

The team of CUIP is still mostly formed by the current or former employees of CKTT and cooperation between both entities is very close. CKTT provides legal and intellectual-property support to scientific research teams at the Charles University and identifies interesting topics and ideas within the University. Moreover, CKTT ensures analysis of the commercial potential, identification of the potential customers and the patenting process of an invention.

Wheres the main focus of CUIP is on the final part of the commercialization process; co-operation with business partners in the commercial sector (the customers) and with investors. Typical workflow is following (see Fig. 4.3). CKTT finds an idea and provides consulting and grant to the originator of the idea at the Charles University. The commercial and innovative potential of the idea is analysed. The potential customer is identified. Once the patent is pending (or the patent application is submitted), CUIP receives the case.

CUIP forms the business strategy and validates the commercial potential, negotiates with the business partner, who is interested in using the patent or trade secret and know-how (or buying the prototype formed based on the patent or buying the spin-off established by CUIP to develop the product based on the patent).

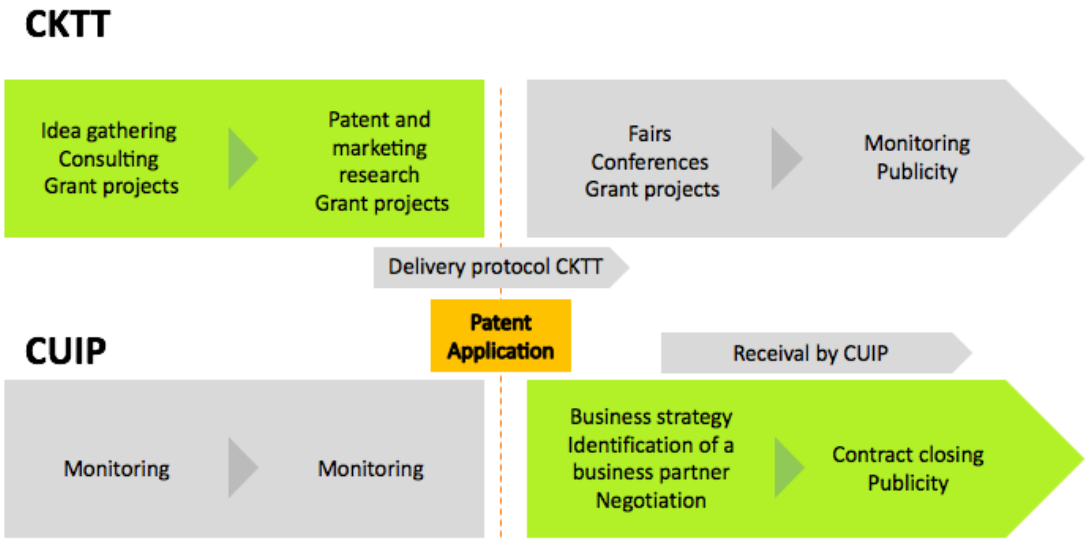


**Figure 4.3:** Relationship arrangement between CUIP and CKTT. Source: Archive of CUIP. Modified.

### 4.1.3 Team

The team (see Figure 4.4) is formed by experts on business, intellectual property, law and project management. The experiences of the members are described below based on the information in www.cuip.cz (2020).


**Figure 4.4:** Team of CUIP. The order of the stuff from left: CEO, In-house Lawyer, Project Manager, Deputy Director, Director. Source: Archive of CUIP.

**CEO – Ivo Žídek:** He worked as an advisor to the Rector of Charles University in the field of commercialization and closely cooperated in sponsorship and fundraising activities. He was the Managing Director of the Sanofi Group in the Czech Republic and stood at birth and worked in the boards of the International Association of Pharmaceutical Societies and the Association of Innovative Pharmaceutical Industries.

**Director – Otomar Sláma:** Graduated in public policy in research, development, and innovation, as well as international relations and European studies. For the past several years he has been lecturing on starting a business, creation of business plans, and establishing spin-off companies. He also gained experience in the private sector where he has founded and managed several companies. He was the Deputy Director of the Centre for Knowledge and Technology Transfer of the Charles University where he was in charge of the final phases of the commercialization process.

**Deputy director and Patent Attorney – Matěj Machů:** Czech Patent Attorney and European Design Attorney who also works as an Intellectual Property consultant at the Charles University. Assistant professor at the Department of Industrial Property at the Metropolitan University Prague where he lectures on foreign and non-European legal systems in the field of the legal protection of intellectual property and the Czech and European patent law.

His academic and scientific work is mainly focused on foreign legal systems, particularly the Anglo-American and Israeli law. In matters of technical specialisation, he primarily focuses on mechanical engineering, physics, and computer technology.

**Project Manager – Daniela Králíková:** Graduated from the Faculty of Law of the Charles University where she currently works as a research associate. She gained experience in the public, private, and non-bank financial sector. She used to work as a conference organiser, a corporate lawyer, and a project manager.

**In-house Lawyer – Miroslav Hoša:** CUIP's In-house lawyer with many years of experience in both the private sector and public administration. For more than 10 years he has been working as a corporate lawyer, focusing on labour and commercial issues. He also specializes in legal counselling on intellectual property law and related contractual agenda. Currently, he also works in the field of corporate law within the Centre for Knowledge and Technology Transfer of the Charles University.

## 4.2 Business Model

In the long run, the establishment of CUIP was perceived by Charles University as a worthwhile investment. Therefore, the University decided on granting its subsidiary company for a minimum of 10 years. According to the experience in Israel and the United Kingdom, CUIP is after this period, expected to earn on its operations and significantly return the investment both, financially and by positive public relations. (Sláma 2018)

CIUP is registered as "the organizations for research and knowledge dissemination", which by law determines that CUIP has to execute 80% of economic activities (e.g. training) and 20% of non-economic activities (e.g. licensing). This means that CUIP can dedicate only 20% to the activities connected to the Business Model described in Subsection 4.2.2.

To address this Section, The Business Model Generation by Osterwalder & Pigneur (2010) is followed and implemented in the case of CUIP by the thesis. It is reminded, CUIP commercializes the R&D results from Charles University, so the business cannot be modelled as sharply as usual commercial firms.

### 4.2.1 Business Model - Charles University

CUIP represents Charles University when closing license agreements and negotiation with business partners. The value proposition to the Charles University is the liability with only limited capital of CUIP, negotiation with commercial entities, training or consultancy. More than 98% of the revenues of CUIP is currently created by the fees for these services (Machů 28/04/2020). The key activities are negotiation with the customers and representation when closing the license agreement. The team represents both, the key resource is and the main cost-driver.

### 4.2.2 Business Model - Commercial Partners

As previously mentioned, the law that limits CUIP in dedicating only 20% of its capacity per year to non-economic activities such as licensing, patent selling and similar doing outside the Charles University. However, this business model is particularly important for further scaling and financial independence. The following building blocks include words in bold letters, which are later used in the Business Model Canvas (see Fig. 4.5).

### Customer Segments

The customer segments consist of **the businesses, which need the specific result of the academic research and development**. However, this customer segment cannot be further characterised, because it differs from case to case. According to the terminology of CUIP, the customers are the commercial partners.

### Value Propositions

CUIP proposes technology originated in a wide spectrum of scientific fields, due to the number of faculties of Charles University. Depending on the particular project case also differs the value proposition.

The technology can be offered in three main forms:

- Know-how
- License (eventually a sold patent)
- Spin-off
- Prototype (commercial offering of a product)
- Consulting

### Channels and Customer Relationships

CUIP approaches its customers mainly **direct**ly. This personal attitude also tightens the relations, so there is a chance of repeating the acquisition of CUIP offering. It can be assumed that the personal approach of CUIP ensures higher perceived customer value, which can engage them to spread the word of mouth in favour of CUIP.

### Revenue Streams

Currently, CUIP receives only around 2% of its revenues from the businesses, which need the specific result of the academic research and development (Machů 28/04/2020). One part of the income is formed by a percentage from the overall **royalties** (i.e. licensing fees) received from the customers. CUIP negotiates each licensing case separately and the overall royalties are split into a larger share of Charles University and minor share of CUIP. Additionally, income is formed by offering workshops and consultancies. A possible revenue stream, but not experienced by CUIP, represents a **patent sale**, which gives the customer a possibility to license the patent further. CUIP discovered, **the prototypes of a product**, rather than the invention described in the patent is demanded. Therefore, the team already experimented with going through the product development phase, so the resulting prototype fits into the product portfolio of a particular potential customer. This activity is aimed to be more accented in the future (Machů 28/04/2020). A very important stream of revenues is **the exits of the spin-off companies** of CUIP. So far, two spin-offs have been founded and their exit cannot be expected in less than 5 years. However, the number of spin-offs established and invested in by CUIP is supposed to grow by 0-3 per year and so the return on their investment.

### Key Resources

Among the key resources is standing out **the team**, **the know-how (i.g. trade secret) and IP** provided by the Charles University (the parent institution and **the personal network** that facilitates validation of the use case, the price, the business of a particular project.

### Key Activities

The key activities include: negotiating with customers; licensing; establishing a spin-off; (co-)investing into a spin-off. Future activities also involve patent selling or transforming the invention idea into a product prototype.

### Key Partnerships

Charles University, the parent institution is a key partner because of financial and human capital. As previously mentioned, CUIP is economically dependent on the University until 2028, when following the financial model designed based on the experience from abroad. Charles University has around 50 000 students, 8 000 employees and 5 000 scientific researchers (Sláma 2018). Therefore, the University represents a source of ideas with commercial potential. Particularly important is the transfer office of Charles University, CKTT (see in the Subsection 4.1.2).

Worth to mention, CUIP widely uses the personal network of the core team depending on the particular project need. Moreover, there is a potential of long-term partnerships with three main functions: consulting (Re-medical s.r.o.), application (DYNEX TECHNOLOGIES, spol. s.r.o.) and investing (i&i Prague s.r.o.). There is only one partner in each category and so far, the significance of the partnership is very low. The importance can increase by closer cooperation and a higher number of relevant partners in each category.

### Cost Structure

The key cost-drivers are 1) the investments into the spin-offs, which are established by CUIP, and 2) the team. Additionally, the operation costs (15K EUR per year) contribute to the total costs.

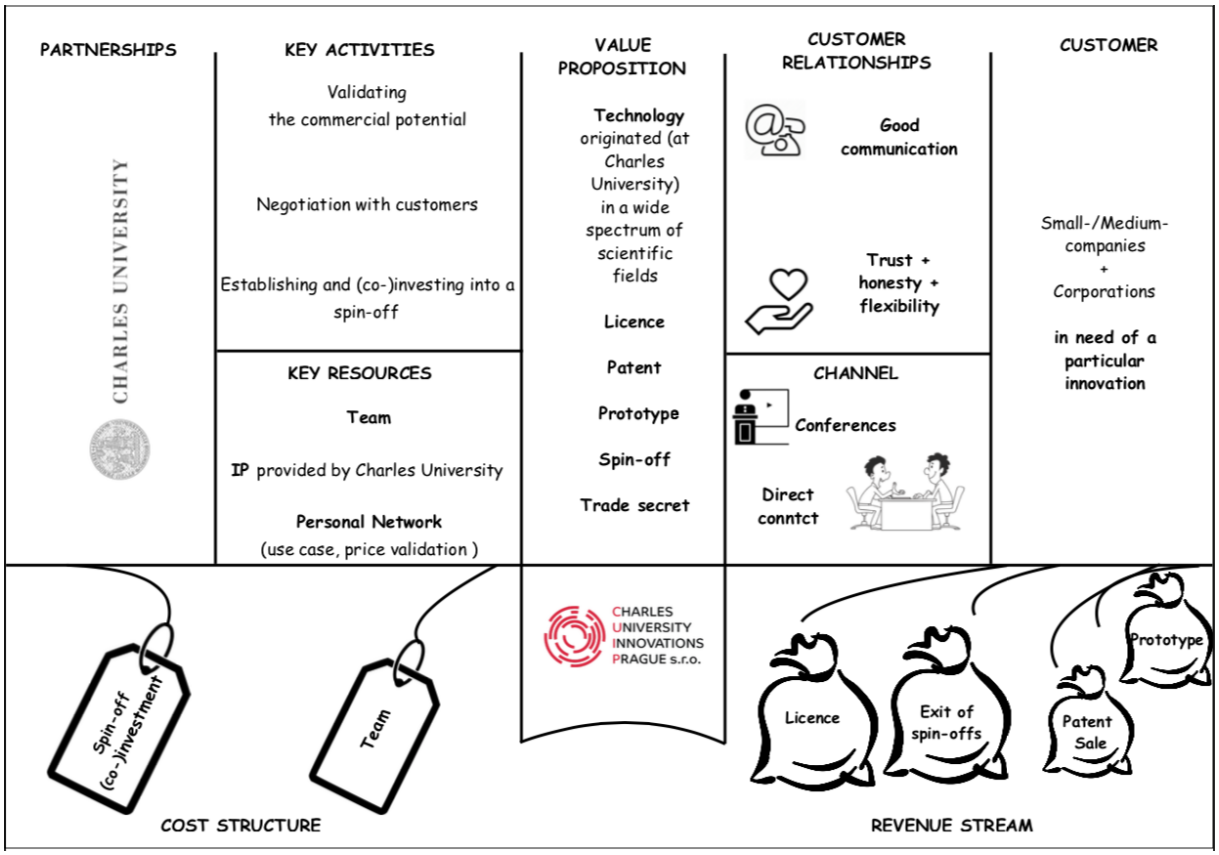


**Figure 4.5:** Business Model Canvas of CUIP

## 4.3 Product Portfolio

### Services

The following services are mostly offered to the researches, employees or eventually students of Charles University. Currently, only in occasional cases, the services are offered to other entities.

**Services:**

- Consulting and management services for projects with a commercial potential
- Founding of spin-off companies emerging from research conducted at the Charles University
- Securing investors for university spin-off companies
- Negotiation of licensing or other agreements in a given area
- Financial support for spin-off companies
- Training and workshops

### Licenses

There is a portfolio of patented **technologies**, which are currently ready **to be licensed** trough CUIP to business partners. The technologies are offered via the personal networks of CUIP

and via the website of CUIP. CKTT, the partnering office of Charles University, is constantly analysing more technologies, in order to be patented and offered by CUIP. The current portfolio lists the following until 14th of May 2020:

- Monitoring and transport system in particular for infectious patients
- Biomarkers of cardiovascular risk in women and children after a complicated pregnancy
- Isokinetic device and method for lower extremity muscle force measurement
- Etched membrane with thin catalyst coating in particular for use in electrolyzer or fuel cells
- High-resolution carbapenemase kit and method spectrophotometric detection of carbapenemase activity
- Metal-CeO2 based catalyst particularly for use in fuel cells
- Measuring the depth of the vaporization plane and kit for performing of this method

**Spin-offs**

CUIP has established two spin-off companies. Charles Games s.r.o. and LAM-X a.s.

**Charles Games s.r.o.** was founded on the 24th of January 2020 in Prague to accelerate commercialisation activities of the pre-existing Charles Games workgroup and to provide wider support for students of the Charles University. Charles Games s.r.o. focuses on three spheres of business; the development of new computer games, the commercialisation of existing computer games and the incubation services for the young development teams.

CUIP invested into Charles Games 36.4K EUR, which forms the initial capital. The spin-off is in the initial phase wholly owned by CUIP and later, 45% of the company shares are distributed among the key employees of Charles Games.

**LAM-X a.s.** was founded on the 20th of February 2020 in Prague. The company focuses on the development of nanomaterials that can be, for instance, utilised for fabrication of disinfecting bandages of the future or as revolutionary healing of wounds. The purpose of LAM-X a.s. is to develop light-activated, antimicrobial materials based on nanofibers and nanoparticles capable of active defence against a wide range of pathogens.

The initial capital of LAM-X is composed by the investment from CUIP and the subsidiary of the Czech Academy of Sciences, i&i Prague. CUIP is supposed to invest 72.9K EUR in April 2020 into LAM-X. The exit of this spin-off is expected in 5 to 10 years.

## 4.4 Finances

The organizations for research and knowledge dissemination have to divide activities into economic and non-economic activities (e.g. licensing). As CUIP is registered as *a research organization* the law restricts many financial aspects of the company.

The initial capital of CUIP, which is provided by Charles University, is 109.3K EUR. A certain amount is used to cover the operating costs and the rest is still owned by Charles University, as the 100% owner of CUIP.

Based on the experience of similar entities in Belgium or Switzerland, Charles University anticipates the financial dependence of its subsidiary for 10 years (see Fig. 4.6). The blue line

shows differences between the revenues and the expenses of CUIP throughout the 10 years of its existence. The blue line shows the valley of death, the increasing tendency apart from 2023 and profitability after 2026. Therefore, Charles University ensures the fixed fees for a minimum of 10 years, so that CUIP is not in the red numbers (see the orange line in Fig. 4.6.). Respecting the non-disclosure agreement with CUIP, the figure shows the tendencies, not the exact numbers in CZK in the vertical axes.

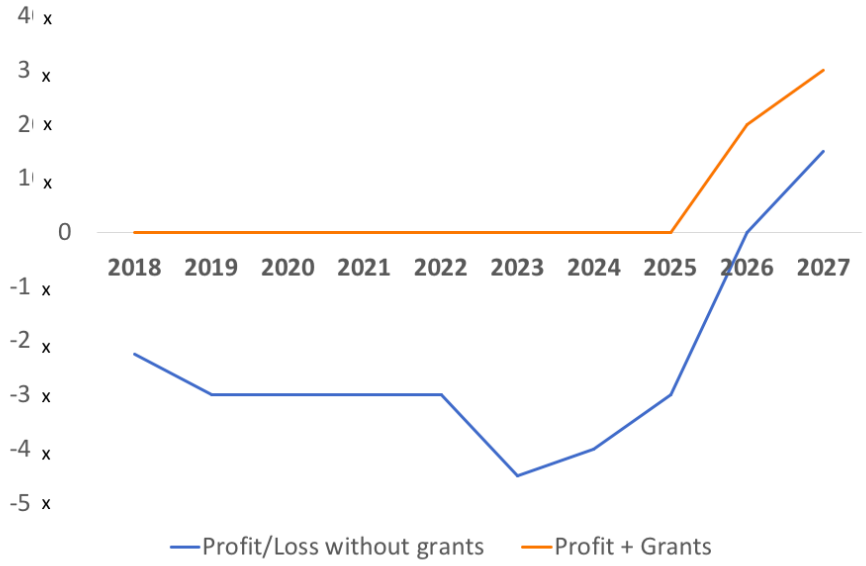


**Figure 4.6:** Dependence of CUIP on Charles University: Prediction of profits with and without grants from Charles University

By the end of 2019 was CUIP expected to prepare the establishment of one spin-off company and to close 2 to 4 licence agreements. CUIP exceeded these expectations by preparing the establishment of three spin-offs and 10 patents. In 2020 CUIP plans to invest 109.3K EUR into its spin-offs, 36.4K EUR into Charles Games s.r.o., 72.9K EUR into LAMX s.r.o. and 1K EUR into FlexiCare s.r.o. These investments into spin-offs, the excellent performance of CUIP and increasing demand for the services of CUIP encourage Charles University to increase the initial capital of CUIP (as agreed during the establishment of CUIP).

With respect to the goals of CUIP to dedicate to 20 projects until 2023 and the demand for establishing a spin-off company, the capital needs to be increased by 145.8K EUR. Charles University agreed on the amount and the transaction is planned for April 2020.

**Differences:** CUIP offers incubation programs for start-up businesses from all scientific disciplines. You have university and institute incubators, technology parks and technology transfer workplaces that have a technology focus on major science disciplines. The exception is the Prague Starter Center which CUIP does not have a network of contacts between top experts from the university environment.

## 4.5 CUIP Crisis

*WQ2: What are the effects of the COVID-19 crises to CUIP?*

### 4.5.1 Before Crisis

The following section sums up the key parts of the developing plan for the beginning of 2020. CUIP is establishing a nanotechnology spin-off LAM-X in February 2020 in which CUIP invests 72.9K EUR. It is planned to extend the offices so that more employees could be hired. In order to develop a construction plan, one engineer is contracted. A grant application is initiated by the team so that CUIP can receive financial support for the equipment in the new office area. Successful grant applications also require deep financial analysis. Therefore, a financial consultant from CKTT is contracted as an employee. Importantly, the Innovation Account Manager is supposed to be hired on the 1st of April 2020. The capital of CUIP should be increased by 145.8K EUR as agreed in its establishment contract and confirmed in 2019. This amount is not intended to use be used for the operational costs of CUIP, but for the investments into spin-off companies of CUIP (Charles Games s.r.o., LAM-X a.s. a FlexiCare s.r.o.).

### 4.5.2 Crisis

As already described in the Section 2.6, in connection with the unfavourable development of the epidemiological situation many emergency measures have been taken by the Ministry of Health of Czech Republic in the incidence of the disease COVID-19. Due to some of the measures, the parent institution of CUIP, Charles University, loses the income related to the exchange students. This causes dramatic financial issues to the University in March 2020. Therefore, the 1st of April 2020 has CUIP to mitigate the financial crisis of Charles University by the following actions.

Firstly, 50% of the team, which is a key asset of CUIP, has to be dismissed. The loss of Innovation Account Manager, who could significantly enlarge CUIP by the external capital from the EU funds, limits the further development. Moreover, the working hours of the core team members are shortened and the salary bonuses are cut down. Secondly, the developing activities of CUIP are immediately stopped. Particularly, the extension of the office space is no more possible to finance by the University. The grant application related to this extension is terminated too (because the funding can be allocated only retrospectively - after CUIP pays all the costs related to improving the innovation infrastructure in Prague and its own facilities). This implies a dismissal of the financial consultant and construction engineer.

Finally, the promise of the capital increase of CUIP by 145.8K EUR cannot be fulfilled. This means insecure survival of CUIP for the following year or two. The investment means to be insolvent regarding spin-off companies of CUIP. To sustain the operating costs per year, all the further licensing activities, spin-off establishments, overall technology transfer has to be limited. This means, also potential revenue-creating activities need to be cut down.

### 4.5.3 Initial Plan

The cost of freezing CUIP (e.g. know-how, talent) by Charles University is higher than the benefit survival plan. Hence, the initial plan is to run the company on the minimum budget for around 2 years. In reaction to the financial need, CUIP also looks for an external

grant/funding, which can cover the salaries and ideally, also the investments into the meaningful development of spin-offs of CUIP. Such funding has CUIP to obtain without the need to invest financial resources. There are several calls from the Czech government, which are linked to the development of the technologies helping in the fight against coronavirus COVID-19, but some new calls should be announced for mitigating the economic impacts.

## 4.6 Conclusion

CUIP characterises its core motivation, organizational structure, extended team and both sided business model.

**The core motivation of CUIP is technology transfer**, which in other words is the implementation of technology from Charles University through the commercial partners (i.e. business in need of a result of academic research and development).

**CUIP is structured as a subsidiary company with the limited liability of the public institution in the Czech Republic, called Charles University.** The only owner of CUIP, Charles University, is in relation to CUIP represented via the General Assembly, which is informed about CUIP through the Governance Board. The Board controls the output and the management of financial resources of CUIP. However, **CUIP has the freedom to manage its business strategy and to proceed with technology transfer cases.**

Charles University has an internal technology transfer office CKTT, which is the key partner of CUIP, and which is focusing on the initial part of transfer and communication inside the University. Whereas the focus of CUIP is to finalize the transfer and communicate outside the University (e.g. commercial partners, investors). **The advantage of CUIP is a very fast decision-making process independent on the University, compared to the integrated technology transfer office.**

**Behind CUIP stands an extended team which includes core team and the analytical team of CKTT.** The core team is very capable and has relevant competencies in the knowledge field of technology transfer, management, business, IP, law, and project management. This team is extended by two members of CKTT with a scientific background, who is analysing the commercial potential and finding the potential customers.

CUIP has a both sided BM (Business Model). In the first part of the model, CUIP proposes to Charles University to be its commercialization facilitator (e.g. to be its representative when signing contracts with commercial partners) and entrepreneurial hub builder. **Currently, 98% of the revenues of CUIP stream from the fixed fees to Charles University, which is in line with the business plan that is build based on the experience of the western countries, and the educational activities for academic staff and students**.

In the second part of the model, CUIP proposes licenses, patents, spin-offs, know-how (i.e. trade secret), and prototypes of a product to commercial partners. **The thesis sees as the most value-creating activity in this BM part, the transformation of the invention idea into a product prototype and indenting and supervising the team for a spin-off company.** Currently, only 2% of CUIP revenues are created through the royalties or sold prototype. However, the future income of CUIP is expected to be formed more and more from sold prototypes, spin-offs, patents and royalties.

The demand of the society need to be solved quicker, then Charles University is in many cases able to respond with an offering. Therefore, **CUIP is very supply-driven. This is also a reason, why the team of CUIP plays such a big role, they have to create the demand.**

Culturally, there is an issue of academic stuff mistrusting entrepreneurship and a natural

solution to this is to motivate the young generation of researchers to have a positive relation to entrepreneurial activities. So **the concern of the thesis is the little engagement of the University students from the side of CUIP compared to the high focus on the academic stuff.** There are, however, *Management and evaluation of science* courses. Moreover, due to CUIP, in the next academic year should appear a new voluntary problem-based entrepreneurial course provided by an external organization *Podniknito!*.

**The effects of the COVID-19 crises to CUIP are the frozen hiring process, the frozen developing activities which should create revenues in the long run and insolvency regarding a spin-off company of CUIP.**

# 5 Innovative Infrastructure

*WQ3: What characterizes a innovative infrastructure?*

Firstly, it is discussed, what is an innovative infrastructure and what it can consist of. Later, an innovative ecosystem is defined, since it has more practical relevancy for the theses. The terminology of innovative infrastructure is explained in the Czech context too. Finally, the innovation ecosystem is characterised. Hence, the characteristics of innovation infrastructure are articulated through the findings of the innovation ecosystem.

## 5.1 Definitions

What is an innovative infrastructure? Before answering that, the separate definitions of innovation and infrastructure are presented. "Innovation is: production or adoption, assimilation, and exploitation of a value-added novelty in economic and social spheres; renewal and enlargement of products, services, and markets; development of new methods of production; and establishment of new management systems. It is both a process and an outcome (Crossan & Apaydin 2010, p. 1155)." Simplistically, innovation can be argued to be an implemented invention, which is reflecting on demand. Infrastructure, according to the Cambridge Dictionary, is the basic systems (including physical structures and facilities) and services, that a country or organization uses to work effectively.

The director of the National Institute of Standards and Technology, Jeffrey (2007) discusses, how to transfer discovery to use? He answers with an analogy explaining, what is an innovative infrastructure. He builds upon the understanding of the physical infrastructures (e.g. highways, communication networks, and the electric power grid) that help to define a nation's capacity to produce and transport goods and services. In direct analogy to a nation's physical infrastructure, there exists an **innovation infrastructure, which defines a nation's capacity to innovate**. Components of this infrastructure include, for example, a nation's education system, public investment in basic science, worker training and retraining, and tax policies to foster private sector investment in research and development. The innovation infrastructure is a key determinant in **a nation's ability to be competitive** in an ever-more competitive world. (Jeffrey 2007)

Furman et al. (2002) give a very similar explanation of an innovation infrastructure, as the cross-cutting factors contributing to innovativeness throughout the economy. Accordingly, it can be argued the innovation infrastructure includes a country's overall science and technology policy environment, the mechanisms in place for supporting basic research and higher education, and the cumulative "stock" of technological knowledge upon which new ideas are developed and commercialized.

How could the innovation infrastructure be split into smaller units? Tomakh (2018) names the subsystems of the innovative infrastructure: financial, production-technological, personnel, information and expert-consulting. Miles (2000) describes innovation agents as information brokers, integrating agents, network facilitators, carriers of new learning about both technological and innovative capabilities.

In conclusion, the innovative infrastructure consists of organizations and interactions between them, which participate in the ability of a nation to create innovation (i. g. innovative

products and processes). The organizations ensure policy, funding, human power, development of research and development, education, innovative products and the services, and support of innovative firms (incubators, accelerators, co-working spaces, transfer organizations, etc.). Particularly interesting are the interactions between these organizations, which can take various forms ranging from the exchange of financial means and information, the communication channels to the transition of people among these diffusing-innovation agents. However, for the this thesis it is not necessary to examine the relations on the national level. Such conclusion strongly relates to a description of an innovation ecosystem. Therefore, the characterisation of the innovation infrastructure is addressed by the characterisation of the innovation ecosystem.

## 5.2 Innovation Ecosystems

What is an innovation ecosystem? Innovation ecosystem is defined as "the evolving set of actors, activities, and artifacts, and the institutions and relations, including complementary and substitute relations, that are important for the innovative performance of an actor or a population of actors" (Granstrand & Holgersson 2020, p. 1).

The firms can and should use the external ideas and paths to market, apart from the internal ones, while advancing their technology (Chesbrough 2003). However, the more partners are engaged, the less likely it is that the common goal can be successfully reached. To ensure the prosperity of a company, its development should not focus only on its own execution. The motivation, abilities, willingness, and likelihood to succeed of all the involved partners between the company and the end customer are crucial too (Adner 2012, p. 230). As partnerships are (in most cases) an inevitable component of a successful business, the development of a venture is likely to be more sustainable and profitable when considering its innovations ecosystem.

### 5.2.1 Characteristics

Thomas & Autio (2019) define four characteristics of an innovation ecosystem: participant heterogeneity, system-level outputs, participant interdependence, and distinctive governance. **Participant heterogeneity** is caused by the fact that participants come from a variety of industries and sectors. Different authors include different participants (competitors, universities, public research institutions, governmental organizations, such as regulatory authorities, standard-setting bodies, and the judiciary). **The system-level output** is the output that is greater than any single participant could deliver alone. It is the value offering of the agents of the ecosystem, which can be represented by products and services or by a business model innovation. The most widely referenced characteristic of innovation ecosystems is **participant interdependence**, the technological, economic, and cognitive dependence among the participants of the ecosystem. Technological interdependence springs from co-specialization of actors within the ecosystem (horizontally related suppliers from different fields). Economic interdependence arises results from the following: the value that each member receives from participating in the ecosystem is dependent on the simultaneous availability of compatible offerings by others. Cognitive interdependence is caused by differences in knowledge and skills and cognitive frames among the participants of the ecosystem. **Distinctive governance** is the differentiation due to the distinctive solution to the distributed governance challenge, which is characterized by co-specialization among ecosystem actors. The ecosystem actors

can have a collective identity, for instance, which shifts the perspective of a participant from the individual to the collective. Therefore, the ecosystem participants connect to deal with challenges that lie beyond their own immediate responsibilities and address the risks of being dependent on each other (Thomas & Autio 2019).

Adner (2012) characterises the innovation ecosystem by mapping the **Value Blueprint**, where the characteristics include the **partners** (e.g. suppliers, inter-mediators) who participate on delivering a complex **value proposition** to the **end customer**. Once identifying the readiness and willingness of all the actors of the ecosystem, **the risks** can be identified.

When characterising an ecosystem according to the **Ecosystem Pie Model**, Talmar (2018) stresses the following constructs: **the ecosystem value proposition**, **the user segments**, and **the actors**. Additionally, Talmar (2018) specifies the ecosystem by describing the actors by: **the resources**, which are invested into the ecosystem to generate a value; **the activities** for producing the value; **the value addition** (the individual contribution of an actor needed, in order to deliver the ecosystem value proposition); **the value capture**; the dependence to another actor; **the risks**; and the **relationship**.

## 5.3 Innovation Infrastructure in Czech Context

The innovation infrastructure has in the Czech context meaning of the organizations supporting the innovation and their facilities. Karel Klusáček & colective (2008), for instance, describes the innovative infrastructure as the technology parks, incubators together with their services and the collaboration within the network of the players from research, development and innovation. In preferences of this theses is to understand innovation infrastructure as concluded in Section 5.1 and use for the terminology *support organizations* for incubators, accelerators, co-working spaces and similar organizations according to a an ecosystem builder, Startup Commons (2020) (see Fig.5.1). The thesis uses also the expression *the supportive innovation infrastructure* for business incubators, science parks and university-based incubators. Interestingly, incubators have long been studied mostly as a peculiar phenomenon in different research streams, above all urban and economic development and university-industry technology transfer (Hausberg & Korreck 2018). This means technology transfer science gave birth to the business incubator idea.

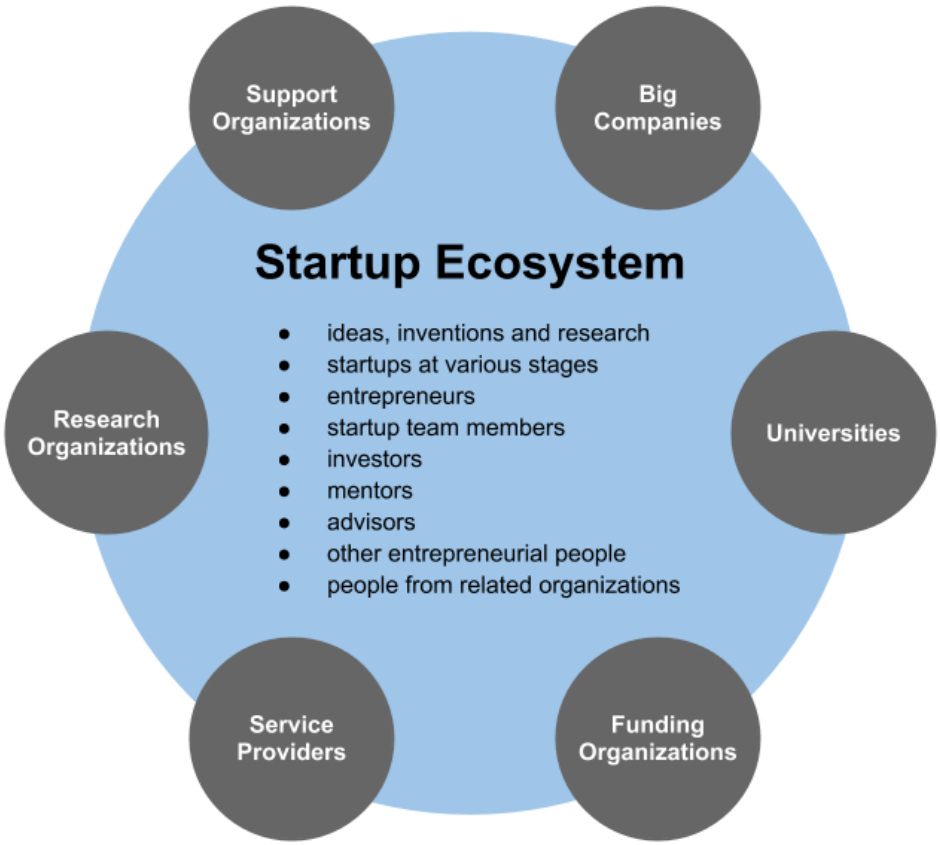


**Figure 5.1:** A startup ecosystem; formed by people, startups in their various stages and various types of organizations in a location (physical and/or virtual), interacting as a system to create new startup companies. Source: https://www.startupcommons.org/what-is-startup-ecosystem.html

## 5.4 Conclusion

In conclusion, an innovation infrastructure addressed by the specifics of an innovation ecosystem, which is sufficient for the needs of the thesis. An innovation ecosystem (and so, innovation infrastructure) is characterised by participant heterogeneity, system-level outputs (e.g. execution of the global value proposition), distinctive governance (i.g collective identity and the unique strength coming from the combination of actors), participant interdependence (i.g. technological, economic, or cognitive dependence between the different participants, whose value contributes to the global value proposition), and the risks arising from investing resources into the ecosystem, co-creating the global value and depending on the willingness and the ability of other participants to contribute too.

# 6 Prague's Innovative Infrastructure

*WQ4: What characterizes Prague's innovative infrastructure?*

Is within Prague's innovative infrastructure any solution to the crisis of CUIP? To make use of the characterization of Prague's innovative infrastructure for the thesis, the findings have to be relevant for CUIP. What can bridge Prague's innovative infrastructure and CUIP? A potentially valid answer is an innovative ecosystem. Why? An innovation ecosystem is not just a set of players anyhow participating in creating innovation, but the set of those players (e.g. a cluster) which are necessary for delivering a specific value proposition. Concerning the core activity of CUIP, the most relevant investigation should focus on the innovation ecosystem, which value proposition is technology transfer. An innovation ecosystem is formulated differently depending on the size of the region, so a different understanding of the ecosystem is on the EU level, national level, or regional level. The project-author focuses on Prague as an interesting region, where CUIP is located.

Does an innovation ecosystem proposing the value of technology transfer exist in Prague? To answer this question, it is assumed it does and the characteristics of a general innovation ecosystem are analysed in the context of Prague and technology transfer. Therefore, the terminology of the innovation ecosystem is used.

This chapter aims to characterise the innovation ecosystem, where CUIP is included. Adner (2012) and Talmar (2018) encourage the thesis to ask further the following questions. What are the key players of Prague's innovation ecosystem? What motivation do the players have to participate in the ecosystem? In other words, what resources are invested in the ecosystem and which activities are co-creating the value proposition of the ecosystem? What value does the player capture from the innovation ecosystem and what value does the participant add from it? What are the dependencies among the key players within Prague's innovation ecosystem?

To answer the mentioned questions, interview Aleš Vlk (07/05/2020) is interviewed, a founder of a portal Vědavýzkum.cz, which is informing about current events in the field of science policy and research, development and innovation in the Czech Republic. based on the Regional Innovation Strategy of the City of Prague by Prague's Municipality (2018), which is broadly analysing all the innovation efforts in Prague in the years 2014 to 2018. Later it is concluded, whether the innovation ecosystem proposing the value of technology transfer exist in Prague or not. The findings are applied when considering a solution to the crisis of CUIP in the later chapters.

## 6.1 Ecosystem's Key Players

Who are the key participants of Prague's innovation ecosystem which proposes the value of technology transfer? Since technology transfer is an instrument for supporting innovation from the public universities to commerce, producers of the R&D (Research and Development) results, institutions receiving the R&D results, and entities supporting the commercialization of the R&D results.

The producers of the R&D results in Prague include public and private universities and the institutes of the Academy of Sciences of the Czech Republic. The receivers of the R&D results in Prague include businesses, which are very hard to specify due to the supply-driven

principle. The supporters of the commercialization of the R&D results in Prague may provide finances, information, or mediation. They include several public institutions, TTOs (Technology Transfer Offices), and both public and commercial incubators etc. For more details about the participants see Appendix B).

Based on the subjective opinion of Vlk (07/05/2020), **the key players of Prague's innovation ecosystem which proposes the value of technology transfer are:**

- out of R&D organisations

  **Institute of Organic Chemistry and Biochemistry of the Czech Academy of Sciences (IOCB)** which is an excellent producer of R& D results on European and world level but based in Prague.

  **Charles University** which is not a key player in the volume of produced R& D results, but due to the structured procedure of the commercialisation process.

  **Czech Technical University in Prague (CTU)** which is probably the key player in the volume of produced R& D results, but due to the high autonomy of its departments and the rivalry among them, the commercialisation process is not unified and maybe even chaotic.

- out of public organisations

  **Technology Agency of the Czech Republic (TACR)** which was established to support technology transfer. TACR provides pre-seed funding for the research projects apart from other activities.

  **Ministry of Education, Youth and Sports (MEYS)**

  **Ministry of Industry and Trade (MIT)**

  **CzechInvest**

- out of another support organisations

  **Transfera.cz** which is a network facilitator for TTOs.

  **i&i Prague** (visible key player according to the interview with Králová (28/04/2020)) which is the subsidiary of the IOCB.

  **CUIP** which is the first subsidiary company of a Czech public university.

According to the Regional Innovation Strategy of the City of Prague by Prague's Municipality (2018) seems **Prague's Municipality** to be the ecosystem leader or at least a key player. However, according to Vlk (07/05/2020), the regional players in Prague, such as Prague's Municipality or development agencies, are far less important and less active than in other Czech regions. They do not have much impact in Prague. Moreover, there is nothing ever really needed in Prague. However, the importance of Prague's Municipality might change because of the newly established innovation centre and the future Smart Accelerator.

No particular private institution, which receives/buys the R&D results in Prague is named by Vlk (07/05/2020). As previously commented, such businesses are hard to specify due to the supply-driven mechanism. On the other hand, Vlk (07/05/2020) claims, that according to the statistics, the most innovative solutions are created when working with existing procedures, (i. e. in factories, in companies). Research organizations and universities are only one source of innovation, and they are not even the primary source. Innovation does not have to involve basic research and development and its impact is even greater.

## 6.2 Key Player's Motivation

Once the key players are identified, the motivation of participating in the innovation ecosystem, which proposes the value of technology transfer is examined. The key players are grouped according to the following sectors: public, R&D (academic), private sector and the sector of supporting organisations. Based on EPM (Ecosystem's Pie Model) by Talmar (2018) are the resources, activities, value addition, value capture, dependence, risks and relations of the key players are investigated. The author of the project is forming the EPM model to estimate the motivation of a player to participate in the ecosystem before (Fig. 6.1) and after (Fig. 6.2) the crisis caused by the COVID-19 effects. The EPM models are coming out of the conclusions from the interview with (Vlk 07/05/2020) from The Regional Innovation Strategy of the City of Prague by Prague's Municipality (2018).

Although reading the graphical EPM is intuitive, here is a reading guide for Fig. 6.1 and Fig. 6.2. ACTORS (i.e. key players), RESOURCES (i.e. resources at the disposal of the actor to be utilized for value creation within the ecosystem), ACTIVITIES (i.e. activities performed in converting resources into value additions toward the ecosystem), VALUE ADDITION (i.e. the unique productive contribution of the actor to the ecosystem), VALUE CAPTURE (i.e. the type, mechanism and quantity of value captured by the actor from the ecosystem) are shown in this order from the outer circle to the inner one on the graphical EPM. RISK (i.e. the potential inability and unwillingness of the actor to supply their productive contribution to the ecosystem) is represented by colouring in the section: red-high, yellow-medium, green-low. DEPENDENCE (i.e. the level of dependence that an actor has on whether the particular EVP (Ecosystem's Value Proposition) is accomplished or not) is measured by three levels: L - low dependence, M - medium, and H - high dependence. On the graphical EPM, the respective grade is marked on the right-side separation line of the Actor by filling in the relevant circle. RELATIONSHIPS (i.e. relationships between elements not explained otherwise) are indicated with arrows (Talmar 2018).

### 6.2.1 Key Players in Public Sector

Public organisations are supporting technology transfer through various operating programs. They are key players on the national level and they are located in Prague. Can the following be considered as a specifically Prague's key player? Answering such a question is not that important for the thesis. What is important is the motivation of the key public players to participate in the ecosystem.

TACR, MEYS, MIT, CzechInvest or Prague's Municipality analysis conclusion for the EPM (Fig. 6.1) is the following:

- Resources: financial resources and policy (vision unification).
- Activity: active facilitation, mediation and motivation to establish contacts between research and business sector.
- Value Addition: **investing**, demand creation for new solutions and innovations.
- Value Capture: increase of the regional competitiveness and prosperity, positive image and in case of TACR, thee fulfilment of its mission.
- Dependence: MEYS, MIT, CzechInvest and Prague's Municipality are not dependent on technology transfer. Therefore, their dependence on achieving the EVP is concluded to

be rather low (L). On the other hand, TACR is established for technology transfer, so the level of dependence that has on whether the technology transfer EVP is accomplished is argued to be high (H).

- Risks: The potential unwillingness of MEYS, MIT, CzechInvest and Prague's Municipality are concluded to be high (H). Despite there are numerous operation programs providing financial support for technology transfer by all the three mentioned institutions, they do not communicate actively with the other participants due to responsibilities behind the technology transfer. Projecting the behaviour to the future, the political instability might cause participating risks of any of them. Moreover, the organisations might be worried to invest in unprofitable projects. The high administrative burden when getting the EU and Prague funding makes it even more difficult to consider them in the ecosystem. TACR is a well-funded organisation with the main focus on technology transfer, so risks of the potential inability and unwillingness to participate in the ecosystem are low (L).

**From the perspective of CUIP:** TACR provides pre-seed funding for the research projects developed at Charles University. The mentioned ministries and Prague's Municipality organize calls within a variety of operational programs relevant for CUIP. Some of the calls are also created in response to the COVID-19 economic issues. The disadvantage of the majority of these calls is the need of CUIP to co-finance or pre-finance all the costs related to the call. Moreover, the man-hours (which is needed to get funding for in CUIP) are usually not covered.

### 6.2.2 Key Players in Research and Development

IOCB, Charles University, and CTU analysis conclusion for the EPM before the COVID-19 crisis (Fig. 6.1) is the following:

- Resources: R&D results, know-how, technology, patents, students, researchers, financial resources.
- Activity: patenting, educating, creating results of research and development, creating the organizational structure for technology transfer (in case of IOCB and Charles University).
- Value Addition: **inventing**, investing or co-investing, offer-creation of new solutions and innovations.
- Value Capture: image creation, return on investment (ROI), getting an international level in tech. transfer aspect.
- Dependence: IOCB and Charles University are investing financial resources into technology transfer, so they are highly (H) dependent on the EVP. CTU has a big volume of R&D results, however, its technology transfer is not as organised as in Charles University, so the level of dependence that has on whether the technology transfer EVP is accomplished is argued to be medium (M).
- Risks: The potential inability and unwillingness of IOCB and Charles University are low (L) and of CTU are middle (M).

**From the perspective of CUIP: A potential opportunity for CUIP represents to build a decentralised technology transfer system at CTU or to develop joint projects with IOCB. CUIP can provide more consulting services to universities in the Czech Republic with developing technology and technology transfer.**

Charles University as the parent institution and key partner is not only a key resource but also one of the most significant components of the Czech academic sector. Charles University has nearly 50 000 students enrolled in more than 300 accredited degree programmes. The University has more than 7,900 employees; of this number, almost 4,500 are academic and research staff (www.cuni.cz 2018). So there is a high potential to build a strong entrepreneurial hub among the students.

### 6.2.3 Key Players in Private/Application Sector

It is very hard to specify the players in the private sector or name a significant one. Moreover, the business partners, which are demanding some academic know-how, might in many cases be beyond the border of Prague or the Czech Republic. However, in relation to the ecosystem with the technology transfer value proposition, it still can be concluded about the business partners the following:

- Resources: end users or end customers of the transferred technology, financial resources provided when buying a licence/patent/spin-off.
- Activity: buying the offer enabled from the support organizations.
- Value Addition: **implementation of the technology in a particular business case**.
- Value Capture: direct financial income from the end customer, solutions to its issues/innovation of its processes.
- Dependence: No or very low (L) dependence on the EVP.
- Risks: High (H). However, the unwillingness of contributing to the EVP can decrease, once identifying specific businesses that gradually need to innovate their portfolio.

**From the perspective of CUIP:** The players in the private sector have the capacity to conduct their own research and quickly react to their current problems. However, **these big companies might be interested in establishing their own spin-offs in relation to the corporate entrepreneurship efforts.** Therefore, CUIP could offer these organisations consultancies regarding the founding of a spin-off. It can be speculated, the profile of these firms can indicate, what is the demand in Prague.

### 6.2.4 Support Innovation Infrastructure

There are several categories of organizations supporting the innovation infrastructure in Prague, for instance, business incubators established by public entities, support organizations within the private sector, academic support innovation infrastructure, business incubators, science and technology parks, centres for technology transfer etc. (see Appendix B).

The most significant institutions which are established for technology transfer are *CUIP* and *i & i Prague*, whose analysis conclusion for the EPM (Fig. 6.1) is the following:

- Resources: suitable space for business, expert business know-how, services (finding market opportunities, analysis of current technological and research trends, consulting in the field of strategic decision-making, finding market partners, technology transfer, protection of intellectual property, access to financial resources, evaluation of the impact of innovation on society, etc.).
- Activity: overall support of innovation efforts, expert consulting, entrepreneurial engagement, filling the gap between academics and business partners and goals of the innovation policymakers.
- Value Addition: **technology transfer**, facilitation of business establishment, enabling the application and public players to use the particular results of research and development.
- Value Capture: financial return, portfolio of successful projects, brand awareness.
- Dependence: Since technology transfer is the mission and main purpose of both, CUIP and i & i Prague, the dependence to deliver the EVP is high (H).
- Risks: Low (L).

The key Czech technology transfer network facilitator is **Transfera.cz**, whose analysis conclusion for the EPM (Fig. 6.1) is the following:

- Resources: a network of TTOs (Technology Transfer Offices), events for them.
- Activity: event organization for the TTOs.
- Value Addition: **unifying the TTOs**.
- Value Capture: revenues for the core activity, the fulfilment of its mission.
- Dependence: Since supporting technology transfer is the mission of Transfera.cz, the dependence to deliver the EVP is high (H).
- Risks: Low (L).

Worth mentioning, **Vedaavyzkum.cz** is a meaningful information broker that plays a key role in promoting the efforts of all the technology transfer key players.

**From the perspective of CUIP:** All the mentioned institutions in Appendix B represent the competition landscape of CUIP. Although the level of competitiveness is questionable because CUIP focuses mainly on ensuring the technology transfer from Charles University and not other institutions. This is a very supply-driven statement, so as the BM creating the most revenues for CUIP is. It is evident, each support organization is strongly related to a particular organization. As the main business model of CUIP - bringing the majority of the revenues - has Charles University as the only customer, there are no other support institutions competing with CUIP to transfer technology from this particular university, Charles University. The graduates of Charles University are transferred to many different working places and in this way is the academic knowledge or technology applied and spread. This event is, however, not classified as the technology transfer (Štěch & Dvořák 2008). Once taking into consideration the business model, where the business partners represent the customers, then all the mentioned institutions are competitors. Rasmussen (20/05/2020), the representative of Aalborg University TTO, does not see other technology transfers entities as competitors [and probably,

neither the other support organisations] since unlimited inventions are able to be adapted. However, there might be competition in getting funds for the TTO in the viewpoint of the Board of Directors at AAU.

### 6.2.5 Relations

Arrows (Fig. 6.1 and Fig. 6.2) depict relationships between elements, which are not explained otherwise (in this chapter). CUIP and i & i Prague are both subsidiaries of a significant R&D institution located in Prague and they already collaborated on establishing and co-investing a spin-off company together. This relation represents a potential partnership for the future too. Transfera.cz facilitates the two mentioned technology transfer entities, so as a with several other technology transfer organisations from the Czech Republic, but the role of Transfera.cz does not seem to be very significant. TACR provides pre-seed funding to the cases of CUIP and other organisations (e.g. i & i Prague). The core challenge of a TTO is to find customers (which have very little reason to contribute to the EVP) and push the technology, so there is a demand for it, which also applies to the case of CUIP. The only relation, which can be seen only in Fig. 6.1 depicting the situation before the COVID-19 crisis, is between the financial resources of Charles University and the activities of CUIP. On the other hand, the relation between the financial means of IOCB and the activities of its technology transfer subsidiary/incubator, i & i Prague, is assumed to be unchanged even after the COVID-19 crisis since IOCB is a well-funded institution and its excellence is reaching the European level Vlk (07/05/2020).

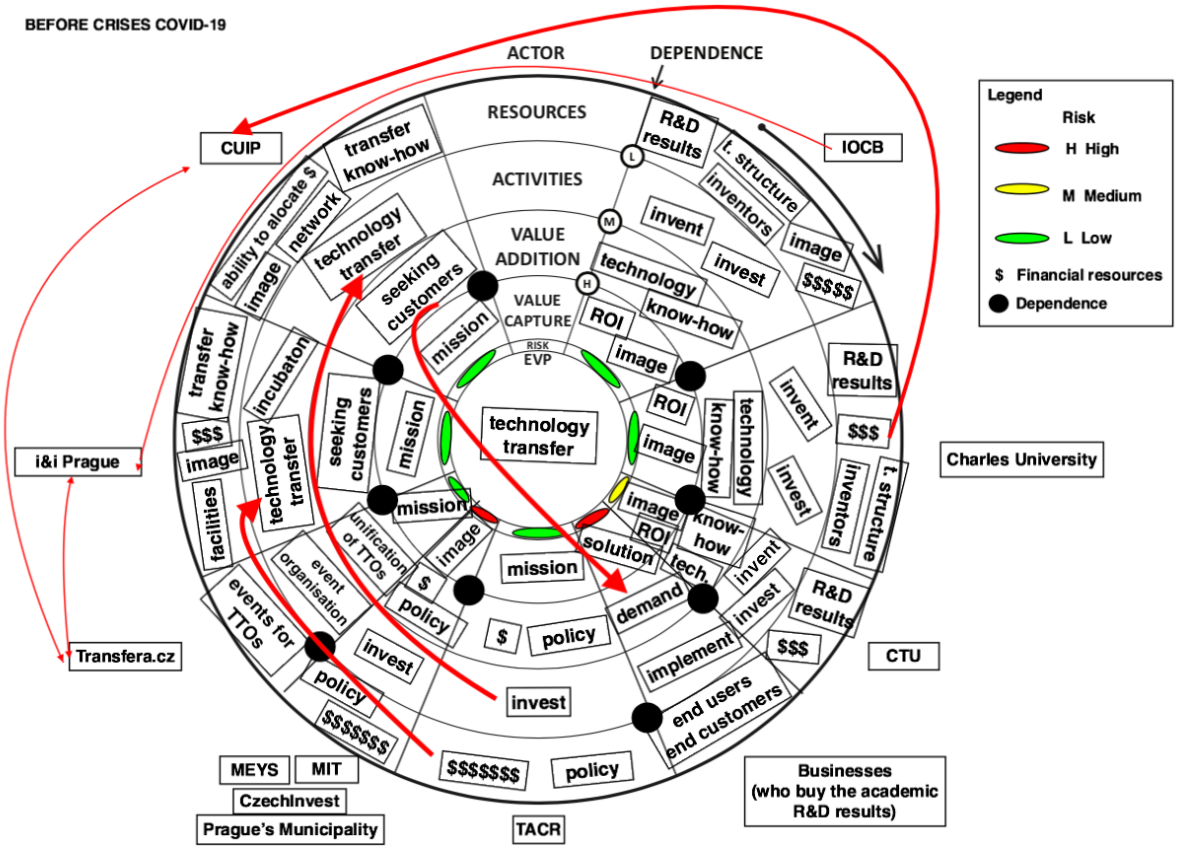


**Figure 6.1:** Ecosystem's Pie Model applied to the key technology transfer players in Prague before the crisis COVID-19. Abbreviation t. structure stands for technology transfer organisational structure and ROI stand for return on investment. The red arrows show the relations.

## 6.3 Ecosystem's Pie Model after the Crisis COVID-19

As previously mentioned, COVID-19 negatively affected the economics of Charles University and its ability to meet its financial commitments to CUIP. A similar phenomenon can be expected at other Czech public universities as well. Projecting the changes into the graphical EPM model after the crisis COVID-19 (Fig. 6.2), the major difference is decreased dependence of Charles University and CTU on technology transfer EVP, which also increases the potential inability and unwillingness of the two actors to supply their productive contribution to the ecosystem. Therefore, the dependence of Charles University shifts from high (H) (Fig. 6.1) to medium (M) (Fig. 6.2) and the relation (red arrow) between the financial resources of Charles University and the activities of CUIP disappears. Therefore, the risk (of the potential inability to supply technology transfer ecosystem) of CUIP might be argued to become medium after the crisis. However, the author of the project claims, based on her subjective observation, the team is going to do the anything possible to mitigate this risk, so it is depicted low (L) in Figure 6.2. Moreover, the dependence of CTU shifts from medium (M) (Fig. 6.1) to low (L) (Fig. 6.2). It is assumed, IOCB is not much affected by the consequences of COVID-19 since their revenues are not dependent on the exchange students and since it is perceived to be a well-funded institution.

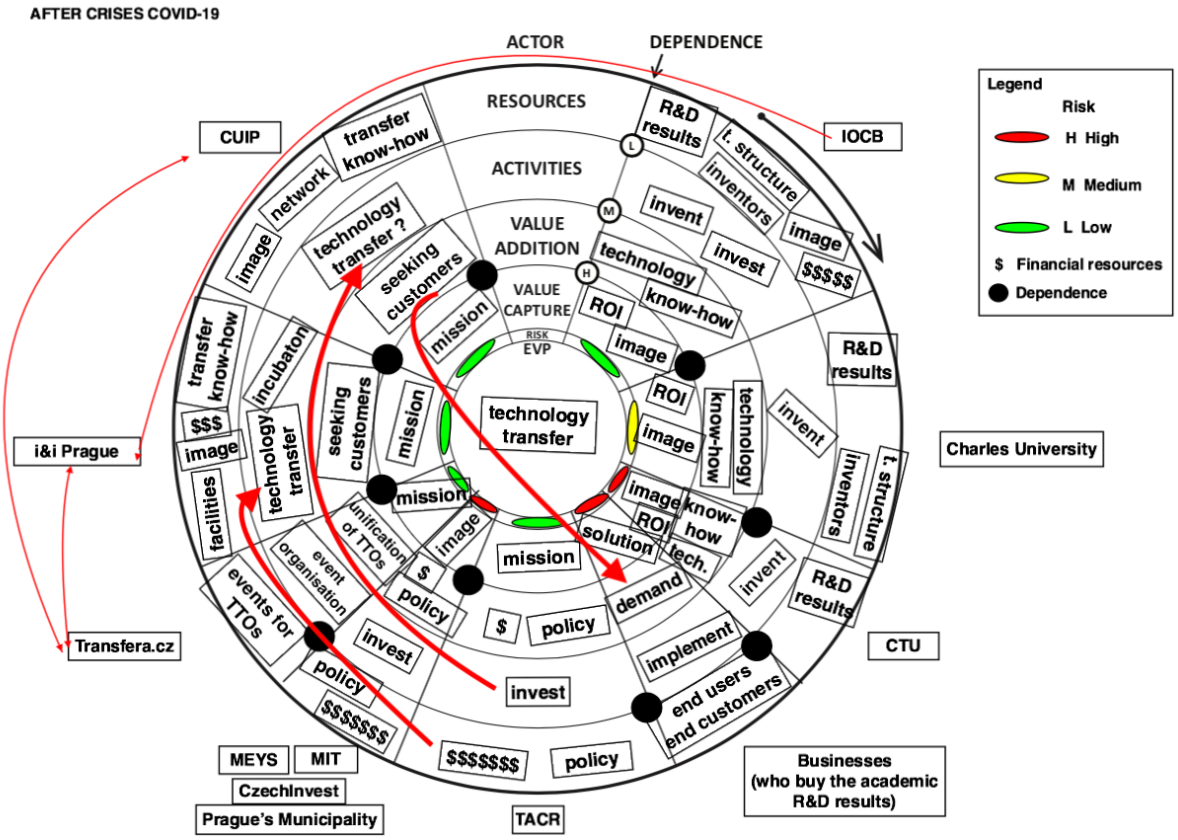


**Figure 6.2:** Ecosystem's Pie Model applied to the key technology transfer players in Prague after the crisis COVID-19.

## 6.4 Conclusion

In conclusion, there is technology transfer innovation ecosystem on the Charles University level a considerably, on the national level, but no real ecosystem on Prague's level. The national ecosystem proposing value of (academic) technology transfer has the inter-dependency among the technology transfer offices and technology transfer subsidiaries of the research and development institutions due to Transfera.cz, who organises meetings on monthly bases. However, based on the reflections of CUIP, there is no system-level output streaming from this collaboration. Moreover, there are public bodies - where the most significant is the Technology Agency of Czech Republic -, who provide funding through numerous operating programs for technology transfer institutions, which are aiming to create a focus and political goal. However, there are too many of the operating programs and it is hard to know what's what Vlk (07/05/2020). Also, the experience of CUIP shows that the programs are not suitable in many cases, because CUIP would need to pre-finance or co-finance projects, where salaries are not covered and which, a lot of times, are not in line with the value-creation of CUIP. Trasnsfera.cz could potentially ensure both sided understanding of the needs between the public institutions and technology transfer organisations, which the author of the project has not spotted Trasnsfera.cz doing until now.

There is a Charles University technology transfer innovation ecosystem, which consists of the creators of the results of research and development (e.g. researchers, students), the identifiers of research results with commercial potential (i.e. trained and funded scout net-

work involving the University researchers), the analysers of the market and commercialisation potential and the potential customer-companies (i.e. CKTT (Centre for Knowledge and Technology Transfer of the Charles University), which is integrated to the University), and transfer technology subsidiary as a the deal-closer (i.e. CUIP, who negotiates with the customers and signs the contracts). The ecosystem has strong interdependence, clear system-level output (e.g. spin.offs, commercial results) and collective identity. However, there is a potential for increasing trust from the actors towards CUIP. Moreover, due to the COVID-19 crisis, the relation between the financial resources of the Charles University and the activities of CUIP has almost disappeared (for a certain period). From the characteristics of an innovation ecosystem, the heterogeneity could be argued not to be fulfilled, since all the pieces of puzzles are in its very nature Charles University.

The actors in Prague seem to have national significance, but very little regional significance. The major issue from the entrepreneurial perspective is that there is very low interdependence of the customer-business with the rest of the players. However, this gives the transfer technology entities reason to exist, to "push the technology". Before the COVID-19 crisis, the highly interdependent entities of the potential ecosystem represented two research institutions and their technology transfer subsidiaries, TACR (Technology Agency of the Czech Republic) and Transfera.cz. As previously discussed, Transfera.cz seems not to have much practical value and TACR communicates only through the operation programs. Moreover, after the COVID-19 crisis, even the interdependence of Charles University decreased, which might very seriously influence the potential inability of CUIP to execute technology transfer. Currently, the ecosystem seems to have very low overall interdependence and questionable system-level output and probably no collective identity. Therefore, the author of the project has a sound argument for Prague's innovative ecosystem, which proposes the value of technology transfer, not to exist.

The findings of this chapter are useful for projecting a possible future innovation ecosystem (Section 11.3 TBD maybe), which can CUIP build once getting out of the crisis. The motivation of MEYS, MIT, CzechInvest or Prague's Municipality is concluded to be rather low because these public organisations are not dependent on technology transfer. On the other hand, TACR is established for technology transfer, so the motivation to be part of a technology transfer ecosystem can be high. The customer business should probably somehow encouraged to participate in the technology transfer ecosystem. It is in the interest of the R&D institutions to commercialise their R&D result. However, commercialisation requires an initial investment, so once securing it for the transfer purposes, the motivation of R&D institutions is estimated to be high. CUIP and i & i Prague seem to be highly motivated to participate in the ecosystem, however, they depend on financial resources to contribute to an ecosystem.

However, coming back to the WQ4 (What characterizes Prague's innovative infrastructure?), it is not fully answered by this chapter. The key players are mapped and the environment is understood better. Nevertheless, the characterisation of Prague's innovation infrastructure is supposed to bring more useful findings. Based on the qualitative research related to ecosystems, it is understood: a particular participant of a specific ecosystem can benefit from the ecosystem, only while adding value into it. Once the potential ecosystem is mapped (in Chapter 6) the proper question to ask is: "What does Prague's innovation ecosystem demand that CUIP can deliver?". The question reflects on the fact that this thesis is aiming to help CUIP out of economic crisis. And the ecosystem might involve perspective partnerships or new customer groups. This question formulates the following propositions. Firstly, Prague's Innovation Infrastructure has a problem and so, demands a solution (investigated in Chapter

7). Secondly, this demand can be fulfilled by CUIP (investigated in Chapter 9).

# 7 Demand in Prague's Innovation Infrastructure

*WQ4: What characterizes Prague's innovative infrastructure?*
*What is the demand in Prague's Innovation Infrastructure?*

The most pragmatic characteristic of Prague's innovation infrastructure turns out to be its demand. To define the demand in Prague's innovative infrastructure, several viewpoints are examined. The starting point is an interview with the director of CUIP, who is asked about the issues (or demand) of the Czech technology transfer ecosystem. Public organisations, such as Prague's Municipality or TACR prepare and realize its programs to fund applied research, experimental development and innovation. To fulfil their tasks, these entities collect data from different stakeholders utilizing surveys. Therefore, the viewpoint of Prague's Municipality is examined. The issues, vision, strategic goals and SWOT analysis of the *Regional Innovation Strategy of the City of Prague* by the Prague's Municipality (2018) are analysed. Moreover, an interview is conducted with the Innovation politics specialist from Prague's Municipality. Furthermore, the viewpoint of the Technology Agency of the Czech Republic is investigated based on Analysis of the TACR Survey 2014 about *Motives, Barriers, and Services regarding Technology Transfer in the Czech Republic* by Heilemann et al. (2014). Finally, the founder and key representative of a significant information broker, Vedavyzkum.cz, who is promoting the efforts of all the key players in R&D, innovation and technology transfer, is interviewed to get his subjective opinions on the topic.

## 7.1 CUIP's Viewpoint

According to the Director of CUIP, the Czech technology transfer community around the Transfera.cz is discussing the issues mainly based on the suggestions of CUIP and TTO of Masaryk's University. Last year, for instance, the establishments of spin-offs were discussed. Particularly, the leadership and the investments in various phases of the business. In conclusion, the issue of spin-off founding allows CUIP to consult this topic with less developed technology transfer offices at other universities, not only in Prague but in the whole Czech Republic. CUIP is aware of this opportunity and already provides this type of consultancy.

## 7.2 Prague's Municipality's Viewpoint

To understand the demand of the Prague's innovative infrastructure from the viewpoint of Prague's Municipality, the technology-transfer-relevant issues, vision, strategic objectives and strengths, weaknesses, opportunities and threats of Prague's innovative infrastructure are described based on the Regional Innovation Strategy of the City of Prague, which has concluded Prague's Municipality (2018). To clarify the findings, the Innovation politics specialist from Prague's Municipality is interviewed.

**Problems of the Prague's Municipality**

The problems are the following. Mistrust and lack of communication between actors from the public, academic and private sectors. Low level of investor care and absence of facilitation activities in cooperation with investors. Low level of commercialization of R&D results. The unused potential of the interdisciplinarity in education and R&D (Municipality 2018).

**Vision**

Czech entrepreneur stands for ideas, self-confidence, competitiveness and prosperity. The Czech Republic is entrepreneurial, creative and attractive for talent and money. The Czech Republic is becoming a country in which a high and sustainable living standard of citizens is based on solid foundations of competitiveness, based on new knowledge and its use in innovation in the corporate and public sectors as sources of future prosperity (Municipality 2018).

**Strategic objectives**

Strategic Objective 1: **Develop an environment stimulating the innovation and the functioning partnership**. Partnerships between the public, private and academic sectors are aimed to be improved via removing the barriers in communication, and aligning the goals and unifying the vision of the development of Prague (Municipality 2018).

Strategic Objective 2: **Support the creation and development of knowledge-intensive companies**. Despite the numerous science and technology parks, business incubators and accelerators, etc., the offer of this support infrastructure in Prague does not correspond to the demand. The goal is to increase the quality of the services by the support organizations so that they bring a sufficient added-value (in comparison to the rental of shared spaces) and so, reduce the failure rate of start-ups (Municipality 2018).

Strategic Objective 3: **Develop the local human resources for the needs of the knowledge-intensive economy**. One component of this goal is to resolve the mismatch between the structure of graduates and the needs of the economy. Another aim of Prague is to create such conditions that talented students and scientists stay in Prague and have the opportunity to further develop and apply their skills and to inspire others. It is especially important to motivate the PhD students and young scientists, when starting their scientific career or when starting up their businesses (Municipality 2018).

Strategic Objective 4: Increase the intensity of internationalization in research and innovation (Municipality 2018).

### 7.2.1 Interview

From the interview with the innovation politics specialist, Renata Králová (28/04/2020), it can be pointed out that Prague's Municipality formulates its needs though the calls (`http://penizeproprahu.cz/vyzvy/?po=1`). The Municipality can influence the technology transfer mainly with its demand for technology. However, the departments of the Municipality need to learn about its technology needs. An interesting issue is that Prague had no innovation centre until February 2020 in comparison to other regions of the Czech Republic, which caused the absence of a clear public player for the development of the innovation environment. **[This also means, the newly built innovation centre might seek for expert-consulting in order to**

**compensate its level of newlines in the field.]** The further serious issue is **the stagnation of tourism in Prague due to the quarantine, which represents 84% of the economy of Prague**.

The thesis has previously investigated the calls and so the problems of Prague's Municipality. The most reasonable action of CUIP to Prague's Municipality needs is a reaction to the calls. As previously discussed, the disadvantage of the is these calls are the need to cover the costs first, before getting the funding. The other two issues are not in the scope of CUIP expertise.

Prague's Municipality is leaving all its calls to the Ministry of Trade starting from the beginning of the year 2021, which will most likely not allocate funds into the Prague region. The question remains whether Prague will finance innovation activities including technology transfer from its own resources, because the Municipality's operation program (OP PPR) co-finances 50% from its own resources.

## 7.3 TACR's (Technology Agency of the Czech Republic) Viewpoint

The barriers regarding technology transfer in the Czech Republic based on the Analysis of the TACR Survey 2014 by Heilemann et al. (2014) are following.

According to the addressed Czech **Research Organizations** (the percentage of the respondents, who agree on the statement is placed in brackets), the barriers regarding technology transfer are "**administrative burden on researchers due to commercialization activities**" and "**lack of time of researchers to commercialize**" (75%), also **unfavorable regulatory standards like funding for research and higher education** (more than 70%) and "**difficulty in finding suitable commercialization partners in the region**" and "problematic commercialization of the results of research financed from public funds (conflict of interest)" (70%). It seems researchers do not perceive the barrier to be their lacking motivation. Some researches believe a barrier is the **low level of absorptive capacity** as it can be understood from the following citation. "It is necessary to raise the overall level of expertise in the corporate sector. As long as there are not qualified people able to articulate their needs and understand the answer, neither of the parties will be able to communicate with each other. This is not provided by any CTT." (Heilemann et al. 2014, p. 10) . Another respondent from an R&D institution commented on **difference in values of R&D and of commerce** "Commercialization is not a prestigious activity, it is not evaluated scientifically, it is not a traditional activity. It is difficult for the institute to looking for suitable partners who are willing to invest sufficiently in joint research." (Heilemann et al. 2014, p. 10).

According to the addressed Czech **TTOs** (Technology Transfer Organizations) (the percentage of the respondents, who agree on the statement is placed in brackets), the barriers regarding technology transfer are "**the lacking motivation of researchers to commercialize**" (95%);"**the difficulty in finding suitable commercialization partners in the region**" (84%); and that "**the research results are in a condition that is very hard to commercialize**" (84%). Some representatives of TTOs believe a barrier for their core activity is the **low level of absorptive capacity** ("There are no local partners, scientists are pushed by the funding system to publish (not only publications but e.g. student dissertations), a large distance from the market."(Heilemann et al. 2014, p. 14)) and inappropriate structure of TTOs, which are not a limited liability company owned by a university, and **hardly-fulfil-able obligations for partners to get the pre-seed projects publicly funded**.

According to the addressed Czech **companies** the major barriers in collaboration with universities and/or RO (Research Organisations) are "**slowness and inflexibility of the uni-**

**versity system**", "**high administrative burden on the company**", "**insufficient quality of research services of the University/RO**" and "**absence of clearly defined methodologies and guidelines for research collaboration**" (Heilemann et al. 2014, p. 19).

Majority of the companies see no (or very little) benefit of following services related to technology transfer: trade fairs for companies and universities/RO, mapping the innovation potential of a business of a company, mediation of networking and meeting opportunities, market analysis, and advice on the introduction of new technologies into operation, the involvement of a companies employees in teaching at the university, and information on further education. Moreover, a significant number of companies have no idea what advice a technology transfer entity could offer.

The companies considered the following services of technology transfer organisations as providing the greatest benefit: informing about the services of R&D, mediating joint research projects, informing about the offer of know-how and technology, mediating opportunities for "networking" and meetings" (63 % of companies, which are TACR clients responded so).

## 7.4 Vedavyzkum.cz Founder's Viewpoint

The founder's of Vedavyzkum.cz subjective opinion is that over time the same cooperation topic has been filed under a term of innovation, later under the concept of the cooperation of universities with industry, which shifted into a technology-transfer talking point and now it is an innovation ecosystem (Vlk 07/05/2020).

According to Vlk (07/05/2020) the issue of Prague's innovation ecosystem, which proposes the value of technology transfer, (if there is any) is a **lack of cooperation between the key entities** (e.g. universities, institutes of the Academy of Sciences, enterprises), in which Prague does not differ from other regions of the Czech Republic. There are only exceptions where it works well. However, the institutions in Prague are probably more self-sufficient compared to other Czech regions and its employees (e.g. university researchers) typically have more jobs, which causes their decreased attention to the cooperation initiatives with other entities.

The particular barriers, adds Vlk (07/05/2020), to better cooperation are following. **R&D and commerce are two separate worlds with different values**. People still do not understand they need each other. Moreover, the cooperation must bring benefits to each actor. They cannot steal from each other. Businesses cannot ask scientists for free work. Also, the researcher cannot offer over-priced services to companies.

The subjective opinion of Vlk (07/05/2020) is that **the main problem is the lacking mobility of people**. Academics are most of their lives at a university as a PhD student, associate professor, professor etc. People, who are working at ministries, have been in the public sector all their lives too. The same applies to employees of companies. The issue is all over the world. Furthermore, academics value the publications, whereas companies the problem-solving.

Vlk (07/05/2020) adds, the Czech Republic is a small country, but the system of innovation support is fragmented and one does not know what is what, which is another barrier to better cooperation. The main public players compete instead of collaborating. CzechInvest, MIT (Ministry of Industry and Trade), TACR, or Government Office are fighting against each other. Besides, the support system is divided into regions and the rules are different at different levels. There are 60 operational programs (i.e. publicly funded financial instrument) announced (by different public bodies) to support innovation and keeping track in them is difficult. The Slovak Republic, in contrast, supposedly wants to announce only one operation

program to support innovation.

## 7.5 Discussion

The demand in Prague's Innovation Infrastructure is perceived differently based on the role of the player.

CUIP is asked about the issues in the technology-transfer ecosystem first, because of the information access-ability and because it sees itself as the technology transfer leader, due to the cognitive inter-dependencies of the technology transfer offices in the Czech Republic on CUIP. CUIP recognises technology transfer ecosystem in Prague as the members of Transfer.cz (which is also the only existing ecosystem). Therefore, CUIP looks on the issue of the ecosystem proposing the value of technology transfer as on the topics discussed on the Transfera.cz meetings. The "establishment of spin-off companies" know-how is indeed demanded, but it is already sold to other TTOs by CUIP. Therefore, it has no practical value for the thesis.

Prague's Municipality identifies some problems, which can be easily linked to technology transfer, within Prague's innovation infrastructure, but they are too general to have a practical value for the thesis. CUIP acknowledges the issue of the mistrust, that the academics express for the entrepreneurial efforts. Prague's Municipality is assumed to demand the solution to it. Once CUIP can find a solution to the mistrust (suggestions can be found in Section 11.1.1), which applies to other organisations, the revenues can stream from such know-how. However, CUIP is still dealing with the academic mistrust phenomenon to entrepreneurship. This is, however, probably a too complex issue to be solved.

Technology Agency of the Czech Republic (TACR) provides the most multiplex view on the topic, despite the data are collected in 2014. The findings from this source turn out to be the most hands-on. Researchers see mainly the barriers, which are related to the policy of their R&D institution or to public institutions providing funding. The most interesting are the findings of how the Czech companies perceive the value-contribution of technology transfer organisations and how unclear image the companies have about the offering of TTOs. Further useful discovery for the thesis represents the barriers of technology transfer distinguished by TTOs, which might be the cornerstones for the future action of CUIP.

The founder of Vedavyzkum.cz gives subjective opinions on the topic, which enables me to narrow down the previous finding and validate, whether they are up to date.

## 7.6 Conclusion

In conclusion, the demand in Prague's innovation infrastructure is following.

Prague's Municipality needs a viable solution to the mistrust and lack of communication between actors from the public, academic and private sectors, for instance. Prague's Municipality demands the answer to, how to achieve greater engagement of all the key players within Prague's innovation infrastructure to cooperate with investors, or how to strive for a higher level of commercialization of R&D results. Prague's Municipality is also seeking way, how to use the potential of the interdisciplinarity in education and R&D. There is a potential demand for expert-consulting related to the newly-build (February 2020) innovation centre of Prague's Municipality. Moreover, the Municipality might also need the solution to the stagnation of tourism (and connected unemployment) in Prague due to the effects of COVID-19.

The researchers of R&D organisations demand the removal of the administrative burden due to commercialization activities and probably, ease of the commercialisation process, so

it takes less time. To dedicate to technology transfer, researchers need a solution to the unfavourable regulatory standards like funding for research and higher education. Furthermore, the engagement of researchers in commercialisation relates to the need for removing the difficulty in finding suitable commercialization partners in the region. The researchers also require that the companies are clear about what they want.

The technology transfer organisations need to engage the motivation of researchers to commercialize. They also need to solve the difficulties in finding suitable commercialization partners in the region or abroad. The technology transfer entities demand idea on, how to ease the commercialisation process of the research results are in a condition hard to do so. The technology transfer offices need the institutional policy to publish market-relevant works and engage the students to work in applied research with local partners. Technology transfer offices need to engage local companies to collaborate with their R&D institution.

Czech companies demand fast and flexible collaboration with a university system to be interested in their technologies. They need the high administrative burden on the company to be removed. Companies need to be assured about the high quality of research services of the University or R&D organisation. The customers also demand very clear guidelines and defined methodologies for research collaboration. Moreover, companies have to know, what they can be advised on or what is the offer of a technology transfer organisation.

The companies probably need that the most valuable services of technology transfer organisations (e.g. informing about the services of R&D, mediating joint research projects, informing about the offer of know-how and technology, mediating opportunities for “networking” and meetings” for companies and R&D players) are promoted more.

# 8 Supporting Prague's Innovative Infrastructure

*WQ5: How to support Prague's innovative infrastructure?*

Answering WQ5 is not the key aim of the thesis, because the political fundamentals of it are out of the scope of Entrepreneurial Engineering curriculum. However, reporting WQ5 might favourably impact the practical outcome of the overall goal of the thesis, which is to find a resolution to the crisis of CUIP or more generally, to develop the business. Therefore, the suggestions to support Prague's innovative infrastructure are viewed through the lens of a potential opportunity for CUIP.

In this chapter, the writer proposes solutions to the identified issues of Prague's innovative infrastructure (Chapter 7) through a possible contribution of CUIP regardless of its current economic crisis. The pieces of advice are composed based on the author's EE (Entrepreneurial Engineering) knowledge and experience gathered throughout the four semesters of the Master program.

As the recommendations for Prague's innovative infrastructure are serving only as an inspiration for the business development of CUIP (rather than as the effort to solve the complex problems, which are very political), the viability of the solutions is very little discussed. Only the viability of those encouragements of Prague's innovative infrastructure is elaborated, which are perspective as development aims for CUIP.

## 8.1 Increasing the Trust-level

Prague's innovative infrastructure might be supported by increasing the level of trust and enhancing the communication between actors from the public, academic and private sectors. According to Shurtleff (1998), mistrust is a result of a lacking commitment, a lower satisfaction, a lacking open communication, empty words and unrealistic images. On the other hand, trust-worthiness is encouraged when doing what is said (in other words when following agreements) (Shurtleff 1998). It can be concluded, that trust and mistrust are very subjective phenomena. Therefore, the solution is not sought for further.

## 8.2 Addressing the Needs of Prague's Municipality

Solutions to the stagnation of tourism (and connected unemployment) in Prague due to the effects of COVID-19 or to the way of using the potential of the interdisciplinarity in education and R&D is too broad is probably not in the interest of CUIP to solve.

On the other hand, the **expert-consulting (related to advising Czech technology transfer offices) the innovation centre of Prague's Municipality** could be interesting both for the centre and CUIP.

Hypothetically, **CUIP could also offer the Municipality consulting on developing an efficient program, where the technology transfer organisations could apply for funding**. To be potentially paid for the service, the 2-year-long existence of CUIP would need to be compensated by explaining the many years of experiences of the team and the technology transfer successes (Králová 28/04/2020). Even not paid interaction of CUIP and Municipality could

lead to a better understanding of Czech technology transfer and have a positive future outcome for CUIP too. However, the Municipality would probably not agree on such a subjective approach of developing the program.

However, Gov-Tech industry brings a lot of challenges. Prague's Municipality formulates its needs related to technology transfer via its operation programs, which allocate funding to organisations based on their relevancy to the goals of Prague's Municipality. This is the most realistic collaboration of CUIP and Prague's Municipality and probably will be.

Concluding the findings of the demand of Prague's Municipality, CUIP is not able (at least not yet) to deliver a service, which brings value on both sides.

## 8.3 Addressing the Needs of Researchers

The administrative burden on researchers due to commercialization activities could be removed by mapping the journey process of a researcher when wanting to engage with the commercialisation process. The inspiration for such a solution is taken by modifying the customer journey map introduced in a workshop by Lieblich (31/11/2019) (provided by InnoFounder). This could be a mitigation for the lack of time of researchers for the commercialisation process too. **The project suggests to CUIP to validate, whether there is a real demand on the side of TACR (eventually technology transfer offices or universities, and R&D organisations) to solve the two mentioned issues**. If so, it is recommended to interview representative sample size of researchers of Charles University by CUIP on their journey when proceeding with the commercialisation process. Later, all the related administrative obligations and time spent per each activity of the overall process have to be identified. Once having a clear overview and recognizing the redundant documents and proceedings, it is advised to negotiate with Charles University the changes. Despite the commercialisation process is in nature iterative process, which differs from case to case, there could be **a clear guideline for Charles University researcher on what to expect from the commercialisation process available on the website of CUIP or CKTT**. By generalising instructions, how to provide the researcher better experience when commercialising their R&D results, CUIP could develop a valuable trade secret, which could be sold to a potentially interested customer (e.g. TACR or other interest).

The unfavourable regulatory standards like funding for research and higher education are a too political issue to be interesting for CUIP.

The researchers also require that the companies are clear about what they want. CUIP could through the Charles University develop a programme to **encourage the students of Charles University to take internships in companies and lead the students to be able to identify the needs of the companies, which can be addressed by the application research conducted at the University.**

## 8.4 Addressing the Needs of TTOs

How could the motivation of researchers to commercialize be increased? According to the author of the project, by creating an entrepreneurial-friendly environment around the future researchers, who are students currently. CUIP has already taken the first step and facilitated the students of Charles University, which are entering the next academic year, to get a very hands-on entrepreneurial course on voluntary bases (provided by Podniknito!). To encourage the curiosity of students in applied research, CUIP could simplify the process of getting internships. As Vlk (07/05/2020) states, people should migrate more across the public, research

and private sectors. Moreover, the writer suggests that CUIP motivates the students to participate in Hackathons and other events, where knowledge disciplines are crossing intending to bring new solutions.

The struggles of TTOs such as finding suitable commercialization partners or the variety of other difficulties in the commercialisation process with the research results can only be responded with an agile and creative approach driven by clear values of TTO.

The TTOs need to promote commercialisation successes as great contributions to society. At the end of the day, it is all about creating value for society, rather than the conflict between the prestige of publishing and prominence of creating revenues. Building an understanding in students of the importance of applied research and the value of it can prevent the dilemma of future researchers, whether to publish or commercialise.

It requires mainly time, patience and dedication to technology transfer to address the demand of the TTOs. In conclusion by the project, no new need for TTOs has been identified, which represent a commercial opportunity for CUIP.

## 8.5 Addressing the Needs of Customer-companies

Czech companies demand fast and flexible collaboration with a university system to be interested in their technologies. Since CUIP claims its strength to be dynamic (and so, fast) team, it is suggested to CUIP, to track customer satisfaction and the time from the first touch to customer close as a KPIs (Key Performance Measurements). This information is advised to be available on the website of CUIP so that more commercial partners are excited to become its customers.

Since the customers demand very clear guidelines and defined methodologies for research collaboration, it is recommended to CUIP to apply the same approach as with researchers (description can be found in Section ). A realistic procedure with companies should be designed, in order to ensure their good experience with CUIP. It is advised to CUIP to place the crystal-clear guideline for customer-companies on the website of CUIP in a way, that the customer-companies understand they are the target audience of the information.

Regarding the communication channels of CUIP towards the companies, the offering and customer-benefit should easy to recognise too. CUIP should write on its website, what the companies can be advised on and its value propositions for customer-companies (apart from the catalogue of the technologies).

CUIP could also mediate more joint research projects with companies and opportunities for networking, where are the participants of both, companies and R&D players.

Corporate companies might be interested in being advised by CUIP on establishing of spin-offs in relation to the corporate entrepreneurship efforts, but the need should be validated first.

**In conclusion, clarity of the communication channel of CUIP to customer-companies might lead to creating more "technology pull" in CUIP. A new value proposition of CUP can be the facilitation of spin-off-establishing for corporate companies, in case of interest.**

## 8.6 Perspective Partnerships

TACR pointed out an interesting statement of a company in its Analysis by Heilemann et al. (2014). Transfer of technology should be focused on centres intended for several institutes in the given locality. The centre should be highly professional, and the state should allocate

funds to support its activities. The centre should assemble several lower-quality TTOs and deliver so a bigger value.

Once validating TACR is interested in the funding of a technology transfer joint centre, CUIP is advised to cooperate with TTO of CTU (Czech Technical University) in Prague and other relevant TTOs of technical universities and R&D institutions (e.g. University of Life Sciences Prague, Institute of Physics of AS CR(Academy of Science of Czech Republic), Food Research Institute Prague, Institute of Chemical Technology Prague, Institute of Organic Chemistry and Biochemistry AS CR, Institute of Microbiology AS CR, Institute of Experimental Medicine AS CR, Institute of Physiology AS CR).

CUIP can provide more consulting services to universities in the Czech Republic on developing technology and on technology transfer. CTU, for instance, is a very specific University, because of a strong autonomy of its departments. A potential opportunity for CUIP represents consulting CTU on the way of building a decentralised TT (technology transfer) sub-system at the departments of CTU, which is at the same time centralised too thorough close collaboration the TT sub-systems.

IOCB and its subsidiary i&i Prague seem to be an interesting partner for CUIP. CUIP can mediate joint projects of the researcher and include the financial resources of this well-funded institution.

## 8.7 Open system

Based on the interview with the Head of Technology Transfer Office at Aalborg University, Peter Rasmussen (20/05/2020), the writer suggests to CUIP to build as much open system as possible, where any organisation (e.g. company, university) feels very welcome to participate but is clear on what does it bring to the system. In practice, CUIP is advised to make sure, there are a lot of activities surrounding Charles University, which inspire different stakeholder (e.g. students, student entrepreneur groups, entrepreneurs, research groups). This strengthens cross-disciplinary learning and ideation.

## 8.8 Conclusion

In conclusion, Prague's innovative infrastructure can be supported by engaging the current and future researchers following measures. The administrative procedure related to commercialisation should be as simple and fast as possible, which can be assured by journey-mapping commercialisation process of a researcher and eliminating the unnecessary steps. The understanding of values of commerce and R&D should be aligned by engaging the current students to take more study internships.

Furthermore, Prague's innovative infrastructure can be strengthened in case TTOs provide the customer-companies fast and flexible interaction and enable a clear understanding of their value propositions. According to the writer, the former should be assured by founding subsidiaries of TTOs with limited liability and by journey-mapping of a customer-company when acquiring any service from a TTO and eliminating the redundant steps. The later should be facilitated by updating the websites of TTOs (or their subsidiaries), so the audience can easily find relevant information on proposed value to the customer-company a TTO and straightforward guideline on the collaboration.

Unifying the TTOs in Prague into a centre of technology transfer, where more funding and commercialisation know-how may lead to greater commercialisation results within Prague's

innovative infrastructure. However, the writer sees too many barriers in executing such project (e.g. institutional rivalry, disproportional funding among the institutions, personal conflicts, operational barriers).

Prague's innovative infrastructure can be supported by an increase in the migration of people among the sectors (e.g. private, public, academic), so that trust is built.

To sum up, the business of CUIP can be developed when pursuing the following suggestions. Improve the experience of both, inventors and customers, as much as possible by mapping the journey throughout the commercialisation process and eliminating unnecessary steps, fighting against the administration burden is time-consuming, but worth it. Eventually, propose CKTT to improve the experience of the researchers instead. Facilitate more internships for the current students of Charles University to build an understanding in future researchers, how is applied research important and how can commerce and R&D share the same motivation to deliver value to society. Besides, promote commercialisation successes as great contributions to society, so that over time commercialisation gets viewed by researchers with the same respect as publishing. Organise a lot of activities at Charles University encourage the curiosity of students in applied research, CUIP could simplify the process of getting internships. Moreover, organise a lot of activities, where students, researchers, and companies can gather and have stimuli to get cross-disciplinary knowledge. Build an open system, where anyone is invited and motivated to bring some sort of value. Motivate the students to participate in Hackathons to find joy in bringing to light new ideas and solutions. Nevertheless, the pieces of advice are not solving the economic crisis of CUIP. Partnership with Prague's Municipality, nor other TTOs in Prague does not seem to be useful in this respect. Other ideas as selling know-how on the organisation of Hackathons once CUIP acquires the experience is irrelevant as much as selling the consulting related to manners of increasing the value of commercialisation in the viewpoint of researchers.

*WQ6: How to help CUIP to stay in business?*

Finding a solution, which is helping CUIP to stay in business and which is at the same time related to the demand in Prague's innovative infrastructure, turned out to be very challenging. The writer recommends to CUIP to validate, whether TACR or other relevant organisation (e.g. a TTO within the network of Transfera.cz, CTU, etc.) is willing to pay for the know-how to faster and less administration-heavy commercialisation procedure and once identifying cost-benefit ration, develop the know-how as described in Section 8.5.

A possible answer to the crisis of CUIP represents a Czech financial instrument. However, CUIP analysed the relevancy of Czech financial instruments without the help of the project-author, so it is not pragmatic to deliver the same outcome to CUIP again.

Finally, the project can conclude, no straight-forward demand in Prague's innovative infrastructure can be delivered by CUIP. Accordingly, Prague's innovative infrastructure offers a solution to the crisis of CUIP.

# 9 Solutions to CUIP Crisis

*WQ7: How can I support CUIP with my EE (Entrepreneurial Engineering) experience?*

The outcome of the striving of the project for answering the RQ is condensed in this chapter. Responding WQ7, the author of the project proposes solutions to the economic crisis of CUIP (no matter they are linked to the Prague's innovation infrastructure or not) based on all the confronted stimuli throughout the project and the writer's EE (Entrepreneurial Engineering) experience. The recommendations for CUIP reflect on an effort to reduce the costs of CUIP or to find a new revenue stream relevant for the case company. The current circumstances of CUIP and the need for its change management are taken into account to have a notion of the cost-benefit ratio of the pieces of the project advise.

## 9.1 Risking Instead of Patenting

CUIP is requested to **reduce the costs related to patents in the technology transfer ecosystem of Charles University**. This piece of advice is based on the interview with the Head of TTO (Technology Transfer Office) at AAU (Aalborg University) (Appendix A) and Legal/IP Masterclass by Vilhelm & Nielsen (14/11/2019) (organized by InnoFounder). According to Rasmussen (20/05/2020), in case of an economic crisis at his department, would invest less in patents. The technology transfer team would work more extensively on inventions together with the companies, but based on trust not by IP protection. They would spend way more time with fundraising and financing cases, rather than patenting (Rasmussen 20/05/2020).

The TTO at AAU already avoids patenting when possible and takes a lot of risks when approaching the companies. Instead of licensing the patents, the TTO licenses the trade secret (i.e. the rights to use the invention without any protection). It depends on the industry, the approach is not applied to pharmaceutical companies, for instance. According to (Rasmussen 20/05/2020), his team have built great industrial relations to a lot of companies over the years, so it is possible to discuss confidential information through calls (without any protection such as NDA) with many companies.

CUIP already has the experience in licensing the trade secret, which represents around 5 to 10 % of the overall activities of CUIP (Sláma 26/05/2020). Sláma (26/05/2020) explains it is not convenient to patent because of the age of the invention, for instance, or because of the high cost. Besides, the commercialisation cases of CUIP are emerging from research projects, which are granted from the TACR. It is highly appreciated at Charles University when such granted project is finalised by a patent, which is perceived as well seen output (Sláma 26/05/2020). CUIP is throughout the crisis shifting or trying to shift the costs related to patenting to CKTT or the application partner (Sláma 26/05/2020).

**In conclusion, the author of the project suggests to CUIP to increase the proportion of trade-secret licensing within the overall activities of CUIP. Once calculating all the saved costs (e.g. initial fees for the patent, maintenance fees) on behalf of CKTT, CUIP can negotiate with its better-funded partner (CKTT) to get financial compensation of the savings for its operations or salaries. Advantage of this solution is that no change management is needed for CUIP (solely).** Disadvantage is the difficulty to change the mindset of academics about the value of a patent. Vanity KPIs (Key Performance Indicators) of universities have to do with culture, which is never easy to change. Moreover, there are risks connected to

having no protection of the IP. In the worst-case scenario, a commercially perspective trade secret could be stolen and the PR of CUIP could dramatically decrease. However, in the best-case scenario, CUIP achieves positioning within the Charles University as the company with trusted network and value-driven KPIs, rather than vanity ones. The author of the project argues the risk is worth taking since the solution goes hand in hand with the Lean Startup by Ries (2011) principles and so, even in case of the worst-case scenario, there is going to be valuable learning.

## 9.2 Income from Participation in Boards of Directors

Another proposition to CUIP is to **offer a new value proposition to corporations and other academic and industrial players, which is participation in the Boards of Directors of newly established spin-off companies**. The suggestion also emerges from the interview with Rasmussen (20/05/2020) (Appendix A).

AAU TTO has been for years asked to participate in the Boards of Directors of newly formed companies by the investors or by the industry because some of the technology transfer team at AAU have had a lot experience. To make sure the technology was very well translated into the investor's spin-off company the members of TTO AAU were asked to participate in the Boards by various parties. They did that to a large extent, but not anymore that much because it requires too many resources. The value-creation of the particular TTO also depends on the environment and the demand of the local ecosystem (Rasmussen 20/05/2020).

According to the author's subjective opinion, there are three members of the extended CUIP team, who are extraordinarily skilled in translating the commercial potential of the R&D results into an interesting business case for investors, companies, entrepreneurs etc. Furthermore, the Director of CUIP is a Board member in both spin-offs, which are established by CUIP, and he has a commercial background. The competencies of the current Director, eventually of the current Deputy Director and the current Market-Potential Analyst too, could catch the interest of corporate companies to include them in the Board of Directors of their spin-off companies. From the perspective of the change management, the core activity to deliver the new value proposition would stay the same, but the key personnel of CUIP would need to dedicate a lot of time and efforts to such side project, which is not even connected to Charles University. On the other hand, the contacts of CUIP with commercial partners can have a major positive influence on the overall technology transfer at Charles University.

In conclusion, the writer advises to CUIP to decide how much revenues would be worth spending the man-hours of its team on participation in the Boards of Directors of newly established spin-off companies by industry. Once realising, the new value proposition is worth executing, research on promising customer segment should be done and the potential customers should be offered the new service of CUIP.

## 9.3 Income from EU Funds

Since CUIP did thorough research on financial instruments in the Czech Republic and the team concluded them being not of use, the Czech funding is not investigated by the project. The EU funds have been considered by CUIP even before the project. Therefore, the Innovation Account Manager with the competencies in applying for the EU funds was supposed to get into CUIP a day before the effects of COVID-19 crisis were projected to the activities of CUIP. Can EU funds be a solution to the crisis of CUIP?

The project has identified only a co-investment fund of relevancy, which is InnovFin Technology Transfer (TT). It is part of the InnovFin Equity umbrella managed by EIF (European Investment Fund), which targets investments technology transfer funds operating in the pre-seed and seed stages. The deadline for submitting the application is the 30th of September 2020. However, CUIP does not have the financial resources to co-finance. The instrument is concluded not to have practical use for the case company.

Since the experience of the writer as an intern in 3rd semester proved the EU funding to be worth to apply, CUIP is advised to do the further research in EU financial instrument and later application being worth trying even without a team member with prior involvement in the EU funds.

## 9.4 Conclusion

Based on the writer's EE experience, CUIP is advised to increase the proportion of trade-secret licensing within the overall activities of CUIP. To elaborate on this, taking the risks related to no protection of IP are worth taking (apart from pharmaceutical cases) with greater frequency by CUIP, due to the potential output of financial compensation provided by CKTT for the savings related to patents; positioning within the Charles University as the company with a trusted network; the image of an initiator of a value-driven KPIs at Charles University (applicability of R&D results instead of the goal of having a patent); valuable learning (in case of IP being stolen).

CUIP is also recommended to decide how much revenues would be worth spending the man-hours of its team on participation in the Boards of Directors of newly established spin-off companies by industry. Once realising, the new value proposition is worth executing, research on prospective customer segment should be done and the potential customers should be offered the new service of CUIP.

Finally, CUIP is suggested to provide further research in EU financial instrument and to apply for funds even without a team member with prior experience with it.

# 10 | Action Plan

**A condensed version of the suggested actions to mitigate the current economic crisis of CUIP are as follows:**

Increase the proportion of trade-secret licensing within the overall activities of CUIP. Savings on patent-related costs can be refunded by CKTT (or Charles University) and used for operations. The potential advantages (e.g. of positioning within the Charles University as the company with a trusted network; the image of an initiator of a value-driven KPIs at Charles University; valuable learning in case of IP being stolen) exceed the disadvantages of risks related to non-protected IP.

Validate the willingness of industrial customers to pay for having the Director of CUIP, alternatively other CUIP members, as member in a Board of Directors companies, which are newly established by the potential client. Later, decide how much revenues would be worth spending the man-hours of the team of CUIP on such a value proposition.

Provide further research in EU financial instrument and to apply for funds even without a team member with prior experience with it. The potential of getting needed resources exceeds the risk of poorly invested time.

Validate the willingness of TACR or other relevant organisation (e.g. a TTO within the network of Transfera.cz, CTU, etc.) to pay for the know-how to faster and less administration-heavy commercialisation procedure. Follow Section 8.5 to gather the know-how, in case of the dedication to this activity seems relevant to the team of CUIP.

**A condensed version of the suggested actions develop its business after the crisis are as follows:**

Improve the website of CUIP to target a specific audience with a personalised content, which clearly addresses the cognitive needs. In particular, clarify the guidelines for research collaboration when targeting customer-companies. Elaborate on what can the companies expect from CUIP. Address the researchers of Charles University in the website of CUIP too and provide them with an explanation, what can they forecast from CUIP. Target the media by placing a "Press" list or file on the website of CUIP, where all the logos, figures and other relevant materials and information can be placed to ease the work of a journalist to report about CUIP.

Provide the researchers with a good experience related to the commercialisation process by mapping the process from his or her point of view and try to minimize their administrative obligations even if it takes the change of guidelines of Charles University. Eventually, propose to do so your partner, CKTT (and get compensated for it). More importantly, secure good experience of customer companies and minimise their time and administration, which relates to technology transfer.

Facilitate more internships for the current students of Charles University to build an understanding in future researchers, how is applied research important and how to share commerce and R&D share the same motivation: delivering value to society. Besides, promote commercialisation successes as great contributions to society, so that with time, commercialisation is more likely to be viewed by researchers with the same respect as publishing. Organise a lot of activities at Charles University, which is encouraging the curiosity of students in applied research and entrepreneurship (e.g. Hackathons), or where students, researchers, serial-entrepreneurs and companies can gather and have stimuli to get cross-disciplinary knowledge. Build an open system, where anyone is invited and motivated to bring some sort of value.

# 11 Further Development after the Crisis

As side effect of the project, few more business development topics are discussed, which are eventually leading to suggestions to CUIP. Most of the pieces of advise do not reflect on the current economic crisis. However, they may be useful once CUIP has sufficient financial resources.

## 11.1 Building Trust with Charles University

### 11.1.1 Mistrust Issue

A significant barrier for technology transfer represents "publish or perish" type of motivation of academic researchers, which means the publishing is the academic value number one. Publication of an invention causes loss of attractiveness for its commercialisation. Another limitation is contradiction of values of commerce and research worlds. The majority of academics perceive the financial resources only as a mean for the scientific advancement, wheres the entrepreneurs see science as a mediator of profit. Moreover, scientist keep distance from application sector, as for many years the basic research has been valued more than the applied one, which causes mistrust or even contempt to commercialisation efforts (Štěch & Dvořák 2008, p. 72).

According to the words of the Director of CUIP, which are available at www.vedavyzkum.cz (05/02/2020)), an obstacle of CUIP is clearly mistrust on all sides. When explaining how CUIP works inside the Charles University (e.g. to the faculty representatives, scientists) or even to the companies from the application side, they do not trust CUIP in the beginning. However, if they give CUIP the space to show what the teams of CUIP can do, then the feedback is usually positive due to the high quality and speed. It is getting easier for CUIP to overcome initial mistrust, because of the expanding portfolio of examples of good practice of CUIP (www.vedavyzkum.cz 05/02/2020).

The described barriers of technology transfer are assumed to be reflected on how the management of Charles University comprehends the importance of CUIP.

### 11.1.2 Importance of Building Credibility

Based on interview with Dr. Aleš Vlk, the founder of the most important Czech news portal on R&D, Vedavyzkum.cz, CUIP should not dedicate to addressing the demand of a Prague's innovative infrastructure or the potentially existing Prague's innovative ecosystem, which is more specified by technology transfer value proposition. Instead, CUIP should build credibility at Charles University. The greatest value CUIP can deliver to Prague's innovative infrastructure is fulfilling all the obligations to Charles University with honor (Vlk 07/05/2020).

Dr. Aleš Vlk is not informed by the project-author about the crisis of CUIP, since the reputation of Charles University and CUIP is aimed not to be damaged. Interestingly, the founder of Vedavyzkum.cz adds the following. Since many representatives of Charles University incline to the left-wing and since there are cost-cuts at public universities due to the departure of foreign students, there is stop-state at Charles University. Therefore, Charles

University might doubt, whether the commercialization activities are redundant or necessary. CUIP must fulfil its internal goal and so, hold up its status the first five years. CUIP should not waste time solving the issues of the Prague innovation infrastructure, since the company should take care of itself. The main goal of CUIP should be to position itself as an integral part of Charles University, not as "parasite". CUIP does no need to fight bigger political problems, until Charles University - during the economic crisis - shows compassion for CUIP and does not want to close the company. Gaining credibility within the Charles University is the main goal. Transfera.cz should take care of politics instead. TTO of Masaryk University, for instance, had to fight for the position of the desired entity for several years (Vlk 07/05/2020).

### 11.1.3 Manner of Building Credibility

How can trust be build? According to Shurtleff (1998), mistrust is a result of a lacking commitment, a lower satisfaction, a lacking open communication, empty words and unrealistic images. Moreover, not keeping promises decrease the trust-level (Vajda 2014). On the other hand, trust-worthiness is encouraged when doing what is said (in other words when following agreements) (Shurtleff 1998). Furthermore, actively-listening is an actions encouraging to trust (Coveney 2018).

When Peter Rasmussen, the Head of TTO at AAU (Aalborg University) is during an interview (Appendix A) touches the trust topic as follows: "You [as a TTO] need to create credibility with the researches. You do not the build the credibility by just identifying inventions or doing the technology transfer and proving you are worth anything. To build credibility, we [AAU TTO] are trying to do it right with researchers. We build the credibility by having the right competencies, the way we deal with inventions, the way we scout and discuss the potential inventions with the researchers, the effort to really try to technically understand what the researchers do, and by showing we are able to have the connection with the investors, funds, private funds and companies and to manage the translation and to use the results, both in terms of research funding and the commercialisation the research. The researchers trust us so much that they sometimes come to us earlier [to announce a new invention] than to their own management (Rasmussen 20/05/2020)."

### 11.1.4 Concluding Suggestion

Mistrust is a subjective phenomenon, which is difficult to overcome. CUIP faces an even greater challenge because of the context of the academic values and of the Czech social history. Nevertheless, trust can be strengthened. The writer suggests the following. Make sure each member of CUIP always actively listens to the academic stuff, follows agreements, shows commitment, communicates openly with them, and secures their high satisfaction. Moreover, try to encourage new generations of researchers to have a positive attitude toward entrepreneurship.

## 11.2 Creation of Value

How it can CUIP deliver even more value to society and its university ecosystem? Once surviving the economic crisis, the writer argues CUIP should align its operations (i.e. execution) with following principles: strive for demand-driven business attitude, build the focus based on clearly defined values (which are building trust), deliver a great experience to researchers

and customer-companies during any interaction, and invite to the technology transfer process of CUIP as many valuable subjects to as possible.

Moreover, CUIP is advised to write down all the important values and hang it on the wall in the office, so it becomes the decision-making motor. Among these values should be asking customer-companies, what they need; becoming more and more demand-driven; prioritisation of getting an invention to society, rather than get money to CUIP out of it; always build credibility (11.1.4) etc. It is also recommended to add to the values the vision statement if CUIP identifies itself in the statement. This might positively affect two aspects. First, the values might reduce the severity of some personal misunderstandings (e.g. between CUIP and CKTT) in favour of achieving some goal of technology transfer. Second, striving for the execution of the proposed vision may bring a significant income from the EU funds. The reason for that is, the EU Horizon programme for the next period is allocating funds to the projects, where the collaboration between many actors may result into a big value contribution of the society (e.g. innovation ecosystems) (Claus Andreas Foss Rosenstand per.comm.).

## 11.3 Potential Ecosystem of CUIP

High-value proposition usually requires the involvement of multiple parties, then building a deep understanding of the structure of collaboration is critical, which can facilitate the *Value Blueprint*. Typically, the tool maps an ecosystem as is based on communication with all the involved parties. Asking the questions about the common path serves as the mitigation of the risks of both, a particular company and its partners because the ecosystem-mapping forces all participants to be explicit about the partial aims, the readiness to deliver a contribution to the ecosystem's value proposition, the motivation of specific parties, and the inter-dependencies among the different actors (Adner 2012).

**The project does not use the Value Blueprint as-is since there is no existing ecosystem in Prague specified by technology transfer, instead the paper aims to forecast a possible future innovation ecosystem, based on the potential of CUIP (after the crisis and after having a capacity to build an ecosystem) and of the key players in Prague, who relate to technology transfer.** Five Levers of Ecosystem Reconfiguration by Adner (2012) serve as an inspiration when executing the prediction of the innovation ecosystem of CUIP. In particular, the elements of Prague's innovation infrastructure are reconfigured through separating, combining, relocating, adding, and subtracting (Adner 2012, p. 177) based on findings from Chapter 6.

### 11.3.1 Value Blueprint Creation

The new Value Blueprint of CUIP results from Ecosystem Pie Model Talmar (2018) applied to the case by in Fig. 6.1 and Fig. 6.2), in place of as-is Value Blueprint of CUIP.

The Value Blueprint of CUIP has to include the end customers, the project needed to be delivered by CUIP within the ecosystem, all the suppliers, the intermediaries, the main risks, and the problems caused by the risks. To build Value Blueprint, it is necessary to ask the following set of questions.

#### Target & CUIP's Project

1. *Who is the final target of the value proposition? Who ultimately needs to adopt our innovation for us to claim success? 2. What is it that CUIP needs to deliver?*

The technology transfer needs a more demand-driven approach. The target should still be the customer-companies and offering should include the R&D results. CUIP should facilitate the connectivity between the two components.

A possible option is that CUIP facilitates such connectivity through a platform, where the issues of customer-companies are gathered and matched with a database of existing research efforts from multiple R&D institutions. The value proposition to customer-companies is a centre for quick, high-quality and low-price solutions. Firstly, the platform is gathering issues of low and medium level of technical difficulty from customer-companies. Secondly, the issues are matched with similar research projects in the database from Charles University, IOCB, and CTU, so the issues can be solved by short-term projects. KPI for the the "solution platform" should be customer's satisfaction, speed of solution delivery, the flexibility of the facilitation process, quality related to the customers expectations, clarity on what to expect through the communication channel and initially, also out-competing price of the service of solving the company's issues.

CUIP can receive customer database, the image of ecosystems builder and facilitator of short-term applied research, fees from each matched project and attractiveness of EU and other funds.

**Inputs & Inter-mediators**

*3. What inputs will CUIP need to build the offer? 4. Who stands between CUIP and the end customer? Who touches the innovation after CUIP, and to whom do they pass it on the way to the end customer?*

Not only an online platform is necessary and an IT partner, who is able to build it and administer it. To ensure a high probability of matched issue with similar on-going research, Charles University, IOCB and CTU know-how database is desired, so as the coordination of all the R&D projects, which can provide the TTO's of the institutions. A financial investment is needed to attract the customer-companies by the lower price of the offered solutions in the initial phase of the project and to star it up. The investment could be provided by TACR, IOCB, Charles University, CTU, EU funds, and private investors.

**Viability of the Project**

*5. Question for each intermediary: Does anything else need to happen before this intermediary can adapt the offer and move it forward to the end customer? 6. Question for every element on the map: a. What is the level of co-innovation risk this element presents—how able are they to undertake the required activity? (On the green–yellow–red traffic light scale.) b. What is the level of adoption risk this element presents—how willing are they to undertake the required activity? (On the green–yellow–red traffic light scale.)*
*7. Question for every partner whose status is not green: What is the cause of the problem and the viable solution? (Adner 2012, p. 86)*

The answers should be constructed based on communication with the partners. However, the thesis discusses, how can the ecosystem approximately look like. CUIP has to overcome its crisis and have a wider team, who can dedicate to such a project. Overcoming administration and organisation barriers of R&D institution (e.g. Charles University, IOCB, and CTU) can be expected to be very challenging too. The willingness of researchers to work on short-term

projects is very can quickly become another significant limitation. Moreover, a big uncertainty lays in the ability to deliver the value proposition as imagined, so as the interest of the customer-companies. **Currently, there are red-lights all over the Value Blueprint.** Therefore, it is not very practical to map the Value Blueprint of CUIP. **On the other hand, the potential value creation can be high indeed.** TACR is interested in a centralised model of a technology transfer (Heilemann et al. 2014) and a positive attitude can be expected from the EU funds as well.

### 11.3.2 Conclusion

In conclusion, CUIP should strive for reaching the status of innovation ecosystem builder and deliver the value of the demand-driven technology transfer. However, significant amounts of resources are needed (e.g. people, finances, change management adaption, cooperation alignment etc.). In case CUIP is interested in such a project after overcoming its financial crisis, **further work should detect more details about the barriers through communication with the relevant partners**. Later, Value Blueprint should be built and updated to achieve Minimum Viable Footprint (i.e. the smallest configuration of elements and partners that can create the unique commercial value (Adner 2012, p. 218)).

# 12 | Discussion

The chapter discusses the limitations of the project and relevancy of the chosen methodology based on the interview with the Head of TTO at AAU.

## 12.1 Technology Push

Entrepreneurial Engineering program highlights the importance of demand-driven concepts of business. CUIP is pushing the technology towards the customer-companies. The project has not identified a viable solution to that. Technology transfer seems to be built on the foundation of supply-driven principles. To elaborate on that, the core motivation of AAU TTO, for instance, is the law. If AAU has been good at understanding the society's need to apply the science its researcher carry out, then it would not have been necessary to apply a law to make sure that AAU is focused on applying the science it carries out (Rasmussen 20/05/2020). According to Rasmussen (20/05/2020), the approach of AAU TTO is 80% tech push and 20% tech pull. The proportion between push and pull changes, as the world around AAU changes too because there is no reluctance to not be demand-driven. Researches are arguing the basic research should not be defined by the industry. However, all research cannot be basic research, there should be also applied research (Rasmussen 20/05/2020).

## 12.2 Methodology

As an Entrepreneurial Engineering student, the author of the project planned to apply mainly the knowledge and theories introduced throughout the Master's programme. However, the public-university-related revenues and the complexity of the business of CUIP makes many entrepreneurial frameworks, models and theories obsolete. Above, it is elaborated on the statement.

### 12.2.1 BM Canvas and BM Innovation

BM Canvas by Osterwalder & Pigneur (2010) is applied in the project, but according to the Head of TTO at AAU, Rasmussen (20/05/2020), it reduces the complexity of the technology transfer, so as all the models are. Rasmussen (20/05/2020) is recommending not to build BM Canvas to a technology transfer company, because it is not so straightforward and much more complex. It is way too simplistic to just say define the building blocks of the Canvas without considering the alternatives. To pic, a winner model for a TTO is the losing game from the beginning, because the world around cannot be defined as one. AAU TTO does not want to have a BM. A model is good to drive focus, but the department of technology transfer at AAU has focus by values (Rasmussen 20/05/2020).

The writer claims the BM being relevance, because of giving the reader of the project quick notion of the business of CUIP. The sound argument of Rasmussen (20/05/2020) for in-applicability of BM to technology transfer changes the approach. Instead of sourcing the inspiration to answer the crises of CUIP based on BM innovation theory, the project uses the finding gathered during the interview with the representative of AAU TTO.

### 12.2.2 Innovation Ecosystem

Aiming to understand the innovation ecosystem topic is argued to be relevant since in response to a key value-creation of a TTO Rasmussen (20/05/2020) spontaneously highlighted the dependence of value-contribution of a particular TTO on demand of the TTO's local ecosystem. However, „a solution seeking a problem" business model opens door to unlimited number of problems, which are very difficult to systematically analyse and matched with CUIP. There is no innovation ecosystem, which is organically, consistently communicating and where participants have defined the activities and resources to participate in delivering a technology transfer EVP. Therefore, the thesis output related to crises of CUIP has not found a solution in the local ecosystem of the case company.

### 12.2.3 Blue Ocean Strategy

Blue Ocean Strategy by Chan Kim & Mauborgne (2004) has not been used to answer RQ based on the argument of Rasmussen (20/05/2020). AAU TTO has been over the years trying to identify the value chains or value curves, but technology transfer is a complex thing. Only different parts of the chain can be seen in the value chain, not all of them. When it comes to goals, the models are not very useful, since there are many aspects to prioritise and consider student-wise,research-wise, student-employ-ability-wise, university-economic-wise, commercial-wise, funding-wise, etc. It is way better to be open to the complexity than to bring order into it Rasmussen (20/05/2020).

## 12.3 Vision

*The vision of CUIP is to become the technology transfer ecosystem leader within the region of Central Europe.*

In light of the current economic crises, the proposed vision statement by the writer is not very relevant. According to Vlk (07/05/2020) the main goal is to fulfil the commitment on the Charles University side and leave the political-related activities to Transfera.cz. The relevance of such vision can be polemized, when having an understanding that the business model of CUIP has been from the establishment constructed in a way, that dependence of CUIP revenues on Charles University is supposed to be a decrease in the 10-years-long period and only then be do the business based on income from customer-companies.

The author of the project argues the importance of CUIP to strive for demand-driven business attitude, to build the focus based on clearly defined values rather than models (proposed by the project), to deliver a great experience to researchers and customer-companies during any interaction with CUIP, and invite to the technology transfer process of CUIP as many valuable subjects to as possible. Despite all the limitations caused by the current financial situation of CUIP, difficulties in regulations of Charles University, nonacceptance of entrepreneurship by the academic culture, and limitations caused by the Czech law, the author of the project proclaims CUIP being capable to become the builder of the technology-transfer ecosystem in Central Europe or even further, in case of surviving the economic crises and aligning the operations (i.e. execution) with the mentioned principles of this paragraph.

## 12.4 CEO

The writer based on her observation has the notion, the current CEO of CUIP is not fulfilling his role as required. From the position of an intern, no change can be done. Otherwise, a key suggestion addressed to the General Assembly of the case company to the CUIP crises, would be a dismissal of the current CEO of CUIP and usage of his salary to the development activities.

# 13 | Conclusion

The understanding of the key features of the business of CUIP; the foundation of the effects of the crises; the local ecosystem needs; the overall functioning of a comparable organisation; and the acquired knowledge and experience from the Entrepreneurial Engineering programme constructed a research outcome, which is argued to be applicable and valuable for the case company. Besides, the methodology might serve in solving financial issues of similar technology transfer subsidiary, which is owned by a public organisation in the Czech Republic, or even abroad.

In particular, the practical conclusions are summarised in the Action Plan (Chapter 10). The pieces of advice are aiming either to mitigate the economic crises of CUIP or to develop the business, once overcoming the stagnation phase. For instance, CUIP is advised to get refunded by CKTT for the savings for replacing patent-related costs by the offering of trade secrets without protection to customer-companies, while trusting them. Other suggestions focus on the new value proposition (e.g. participation in the Boards of Directors of industrial spin-offs, know-how for faster and less administration-heavy commercialisation procedure) and the improvement of the experience of the researchers and customer companies (e.g. by targeting a specific audience with personalised content on the website of CUIP; by the elimination of unnecessary steps in the technology transfer process, which is related to academic policy; by building mutual understanding between R&D and commerce via providing more internships and activities for the current students, who are the future researchers). Moreover, a vision statement is recommended, so as principles, which might enhance the process of building credibility at Charles University.

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# A | Interview: TTO at Aalborg University

This interview with Peter Rasmussen (20/05/2020), Head of Technology Transfer Office at AAU (Aalborg University) ( see https://www.en.patent.aau.dk/), aims to get a new view on the functioning of technology transfer entity. Another goal is to discover, whether this similar institution, which is also aiming to transfer the technology from a university, is dealing with economic issues caused by COVID-19. If so, the taken measures are discussed.

To do the comparison of the TTO at AAU (a 20-year-old entity) and in CUIP, the discussed topics include the core motivation of the TTO, the business model, the technology transfer barriers, the trust between AAU and its TTO, the motivation level of AAU researchers for entrepreneurship, the next milestone of the TTO, the local and the national ecosystem around the TTO, the value curve and competitors landscape of the TTO.

Note, the interview is slightly modified to make the answers more comprehensive. P (Peter Rasmussen) indicates the interviewee and L (Luna Azul Cantillo) indicates the interviewer.

**Questions and Answers:**

L: **What is the core motivation of AAU TTO?**
P: Law of the AAU. If the AAU have been good at understanding the society's need to apply the science they carry out, then it wouldn't have been necessary to apply a law to make sure that the AAU is actually focused on applying the science that they carries out. Therefore, our core motivation is that we carry out the appliance of science in the best interest of science. Appliance (in the more direct meaning) in terms of commercial exploitation of science.
L: **Is your office integrated into the AAU (Aalborg University)?**
P: Yes.
L: **How long does the decision-making process of AAU TTO last?**
P: It is very quick, since I have a clear mandate in my department for inventions and it is mostly the same in everywhere in Denmark.
L: **Are you planning on establishing a subsidiary company for technology transfer operations?**
P: We have one. Based on the law, each university in Denmark is allowed to form one technology transfer company. At that time [when our was formed] - in 2000 - it was allowed to universities to purchase shears in their local innovation environment, which was funded by state. And we did that. We formed the company and bought some of the shears. However, the innovation environment was terminated later by the government. We keep it because of only reason, in case we would like to mature inventions by forming a spin-off company, because we are cannot do that. The subsidiary has no employees, it is just a "shelf" company, and of course, it has a board of directors. There is only one company, that has an active subsidiary, which is the University of Southern Denmark.
L: **What knowledge fields is covering your team?**
P: We cover very different fields, because it is the intention actually. We are a small team, the technology transfer part it self has 6 people and we have some people employed in the legal department, so we also cover those kind of competencies. In the TTO there are people with a variety of backgrounds; in biochemistry, electrical statistics - they are both PhDs and one of

them is a senior researcher at another university, (master's in) international marketing, international commerce, economics and business administration. Most people have an extensive commercial background before coming to the TTO. Some are serial entrepreneurs, who fund many companies and have been in many boards in the companies that have been spun-out earlier. We wanted from the beginning to have a team with complementary competencies.
L: **What competencies are in your opinion the key one for technology transfer?**
P: There is no education for being a technology transfer manager and there never will be, because you cannot acquire every skill-sets in the world, so you need to compromise. You need a mix of skills. You need people, who are driven by making commercial results and with certain amount of diplomacy and understanding of that you are trying to enforce a commercial work inside of the public institution. You need to balance those two different worlds of investors and researchers. No one comes with the full set of skills. It is very hard to employ someone, who has good commercial background and has at the same time relevant technical background suited for a case. For instance, when having a pharmaceutical or biochemistry case, the team needs a person with the background in that field, who can ask the critical questions. Almost all other fields, you can, to a certain extent, cover with other skills. I am not saying it is trivial, but it does not seem it is needed to have a degree, which is matching to the research field to each [transfer] case [apart from pharmaceutical or biochemistry cases]. Especially pharmaceutical industry is specific, where you have a very straightforward path. In other fields, it is more fragmented. There is a different approach needed and combination of skills in wind turbines industry and different in electrical circuits industry. There skills of the TTO team should be balanced according to the research which is going on at the particular university.
L: **How does your BM (Business Model) look like?**
P: We implemented the traditional BM Canvas for the specific cases. For the purpose of the TTO, it is question of applying the research into society (not just putting up applications). And that leaves a big room for a very broad approach to the BM. Making money? That is not a model for a university. Five US universities tried to make money for the university, but they do so not by doing the traditional TTO activities. We try to select inventions based on their commercial potential. [Then, the proceeding frames, rather than a BM, the brainstorming based on question:] can we, as the TTO, do anything to bring this out? If it is a moneymaker, than it is great, but it is the side effect of the initial intention to apply research to society. There is no need for the tech, since no one knows it exists.
L: **Lets say there is a both-sided principle of the TTO functioning. Who represents the target "customer segment" of your business towards AAU?**
P: The inventions typically come from the AAU researchers. The students would be treated equally as the researchers, but they do not frequently come to an invention with a commercial potential. Students are sometimes co-inventing or otherwise helping with the project. A co-inventing body can also be represented by a company. However, there student entrepreneurship program.
L: **Who represents the target "customer segment" of your business towards society. Do you have any focus in customer-companies?**
P: There is always a focus because of the policy. At the moment, there are at least extra funds for green technologies and green transformation. However, a focus on something does not mean that all other good commercial technologies are not looked up. I would say, there is focus [of our TTO] is on good commercial cases and techs. If companies or investors are interested in those fields, they will invest. So we do not try to particularly teamatise. However,

we have majority of inventions coming from specific fields because there are some tendencies, but we also have cross-disciplinary fields [and inventions].
L: **If you would potentially build a BM Canvas for the AAU TTO, would you be able to characterise the customer segment?**
P: I would always say, do not do that, because it is not so straightforward. This is much more complex. It is way too simplistic to just say it is this this and that [meaning the building ]... To pic your winner model is the losing game from the beginning, because if you try to define the world around you as one, you will fail. I do not want to have a model. Model is good to drive focus, but in our department we have focus by values. The model looks good when presenting to the Board of Directors, but in practice it is not worth of doing things. You miss the new and get administration [instead of execution in such way].
L: **How are the revenues of TTO created? What is the income for the cases?**
P: The revenues for the activities of the TTO is 100% from the AAU. The disclosed [to the TTO] inventions need to mature, so a different kinds of funding is involved until the maturity state, when an investor can be potentially interested. Research and commercialisation funding for maturing the technology is an income for the University as well. The funding can be from both, governmental and private. There are several companies providing early-stage (e. g. proof-of-concept) funds as Novo Nordisk, Lundbeck, or Chr Hansen and another large, typically pharmaceutical, companies. Moreover, there is a public proof-of-concept fund in Denmark, Innovation Fund Denmark. There is also an internal proof-of-concept fund at AAU. A possible funding streams from commercial collaboration, typically though the grant solution projects (Innovation Fund Denmark) or EU fund, when a company is making an early-stage maturation together with the University.
L: **What is the key value-creation of a TTO?**
P: It depends of the specific set-up at a university. However, a lot of it has to do with systematical identifying commercial potential of the R&D results and then, translating them into an interesting business case for investors, companies, entrepreneurs etc., so they invest their time and resources apart from money. So I think the value-contribution is really in that field. Some universities have extra competencies that can be applied on the top of that. AAU TTO, for instance, has been for years asked to participate in the Boards of newly formed companies by the investors or by the industry, because some of us have had a lot experience. To make sure the technology was very well translated into the investors spin-off company we were asked to participate in the Boards. We did that to large extend, but we do not do that anymore that much, because it requires to much resources. The value-creation of the particular TTO also depends on environment and the demand of the local ecosystem.
L: **Are you offering product prototypes apart from licenses, patents or spin-offs?**
P: No, not directly. We provide (develop) prototypes in some of the proof-of-concept projects. Mostly when the prototype is necessary to convince the investor, then it is a viable concept. Or if a prototype is needed to de-risk something, because you need to do tests on the prototype (to prove it works as stated).
L: **What do you offer the most?**
P: We tend to sell most of our rights directly, so we sell the rights to inventions. We do not patent them. It is also because a lot of inventions are also made together with the companies or based on company IP. It is not that we do not have other choice, we do that. We do licensing as well, but not to a great extent. We have also acquired shares in spin-out companies as payment for IP, (we are allowed to do that as well) but not so much lately. We are turning towards licensing.

L: **What form of inventions (e.g. licenses, patents or spin-offs) do you offer the most?**
P: We ask the customer, what they need. A lot of times, they are not sure about their needs and we can typically advise them what would be in their interest. For instance, a a small company producing a small plastic thing initially wants exclusive rights. TTO reacts, so are you going to use that to produce pharmaceutical products and also cars, because you need to pay for everything. Then, the company realises, they want non-exclusive rights for the field of it. Companies, who are not experienced with licences and even the experienced ones need advice, because they get new people in. We try to see what the needs are, that is way I do not do the BM too standard, because it is more the question of whether we succeed with applying the invention into the society, rather than following the specific model to generate profits in certain way.
L: **Do you do contract research?**
P: Not much.
L: **How much does your budget depend on workshops or other educating programs related to the technolgy transfer at AAU?**
P: We have different initiatives, but there are a lot of reasons why we do not do that so direct. We have a lot of opportunities at AAU based on the level of competences in the field and where the person is. If a researcher wants to make a spin-off company with this research (not an invention), than we have people can advise him or her on the further procedure. We try to put them in existing programs, to not create confusion what is happening where. So the person always comes to AAU Innovation and later we place him or her to the relevant program. [So our budget does not depend on it.]
L: **Do you have scout network, who are trying to find the business opportunity?**
P: We do a lot different initiatives, such as fundraising (to certain degree the two agendas stick together). We spend a lot of time with the researcher (in that way we do some scouting), so each 2 years we follow up on researches to hear what is new, the researches a lot of times tend to forget about their new inventions. The researchers are obliged by law to disclose the inventions to the TTO, so we get the invention disclosures. This is the legal thing, but it works better if we do it in cooperation. We also get help of deans and pro-deans, who have the application off research into society on their agenda, so they would push the head of institutes and head of research groups. A lot of times we try to unite the resources. It is clear, it is good to have the management on your side in this.
L: **So there is no funded scout network of researchers?**
P: No and there are a lot of reasons for that. You need to create credibility with the researches. You do not the build the credibility by just identifying inventions, but not doing the technology transfer and proving you are worth anything. To build credibility, we are trying to do it right with researchers. We build the credibility by having the right competencies, the way we deal with inventions, the way we scout and discuss the potential inventions with the researchers, the effort to try to really try to really technically understand what the researchers do, and by showing we are able to have the connection with the investors, funds, private funds and companies and to manage the translation and to use the results, both in terms of research funding and the commercialisation the research. The researchers trust us so much that they sometimes come to us earlier than to their own management.
L: **Does the AAU TTO contribute on the development part of the invention?**
P: I do not see that as goal, but it foes not heart anyone to say an opinion.
L: **Is AAU TTO dealing with the mistrust of the AAU researchers, management and students to entrepreneurship?**

P: Overall no, I do not think we deal with a lot of mistrust, but we are not blind. The University is a huge organic ties, so there is room for a lot of opinions. We do not run into mistrust issues, but we run into misunderstanding issues. That is another thing.
L: **Culture-wise, do you think Denmark society is not trusting entrepreneurship?**
P: Danish society overall is build on immanence amount of trust. Inherently, there is trust. However, there is also some realism and there is acceptance of a lot of agendas. It is not only matter of mistrust, but lack of interest in entrepreneurship. It depends on, how a person perceives adding value to the world, which depends on an individual. I believe, the researchers does not think the companies are there to exploit them. I think the researchers perceive the companies as the necessary evil to gain the finances for the research. The researcher still value more the publishing, rather than commercialisation. It has to do with the motivation. The researches are motivated by the management, which politically prefers publishing. However, there is a clear understanding, that we need to commercialise and that we need to prove to society that we create knowledge, which is valid also now and not only 50 years down the line. Danes know they have to do something, but is up to an individual, so culture-wise commercial drive is not as in the US, for instance.
L: **Is AAU TTO supply or demand-driven?**
P: It is 80 % tech push and 20 % tech pull (e.g.demand-driven). It is still largely tech push. However, it changes as the world around AAU changes, because there is no reluctance to not be demand driven. There are researches arguing the basic research should not be defiled by the industry. This is good enough. All research cannot be basic research, there should be also applied research.
L: **What are the goals of AAU TTO?**
P: To apply research into society and create value in society. From the perspective of big milestones or goals, it is to be aligned to the AAU primary strategy. There are a lot of tactical or operational particular ways, which can be selected. However, the best answer would be the goal is to benefit society.
L: **Could you describe the next development phase of AAU TTO?**
P: More funding orientation phase. Because both, AAU and national government are focused on putting research funds into programmes, instead of having national systematic efforts where the money is put out to invest into pre-seed projects, for instance. That is way, we feel a certain amount of interest and depression to look more into funding for maturation of new technology.
L: **Have the effects of COVID-19 crises negatively influenced the key activities or the budget of your office?**
P: It does not influence our budget. We see some slight impact, because the researchers are not been able to work for some time. Neither the AAU is influenced, because of being governmental funded. COVID-19 could be projected to the next year's budget of AAU. Then, how much it will influence TTO depends on negotiation power inside of the niversity.
L: **If you imagine, AAU TTO has major economic crises, how would you probably solve it?**
P: I think, we would invest less in patents. This would be the primary thing to do. We would work more extensively on inventions together with the companies, but based on trust not by IP protection. We would spend way more time with fundraising and financing things, rather than patenting. Based on our experience, there are so much pitfalls (of patenting too soon).
L: **How do you avoid the IP protection?**
P: Based on trust. And we do take a lot of risk approaching companies. However, when approaching pharmaceutical companies, it is hard not to patent. We have build great industrial

relations to a lot of companies, with some of them we can even discuss confidential information through calls without protection. We build the network by trading the technology and sold rights for years. AAU has our own proof-of-concept fund to mature and de-risk the projects, where the decision of allocating the money to a particular technology is taken by the 100% industrial Board of Directors. There is no one from the AAU included in the decision-making process of getting the AAU funding or not (despite it is the money of AAU). There are directors from very large Danish corporations in the Board and when they say some opinion, people trust it. There is a lot of preparation before the Board presentation, so it is an indirect way of displaying the knowledge to large companies. Moreover, the members of the Board are bringing their own network to the cases, when they are interested.

L: **How can you describe an innovation ecosystem in Aalborg?**

P: I would say, there is a lot players in the ecosystem, but nothing clear has emerged from that. There is a room for different players in that field. We working towards the "game": for instance, we have 100 or 200 M and now are going to build the science and innovation hub together with the local ecosystem, that is not what we want. We want to build an open system, where we want to invite everyone who wants to contribute something and we want to make them feel very welcome. However, everyone has to bring something and they need to be clear on what do they bring. The value proposition should be clear, but it does not have to be money, it can be access to contacts, their own resources etc. There some real estate companies, who claim to grow an innovation ecosystem, but they actually just renting out some shared spaces. There is also the Municipality, which is growing the cities environment... We want to make sure, it is easy to connect with the ecosystem. We do not want to own an ecosystem. We need to align the ecosystem with value. The ecosystem consists of serial entrepreneurs, local companies, local start-ups, people, who see themselves building something and being in the need of university based knowledge. Trying to have the system as open as possible.

L: **How do you technically do the "invitation"?**

P: We need to lead by example. Just having different kinds of which are activities which aligned what we do and where can meet students, student entrepreneur groups, entrepreneurs, and research groups. The activities include spontaneous gatherings, but also initiatives funded by the University or the business schools and entrepreneurial engineering programs. So we make sure, there are a lot of activities around the building encouraging the cross-disciplinary learning.

L: **How can you describe an innovation ecosystem in Denmark?**

P: The Danish corporation, whose representatives are in the AAU fund Board.

L: **Is there an organised conference or other event from AAU TTO to build an ecosystem?**

P: We have a project called Opened entrepreneurship, which really helps the researches to be in contact with the serial entrepreneurs. We have *ESA BIC* incubator for spacial inventions or an Student Entrepreneurial programme or *Science for Society* programme. We also have business schools or PhD school, where there are commercialisation and patent courses etc. There are a lot activities, where they are relevant. Pushing technology transfer agenda everywhere does not work.

L: **I have been thinking use the Blue Ocean Strategy by Chan Kim & Mauborgne (2004) to the crises of my case company. Have you ever designed a value curve of your TTO?**

P: We have been over the years tried to identify the value chains, but again it is a complex thing. You can only transfer different parts of the chain. When it comes to goals, the models are not very useful, since there are many aspects to prioritise and consider student-wise, research-wise, student-employ-ability-wise, university-economic-wise, commercial-wise, funding-

wise, etc. It is way better to be open to the complexity than to bring order into it.
L: **What is your AAU TTO competitors landscape?**
P: Depends, who you ask. Board would probably say there is competition for getting funds. Some TTOs see other TTOs as competitors. I do not see them as competitors. There can be unlimited amount of inventions and world will be able to adapt them. We can work and we do work closely, for instance, when applying funds. Also within the local ecosystem we do not the other players as opposition, all the players should be confident they are accepted.

# B Key Players in Prague's Innovative Infrastructure

Identification of the key players in public, R&D (academic) and private sector is based on The Regional Innovation Strategy of the City of Prague, which has concluded the Prague City Municipality (2018). Based on Ecosystem's Pie Model by Talmar (2018) are the resources, activities, value addition, value capture and the risks examined, so as all the relevant in formations for the CUIP case.

## B.1 Key Players in Public Sector

The main public administration bodies in charge of research, development and innovation in the Czech Republic are **the Ministry of Education, Youth and Sports** and **the Ministry of Industry and Trade**. Other providers of state aid in this area are, for example, the Academy of Sciences of the Czech Republic,**the Technology Agency of the Czech Republic**, the Grant Agency of the Czech Republic, or **the Prague self-government**.

Conclusions related to the ecosystem with the technology transfer value proposition:

- Resources: financial resources and policy (vision unification).
- Activity: active facilitation, mediation and motivation to establish contacts between research and business sector.
- Value Addition: **investing**, demand creation for new solutions and innovations.
- Value Capture: increase of the regional competitiveness and prosperity.
- Risks: investments into unprofitable projects, scaring away knowledge intensive firms by high administrative burden when getting the EU and Prague funding (necessary for their survival)

**From the perspective of CUIP:** The Technology Agency of the Czech Republic provides pre-seed funding for the research projects developed at Charles University. The mentioned ministries and the Prague City organize calls within a variety of operational programs relevant for CUIP. Some of the calls are also created in response to the COVID-19 economic issues. The disadvantage of the majority of these calls is the need of CUIP to co-finance or pre-finance the all the costs related to the call. Moreover, the man-hours (which is needed to get funding for in CUIP) are usually not covered.

## B.2 Key Players in Research and Development

The ability to publish in impacted journals is an indicator of research quality of universities, research organizations, and similar institutions. The most frequently appearing Czech organizations in the impacted journals (in the Web of Science 2013-2017 database) are Charles University, Czech Technical University in Prague (CTU), University of Chemistry and Technology, Prague (UCT Prague), Czech University of Life Sciences Prague (CZU) and the Institutes

of of the Academy of Sciences (in particular, Institutes of Physics and Chemistry) and University hospital in Prague and University hospital Motol.

Conclusions related to the ecosystem with the technology transfer value proposition:

- Resources: knowledge, technology, patents, students, researchers, capital.
- Activity: patenting, educating, creating results of research and development
- Value Addition: **inventing**, co-investment, offer creation of new solutions and innovations.
- Value Capture: image creation, return on investment, getting international level in transfer aspect.
- Risks: creating market push; slow reaction to ongoing issues (and demand) in society due to administration and length of R&D process.

**From the perspective of CUIP:** Charles University as the parent institution and key partner is not only a key resource, but also one of the most significant component of the Czech academic sector. Charles University has nearly 50 000 students enrolled in more than 300 accredited degree programmes. The University has more than 7,900 employees; of this number, almost 4,500 are academic and research staff. (www.cuni.cz, 2018) Other key players in R&D represent potential customer for consulting services of CUIP.

## B.3 Key Players in Private/Application Sector

The major knowledge-intensive companies that carry out their own R&D equal to the largest public research organizations include:

1) life science companies in pharmaceutical industry (e.g. Zentiva, Sanofi- aventis, s.r.o.; AstraZeneca Czech Republic s.r.o., PRO.MED.CS Praha a.s.; Intherpharma a.s.; Pharmaceutical research Associates CZ, s.r.o.) and in specialized medical industry (e.g. UJP Praha, a.s.; GlaxoSmithKline s.r.o.; LASAK s.r.o.);

2) manufacturing companies in specialized electrical and optical equipment field (e.g. Siemens, s.r.o.), in the field of the means of transport (e.g. Stadler Praha s.r.o., TUV SUD Czech s.r.o., Vyzkumny ustav zeleznicni, a.s.).

3) firms within the ICT industry, providing communication technologies (e.g. T-mobile Czech Republic, Seznam.cz, a.s.), solutions in the field of process management, security systems etc. (e.g. Siemens, s.r.o; TTC TELEKOMUNIKACE, s.r.o.), specialized software solutions, design, highly specialized services and consulting for research, development and innovation (e.g. CA CZ, s.r.o, CESNET).

The mentioned actors of the application sector, are not necessarily the implementer of the academic R&D results. Moreover, the business partners demanding some academic know-how, might in many cases be beyond the border of Prague or Czech Republic. However, in relation to the ecosystem with the technology transfer value proposition, it still can be concluded about the business partners the following:

- Resources: financial resources provided when buying a licence/patent/spin-off.
- Activity: buying the offer enabled from the support organizations.

- Value Addition: **implementation of the technology in a particular business case**.
- Value Capture: direct financial income from the end customer, solutions to its issues/innovation of its processes.
- Risks: lacking demand from the end customer.

**From the perspective of CUIP:** I assume these player not to be the potential customers of CUIP. As they have capacity to conduct their own research and quickly react to their current problems. However, these big companies might be interested in establishing their own spin-offs in relation to the corporate entrepreneurship efforts. Therefore, CUIP could offer these organizations consultancies regarding the founding of a spin-off. It can be speculated, the profile of these firms can indicate, what is the demand in Prague.

## B.4 Support Innovation Infrastructure

There are several categories of organizations supporting the innovation infrastructure in Prague.

Firstly, there are **business incubators established by public entities**. *ESA BIC Prague* is a centre for incubation of space-related technology established due to CzechInvest (Business and Investment Development Agency CzechInvest), with the support from the Ministry of Industry and Trade, the Ministry of Transportation and the City of Prague. *Prague StartUp Center*, founded by Czech ICT Alliance (the official export alliance of the government's Czech Trade Promotion Agency), has mainly character of a shared space, but they also offer CEO's network facilitation, technology transfer or services as company establishment, legal and accounting advisory or administration support (`www.praguestartupcentre.cz`).

Secondly, there are numerous very important **support organizations within the private sector**. They focus primarily on small and progressive firms and invest only private capital. *StartupYard* is business incubator partnering up with business angels from the Global Accelerator Network. *H4O Art & Digital Lab* is business incubator focused on creative and digital industries. *Impact HUB Praha* are shared spaces for start-ups. Other shared spaces include *Node5* or *TechSquare*.

Thirdly, there is **academic support innovation infrastructure** consisting of university business incubators, university science and technology parks, centers for technology transfer at universities and subsidiaries of significant research institutions.

University **business incubators** in Prague include: *InQbay* (Czech Technical University in Prague), *ČZU PointOne* (Czech University of Life Sciences), *xPORT* Business Accelerator (University of Economics, Prague), *Biomedical Innovation Center of IEM Academy of Sciences of the Czech Republic* (Bioinova, s.r.o.). In this category should be named also *Incubator of Technology Center, Academy of Sciences of the Czech Republic*.

**Science and technology parks** in Prague include: *Research and testing aviation institute, a. S.*, *Research Institute for Soil and Water Conservation (VUMOP, v.v.i. in Czech)*.

Among all the university **centers for technology transfer** in Prague stands the most out the *Center of Knowledge and Technology Transfer, Charles University Prague (CKTT)*, a close partner of CUIP, and *Masaryk University Technology Transfer Office*, the whereas *IOCB TTO* is probably the most significant out of technology transfers of the institutes of the Academy of Sciences of the Czech Republic. The universities having the technology transfer office (TTO) in Prague involve Czech University of Life Sciences Prague and University of Chemical Technology Prague. Institution of the Academy of Science of Czech Republic with TTO: Institute

of Organic Chemistry and Biochemistry, Institute of Physics, Food Research Institute Prague, Institute of Microbiology, Institute of Experimental Medicine, Institute of Physiology.

The most significant subsidiaries of research institutions are *CUIP* and *i & i Prague*, the subsidiary of the Institute of Organic Chemistry and Biochemistry of the Academy of Sciences of the Czech Republic.

Conclusions related to the ecosystem with the technology transfer value proposition:

- Resources: suitable space for business, expert business know-how, services (finding market opportunities, analysis of current technological and research trends, consulting in the field of strategic decision-making, finding market partners, technology transfer, protection of intellectual property, access to financial resources, evaluation of the impact of innovation on society, etc.).
- Activity: overall support of innovation efforts, expert consulting, entrepreneurial engagement, filling the gap between academics and business partners and goals of the innovation policy makers.
- Value Addition: **technology transfer**, facilitation of business establishment, enabling the application and public players to use the particular results of research and development.
- Value Capture: financial return, portfolio of successful projects, brand awareness.
- Risks: losing the priority to engage the entrepreneurial effort, while focusing on the return on investment; supporting unprofitable projects.

**From the perspective of CUIP:** This is the competition landscape of CUIP. Despite the fact, the level of competitiveness is questionable. It is evident, each support organization is strongly related to a particular organization. As the main business model of CUIP - bringing the majority of the revenues - has Charles University as the only customer, there no other support institutions competing to transfer the technology from this particular university. The graduates of Charles University are transferred to many different working places and in this way is the academic knowledge or technology applied and spread. This event is, however, not classified as the technology transfer (Štěch & Dvořák, 2008). Once taking in consideration the business model, where the business partners represent the customers, than all the mentioned institutions are competitors. However, there are major differences in these organizations. A shared space solely gives very little added value. xPORT, for instance, provides the incubation services mainly to students, on the other hand the TTO's have in their scope primarily the researchers. The organizations providing incubation process the beginning enterprises have many further differences, which is discussed in more details in the Section **??**. In this context is worth to mention a key Czech technology transfer network facilitator, **Transfera.cz** and a meaningful information broker **Vedaavyzkum.cz**.