

**TIKARI**  
**Project Report**  
**Version 1.0**

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## **Executive Summary**

This project was executed as a benchmarking project analyzing the status and future of the value-creation of the university-based ideas in Finland, Israel, Massachusetts and Singapore.

### **Ecosystem Approach**

The key finding in all benchmarked regions (Israel, MA, Singapore) is that major universities have adopted an ecosystem view on the value-creation activities of university-based ideas. It is estimated that 15-20% of the knowledge transfer and innovation in the university space is created by research, the majority (80-85%) by alumni and students. On the other hand, the technology transfer office (TTO) - related activities represent only a small percentage of the overall university budget; 30% in the best case, typically around 10-15%. Technology transfer operations are generally over-hyped as revenue generators. The ecosystem impact is much more significant, as the Kauffman study from MIT shows. Therefore Aalto University needs a comprehensive ecosystem approach through ACE operations to be successful in the future.

### **High-quality Research**

All best performing universities (both scientifically and commercially) have strong emphasis on applied research and industry projects. They typically see them as a strategic activity creating value for all operations, including scientific basic research. According to findings it is not feasible to only focus on basic research without strong commercial focus on research operations.

### **Evolving Role of the TTO**

Due to the significance of the ecosystem approach, the role of TTO's is evolving rapidly. TTO's are transforming themselves into networking organizations with strong focus on creating collisions between university and the industry. This requires new external targets and new competence for TTOs; the internal focus on IPR and licensing is not enough. It was also found that licensing works only in life sciences - in all other verticals the value-creation is usually based on spin-off approach. In most universities analyzed, there are separate organizations managing the internal activities (licensing etc.) on one side and the entrepreneurship operations on the other side. However, they are closely cooperating and the process typically starts from business case analysis. Key decisions (such as IPR protection) are based on the business case, not the other way around. TTO's also act as sole gatekeepers to all external connections to university including companies, entrepreneurs, investors and partner facilities. The actual management of the value-creation process should be outsourced. This is a major change needed in Finnish universities.

### **Key Funding Mechanisms**

Proof-Of-Concept (POC) funding is widely regarded as the key element in the value-creation process. Typically 50 K\$ is regarded as adequate in the 1<sup>st</sup> phase, 150 K\$ or more in the 2<sup>nd</sup> phase (Proof-Of-Value POV). Analysis and decision-making is typically done by external experts, not by university people. In most universities, ideas are pulled out by experienced entrepreneurs, not pushed out by TTO's. After POC and POV -phases, the cases are developed by incubators (Israel and Singapore) or business angels (US) with strong focus on the market access, growth and VC funding. In startup phase funding requirements vary depending on the industry. Internet/software companies can be established with very little funding, even 250-500 K\$ - typically around 1 M\$, but life science companies require many times more funding and for a longer period of time. Sometimes they are ready for VC's to invest. Most

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research-based spin-offs are relying on the VC business model since their ideas typically require strong funding and fast access to global markets. It must be noted here, that the major incentive for universities to create spin-offs is not the direct ROI through ownership etc, but rather to empower a vibrant ecosystem and provide market exposure for decisions on research as well.

### **Bridging the Gap**

The people involved in the value-creation process in the top universities have very significant business experience. Universities are also heavily networked with the major hubs globally. Networking is executed in multiple levels (students, research groups, entrepreneurship activities etc) with strong focus on acquiring competence and providing market access. Partnerships are supervised by the university management and normally managed by TTO's. It is essential to network with the major hubs if Aalto wants to be a major player. Suggested parties are found in the US, Israel, China and perhaps Singapore.

Finnish universities should bridge the competence gap through active partnership with selected globally acknowledged players by creating new programs for growth entrepreneurship research, growth entrepreneurship education and broad entrepreneurial activities. A new process for analyzing ideas through a boot camp or similar concept is also needed, as are incubational activities with strong international focus and a model to push out entrepreneurs to expose them to the major markets. AVG and similar initiatives can be a platform for such operations, but it cannot be managed by university since such operation is not part of the university business model.

### **Key Recommendations**

There are 3 key issues recommended for Finnish universities based on the findings of the benchmarking:

- Business Development Services. New business development services organized around universities and resourced with world-class talent possessing strong experience from growth entrepreneurship. New funding instruments to support growth-oriented development are needed.
- Business Competence Development. New leading edge research program with global partners, executed in global markets. New growth entrepreneurship education track for students at the university attracting the best talent. And a professionally managed 3-4 month bootcamp / development program for new business creation – targeted for students and researchers.
- New funding mechanisms to boost the development. The funding ecosystem must be revised. The shortage of active business angels and VC's must be fixed by introducing tax breaks and Yozma-like program to re-launch the venture finance ecosystem.

The cornerstone of a successful value-creation process is world-class competence. In fact, it is everything. In order to attract right people with right competence, organizational structures, incentives and focus must be assessed correctly. Existing actors are not applicable. Otherwise transformation is not possible.

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## 1 Introduction

### 1.1 Project Background

Universities and other research institutions can play a major role in the high-growth ecosystem and if resourced properly they can be the hotspot for high-growth businesses. Universities have traditionally been focused on two main activities; education and research. Recently, third activity has gained importance – the value-creation activities based on university research and IPR. Value-creation typically includes two separate tracks – licensing track for commercializing the university IPR, and the entrepreneurship track for mainly establishing companies based either on university research or ideas developed by the university graduates (alumni).

This report is the outcome of a benchmarking project established by the Finnish Funding Agency for Technology and Innovation ([www.tekes.fi](http://www.tekes.fi)) and the newly established Aalto University ([www.aalto.fi](http://www.aalto.fi)). The goals of the project were:

- To analyze the current status of the value-creation
- To benchmark the value-creation models of the leading regions globally
- To review the impact of universities in the high-growth ecosystem
- To design a new model and process for the value-creation activities based on university research and IPR in Finland, including targets and metrics
- To suggest the implementation plan of the new model for Aalto University

The initial focus of the project was to analyze and design a new model for the value-creation track only based on university research. However – during the project – the impact of universities in the high-growth ecosystem became ever more important leading to the expansion of the project focus to include also the entrepreneurship track for mainly establishing companies based on either university research or ideas developed by the university graduates (alumni).

The value-creation activities based on university research and IPR are analyzed from the ecosystem perspective rather than from the internal angle. It is more important to understand the comprehensive role of the universities than to try to sub-optimize the internal activities of the university itself.

### 1.2 Definitions and Restrictions

Term	Definition
Endowment	Academic institutions such as colleges and universities will frequently control an endowment fund that funds a portion of the operating or capital requirements of the institution. In addition to a general endowment fund, each university may also control a number of restricted endowments that are intended to fund specific areas within the institution. The most common examples are endowed professorships (also known as named chairs), and endowed scholarships or fellowships.
Tuition	Tuition is one of the costs of a post-secondary education in the U.S. The total cost of college in the U.S. is called the cost of attendance or the "sticker price" and in addition to tuition it can include room and board, travel expenses, books, fees, and other expenses such as computers.
Technology Transfer	Technology transfer is the process of sharing of skills, knowledge, technologies, methods of manufacturing, samples of manufacturing and facilities among governments and other institutions to ensure that scientific and technological developments are accessible to a wider range of users who can then further develop and exploit the technology into new products, processes, applications, materials or service.
TTO	Many companies, universities and governmental organizations now have an "Office of Technology Transfer", TTO (also known as "Tech Transfer" or "TechXfer") dedicated to

	identifying research that has potential commercial interest and strategies for how to exploit it.
Business Angel	An angel investor or angel (also known as a business angel or informal investor) is an affluent individual who provides capital for a business start-up, usually in exchange for convertible debt or ownership equity. A small but increasing number of angel investors organize themselves into angel groups or angel networks to share research and pool their investment capital.
IP / IPR	Intellectual property rights are the recognition of a property in an individual creation. Intellectual property rights are usually limited to non-rival goods, that is, goods that can be used or enjoyed by many people simultaneously—the use by one person does not exclude use by another.
Incubator	Business incubators are programs designed to accelerate the successful development of entrepreneurial companies through an array of business support resources and services, developed and orchestrated by incubator management and offered both in the incubator and through its network of contacts.
Licensing	Licensing is a business-model where technology is sold to buying company. The most common business model is based on royalties, revenue share –based models also exist.
Spin-Off	The United States Securities and Exchange Commission definition of "spin out" is more precise. Spinouts occur when the equity owners of the parent company receive equity stakes in the newly spun out company.
Start-Up	Start-up is a newly established company focused on developing and selling a product or service typically based on technology. Start-ups are typically aiming for fast growth, especially when founded by VC's
Lifestyle Entrepreneur	Someone who goes into business for a reason other than the financial rewards of owning a business, but because of their lifestyle. Typically not looking for growth and therefore not willing to tolerate the risk involved in growing business.
Growth Entrepreneur	Someone who goes into business to grow the company based on scalable business idea. Typically global focus for business. Widely used definition is e.g. the Deloitte Fast 500 criteria stating min. 50% annual revenue growth for 5 consecutive years in the end reaching 5 M\$.
Venture Capital (VC)	Venture capital (also known as VC or Venture) is provided as seed funding to early-stage, high-potential, growth companies and more often after the seed funding round as growth funding round (also referred as series A round) in the interest of generating a return through an eventual realization event such as an IPO or trade sale of the company

### 1.3 Process for Data Collection and Analysis

The data collection is based on analyzing data and materials received both from public domain and proprietary sources. More information was also collected through interviews conducted in the benchmarking part of the project. The people interviewed are listed in appendix 2.

### 1.4 Project Resources

The project team consists of 3 members:

- Juha Ruohonen, Project Manager
- Pasi Sorvisto
- Pekka Roine

The project team has extensive experience from international business including growth entrepreneurship, early-stage venture capital and global corporations. In addition they have studied different aspects of high-growth venturing. The report is based on interpretations of the information received from the sources and the interviews. No warranties on the estimates and figures received from interviewees and materials analyzed are given by the project team.

Additionally, the project has an interest group that consists of following people

- Will Cardwell, Aalto University
- Teemu Seppälä, Aalto University
- Antti Aarnio, Aalto University
- Jorma Helin, IP Finland

- Sami Heikkiniemi, Tekes
- Jukka Viitasaari, Finnish Technology Industry
- OP Mutanen, Aalto University
- Jaakko Salminen, Finnish SW Entrepreneurs

All other resources utilized are listed in appendix 2.

This report was commissioned for the purpose of having an independent analysis of several successful university ecosystems, and to evaluate how to incorporate apparent success factors into the Finnish Innovation Ecosystem. However, any and all views expressed in the report are solely those of the authors, and not necessarily those of the funding parties.

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## 2 Creating value from research – theory and evidence

### 2.1 The University Perspective

#### 2.1.1 Basic Research vs. Applied Research

One of the fundamental issues regarding the value-creation process of university-based ideas is the division between basic (ground) research vs. applied research. Traditionally, universities consider basic research as their fundamental activity and are quite sensitive towards it. Basic research is often regarded as the source for high-level scientific competence and it should not be compromised.

However, privatization, intense competition and other changes in the university landscape have raised the importance of applied research. Applied research is typically executed in cooperation with the industry (contract or sponsored research) providing access to the major markets and on the other hand input for the university research strategy.

There is quite frequently a confrontation between supporters of basic research and applied research. Applied research focus is seen to be compromising the academic freedom of the university and the level of scientific competence. However, the universities excelling in the global university performance rankings are also the ones showing best performance in the value-creation activities based on applied research.

One of the challenges with focusing on basic research is the long time-span of operations. Basic research typically takes a long time to yield significant results and the publication cycles for scientific research are quite slow. With the value-creation and commercialization cycles getting shorter in the current fast-paced economy, the value opportunity is often missed. Therefore high-level basic research should be seen as building block in conjunction with active and vibrant environment for applied research and industry cooperation when extracting value from the university-based ideas.

Another aspect on the university research is the social responsibility factor. If and when university operations are largely funded by the society (government etc), it is feasible to expect that universities provide value back through their core operations. Far-fetched academic freedom can lead to research and education providing little or no value to the society. Therefore it is vital to connect the university core operations like research to the problems found in the market.

#### 2.1.2 The Earning Logic for Universities

The basic earning logic for universities consists of following components:

- Endowments (US etc.)
- Public funding (e.g. Finland)
- Tuitions
- Sponsored Research
- Technology Transfer
- Other possible income (value-adding services etc)

Endowments or public funding and Sponsored Research typically provide the major source for operational funding. Depending on the university, tuitions can also be a significant source. Here are some revenue stream examples in some of the best-known universities in the United States. Those are often cited when referring to the technology licensing success stories.

2.1.2.1 Stanford University

FY09 UNIVERSITY OPERATING REVENUES (\$3.5 BILLION)

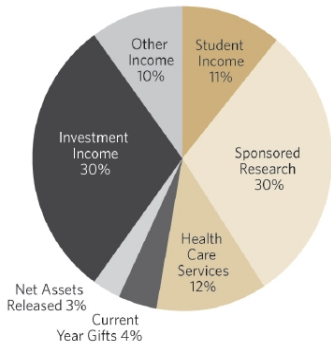


Figure X. Stanford University - operating revenues in 2009 (Stanford University, 2010).

In fiscal year 2009 consolidated revenues at Stanford University were \$3.5 billion and total endowment \$12.6 billion. "Investment income" – e.g. endowments – was the most significant revenue stream for Stanford University representing \$1 billion (30%) of the total revenues. Sponsored Research was an equal revenue generator; it generated \$1 billion (30% of revenues) of which 80% came directly or indirectly from the federal government. Other important revenue streams come from sales of health care services \$429 million (12% of revenues), and student income \$401 million (11% of the revenue), gifts were \$149 million (4%). Technology transfer income is included in the category "Other income" and generated \$341 million income for Stanford University.

2.1.2.2 MIT -Massachusetts Institute of Technology

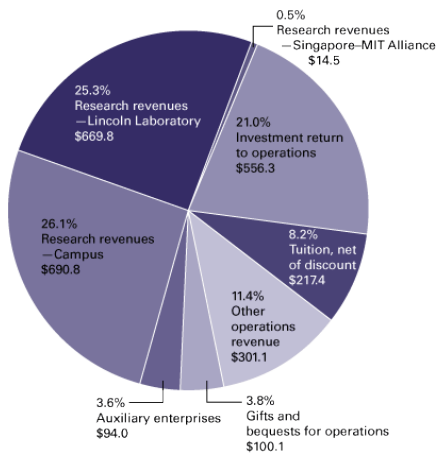


Figure z. MIT operating revenue 2009 (MIT, 2010).

MIT is more heavily geared towards Sponsored Research revenue than Stanford. In fiscal year 2009 MIT operating revenue was \$2.64 billion of which research revenues were \$1.36 billion (51.4%), investment returns \$556 million (21%), tuitions \$217 million (8%) and other revenue including services like training was \$301 million (11%).

### 2.1.2.3 Harvard University

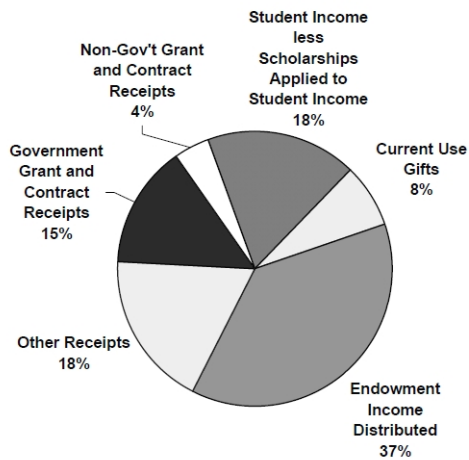


Figure t. Harvard University total income fiscal year 2009.

The total income for Harvard University in fiscal year 2009 was \$3.83 billion and market value of endowment funds was \$26 billion. Largest portion of revenue was collected through endowment income, and that represented 37% of total income. Sponsored Research was approximately half of that size; it generated \$705 million of which federal government Sponsored Research was \$554.5 million (79% of all Sponsored Research).

### 2.1.2.4 University of California (UC)

The University of California system has 226,000 students and, excluding medical centers and hospitals, it collected in 2009 \$14.6 billion revenue. UC has 10 campuses in California and Lawrence Berkeley National Laboratory. Campuses are:

- UC Berkeley
- UC Davis
- UC Irvine
- UC Los Angeles
- UC Merced
- UC Riverside
- UC Santa Barbara
- UC Santa Cruz
- UC San Diego
- UC San Francisco

Revenue streams were according to figure k (now including medical center revenues).

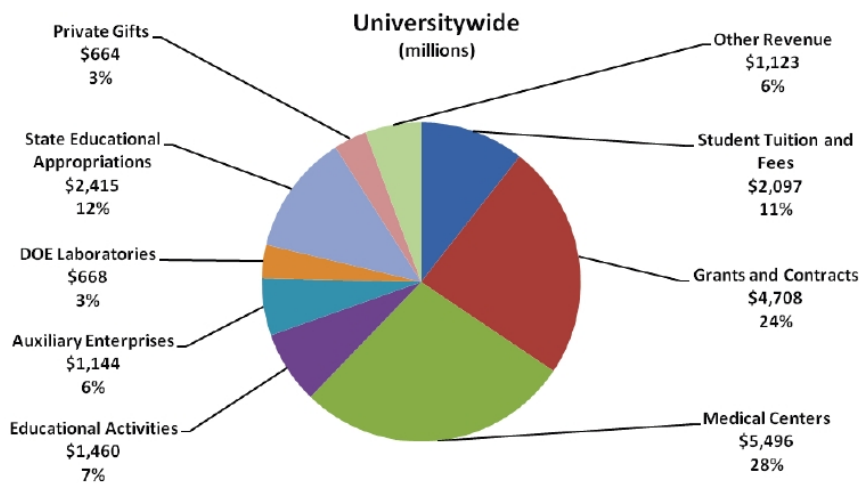


Figure k. University of California – revenue in fiscal year 2009.

**2.1.2.5 Comparison of the universities**

	Harvard	MIT	Stanford	UC System
Students	21,115	10,384	15,319	226,000
Revenue FY2008-09*	\$3.8 billion	\$2.6 billion	\$3.5 billion	\$14.3 billion
Inventions Disclosed	277	501	>400	1,482
US Patent Applications Filed	172	131	NA	1175
US Patents Issued	45	153	NA	244
Licensing Agreements (incl. options)	36	122	77	403
Total Licensing Income	\$12.1 million	\$75.7 million	\$65.1 million	\$121.4 million
Startup Companies Formed	8	21	9	47

Table 1. Statistics regarding some U.S. universities.

\* Medical centers and hospitals venues are excluded

Top-tier universities in the United States have several different earning structures, but Tech Transfer – based (technology licensing and startup-based earning) revenue represents only a fraction of the revenue streams. Not even in the most successful universities “technology licensing” has played an important role in revenue terms. The US universities are aiming for few big hits as the guideline for their tech transfer operations – those hits have generated hundreds of millions revenue during the years. The most famous success story e.g. for Stanford University has been Google, (net effect \$336 million in IPO), but there are not many such success stories in other universities.

**2.1.3 The Business Ecosystem Perspective**

Universities are a significant force in the business ecosystem. The value from university-based ideas is extracted directly (from research) and indirectly (from alumni).

As the evidence from Kauffman Study on MIT shows, companies established by university graduates (alumni) can have a huge impact on the local ecosystem. For example the 25 800 currently active companies established by MIT Alumni currently employ 3.3 million people with revenues of more than \$2 trillion. That is a huge driver for the US economy and especially for the state of Massachusetts.

One has to bear in mind that MIT is one of the leading universities in the world attracting talent from all over the world. Therefore it has the ability to generate value that smaller and less capable universities do not have. For any university it is vital to understand the major value drivers and core competencies of its operations and to develop a model to leverage those building blocks in the global economy. This requires several key components as shown in the framework in section 2.5.

#### 2.1.4 The Public Authorities Perspective

Growth companies based on university competence can be an extremely important source for value creation from the public authorities perspective. Universities are typically quite well networked and they do not have the natural tendency to move operations overseas as companies might have.

Public authorities are interested in several aspects of economic development, but two major impacts of new business creation and economic development are the increase in tax income and additional jobs created. There is clear evidence (i.e. 2009 Massachusetts Innovation Index) that innovation and high technology -based jobs are highly paid and generate more wealth and higher tax income for the state.

Many studies, i.e. a new report from Kauffman Foundation (Stangler, 2010), have shown that net job growth in the economy is mostly generated by high-growth companies. Basic rule is that 5-10% of the all companies generate 2/3 of the new net jobs, and these jobs are mostly created by high-growth companies. High growth can be achieved through various ways, but in many cases it has been achieved through a scalable business model based on unique technology. This usually requires groundbreaking innovations, and is tightly linked to universities and university education.

## 2.2 Technology Transfer

Most of the successful universities run their own Tech Transfer Operations (TTO) to generate value from research and university competence. The major goals for university TTO operations traditionally have been:

- To maximize the incoming revenue (industry and government)
- To network with the industry
- To manage and commercialize the university IPR

The Key Performance Indicator (KPI) used to describe successful TTO operations is the ROI for Research metric. The measure describes the amount of incoming external revenue from Tech Transfer (and equivalent) activities and Sponsored Research in relation to the overall annual budget of the university. The best universities globally can reach a 30% share – some examples are featured in the chart below:

University	Total Revenue M\$	Research-based Income M\$	% of revenue
Aalto University (FIN)	420	25	6
Harvard University (USA)	3800	705	19
Stanford University (USA)	3842	1210	31
MIT (USA)	2644	718	27
Technion (ISR)	400	28	7
Hebrew University of Jerusalem (ISR)	410	60	15
Ben Gurion University (ISR)	280	20	7

Table 2. Comparison on selected universities.

It must be noted that the revenue from actual Tech Transfer (licensing etc) is much lower. Even the best universities are well below the 5% level. Another key measure is the operating process expenses (OPEX) related to the value-creation activities. The best universities run a 15-20% OPEX.

However, the role of the TTO operations is changing. Instead of having the internal view, universities must see their TTO's as business organizations heavily networking with the industry and the major growth hubs in the world. Future TTO's must also be the sole commercial interface for the university and manage actively in the value-creation activities of the alumni-based ideas as shown in the framework in section 2.5. It is also feasible to consider the outsourcing of the business development activities since it is not the core competence of a university.

## **2.3 Sales of Competencies**

### **2.3.1 Sponsored Research**

Contract or sponsored research is one of the major sources for external funding for universities. Contract research can be strategic providing value for research activities or with less strategic value generating cash flow for university.

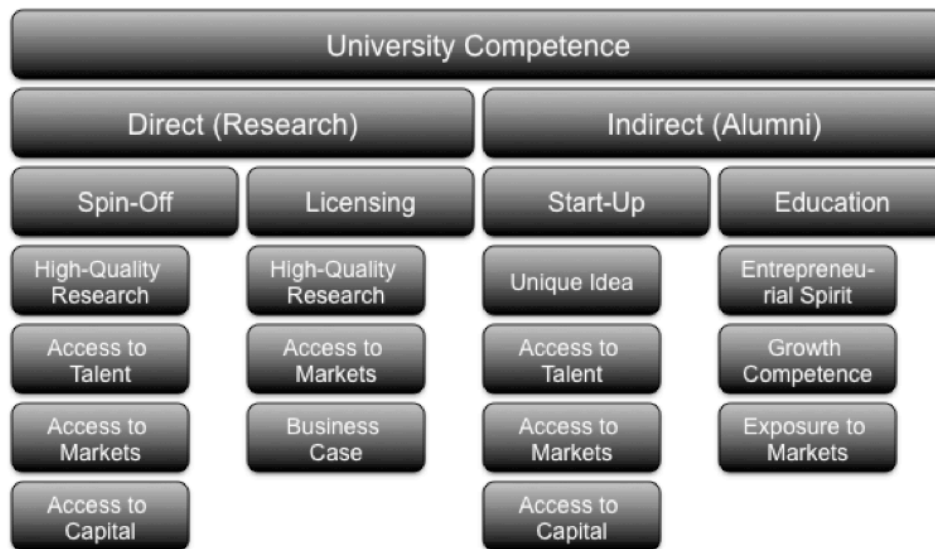
Contract research can be a double-edged sword. It can provide access to industry knowledge and networking to major hubs of the industry. It provides input for the strategic decisions for the university – especially on research. On the other hand it can be a cash cow with very limited true value-added. IPR can leak out to corporations and universities are mainly regarded as an outsourced resource pool for companies outsourcing their R&D.

### **2.3.2 Value Adding Services**

Lot of the universities also commercialize their competence by offering value-added services to companies and in some cases also to the individual consumers. These services can account for a significant part of the revenues for universities – even more than 10% of the annual budget. Examples of these services include consulting, reviews and evaluation, medical services, and laboratory and research services.

## **2.4 Benchmarking Framework**

When considering the approach to value-creation of university-based IPR, a comprehensive framework is needed. The picture below shows the major components of such a framework. This framework was also used as basis for the benchmarking analysis:



Firstly, a division between direct and indirect is needed. As mentioned, university TTO's have traditionally been focused on direct operations (internal IPR) i.e. protection and commercialization of ideas based on research executed within the university (research groups etc). This research also includes any contract research activities executed in cooperation with the industry. However, evidence shows that most of the knowledge transfer from universities is generated through graduates (alumni) and their ideas and projects. The benchmarking model therefore includes also the indirect operations.

## 2.4.1 Direct Approach

When creating value from the internal IPR, licensing is regarded in many cases as the default business opportunity. However, this is normally the case only in life sciences. In all other verticals, commercialization activities should rather be focused around creating successful spin-offs than on push-out licensing activities. The business model for university can still be based on licensing from spin-offs instead of equity or other share ownership-based models.

### 2.4.1.1 Licensing

The recent trends in high-tech industry make it even harder to execute successful licensing operations. Corporations who are potential buyers for IPR need stronger business cases and more advanced proof on the business potential of the innovation. In practice licensing cannot be pushed out without business case to support it.

In order to be successful in licensing following aspects need to be taken into account:

- High-Quality Research and ideas. There needs to be groundbreaking research with a strong disruptive factor. IPR should be protected according the industry guidelines.
- Business Case. The most important component in licensing business model is a solid business case. Business case should be analyzed and executed by external experts. Decisions on IPR protection should be part of business case analysis.
- Access To Markets and Buyers. Licensing activities need to be executed at the main markets, especially if the main buyers are not actively present in the university home markets. This requires active networking with the major players of the industry to create a "pull" for the IPR. If the IPR is just pushed to remote markets, the deal value and hit-rate will be low.

### 2.4.1.2 Spin-Offs

When creating spin-off companies to drive the value out of university IPR, it is crucial to understand the dynamics of the high-growth venturing in the target business area. This requires active networking with a) the local value-added actors (business development services, business angels, VC's etc) and b) with the major hubs and actors globally. Most of the university-based spin-offs are developed in a local vacuum without exposure to the major markets and the right mentality and competence.

The building blocks for a successful growth companies based on university research can be defined as:

- High-Quality Research. There needs to be groundbreaking research with a strong disruptive factor. IPR should be protected according the industry guidelines. IPR protection should be seen as a business decision to serve the ramp-up of a spin-off. In some cases IPR should not be exposed by patenting.
- Access to talent. It makes no sense to try to convert researchers to become business professionals. Instead, projects must be resourced with experienced business professionals to be in charge of the business development activities and the early ramp-up of business. A pull-out model should be implemented rather than pushing technologies into markets.
- Access to main markets. Spin-off companies must be exposed to the major global markets as soon as possible. Universities need to establish a cooperation model with selected global hubs to provide the access. This cooperation should be executed in multiple levels to provide leverage.
- Access to capital. Most of the research-based spin-offs cannot raise enough capital to be able to quickly ramp-up their business in target markets. There needs to be a local source for capital in the early stage and access to major capital markets in the growth stage. Cases need to be built VC –fundable from the day one. However, universities should not run investment funds in general since it is not their core business.

## 2.4.2 Indirect Approach

### 2.4.2.1 Start-Ups

When creating spin-off companies to drive the value of alumni or student ideas, it is crucial to understand the dynamics of the high-growth venturing in the target business area. The entrepreneurs are typically non-experienced and therefore they need be hooked up with experienced entrepreneurs and with business developers providing world-class advice.

The building blocks for a successful growth companies based on alumni research can be defined as:

- Unique Idea. The ideas need to be disruptive. Most of the ideas by alumni are “me-too” category with incremental development component.
- Access to talent. Building successful start-ups is a team effort. Most common mistake for start-ups is an overwhelming trust on their own competencies. Even from the start, companies must be resourced with experienced growth entrepreneurs and the people providing them with business development services (incubators with international exposure etc.) must have extensive experience from growth entrepreneurship and VC industry.
- Access to main markets. Companies must be exposed to the major global markets as soon as possible. Universities need to establish a cooperation model with selected global hubs to provide the access. This cooperation should be executed in multiple levels to provide leverage.
- Access to capital. Most of the research-based spin-offs cannot raise enough capital to be able to quickly ramp-up their business in target markets. There needs to be a local source for capital in the early stage and access to major capital markets in the growth stage. Cases need to be built VC –fundable from the day one. Vibrant business angel networks are a pre-requisite for success.

### 2.4.2.2 Education

Entrepreneurship education needs a transformation from the basic entrepreneurship skills to the special skills needed in growth companies and international business. The skill set needed in local slow-moving lifestyle entrepreneurship is completely different than e.g. in fast-paced international high-tech business. The key components are:

- Entrepreneurial Spirit. Potential entrepreneurs should be exposed to right kind of thinking. One of the issues is to adapt the “fail fast” –mentality in order to gain vital experience.
- Growth Competence. It is vital that future entrepreneurs understand the dynamic needed for fast growth. They need to be exposed to the major hubs and their vibrant environment when they are studying.
- Exposure to Markets. Students need to be offered exposure to major market to provide the correct market information.

These competencies can be taught through special growth entrepreneurship training program arranged with international partners. Substance should come mainly from the experienced entrepreneurs rather than the faculty.

### 2.4.3 Other Issues

Additional issues needing consideration are:

- Window of Opportunity. Disruptive innovations typically have longer window of opportunity than non-disruptive innovations. Typical WoO for non-disruptive innovation is regarded at 12-18 months. In practise a significant market presence needs to be acquired in a short time whereas disruptive innovations with strong IPR are less sensitive for the WoO factor.
- Competition in licensing technology. Competition in licensing technology is many times forgotten in the discussions when developing the technology transfer operations for universities. Large corporations have become more risk averse against new technologies and they require more solid proof for concept than 10-15 years ago.

## 2.5 Summary

The environment described above creates new demands for the competence of the universities. They must expand their focus from direct operations (IPR protection, licensing deals and agreement structures) to also include indirect activities (start-ups). In fact the whole notion of the current TTO operations can be questioned as they are currently organized within most universities. They are typically misresourced, static and bureaucratic.

The future TTO's must be facilitators focused more on creating collisions between university and the industry. These collisions will create new innovations and opportunities that can then be developed forward by actively networked TTO's. The people working for TTO's must have experience from business development and growth entrepreneurship.

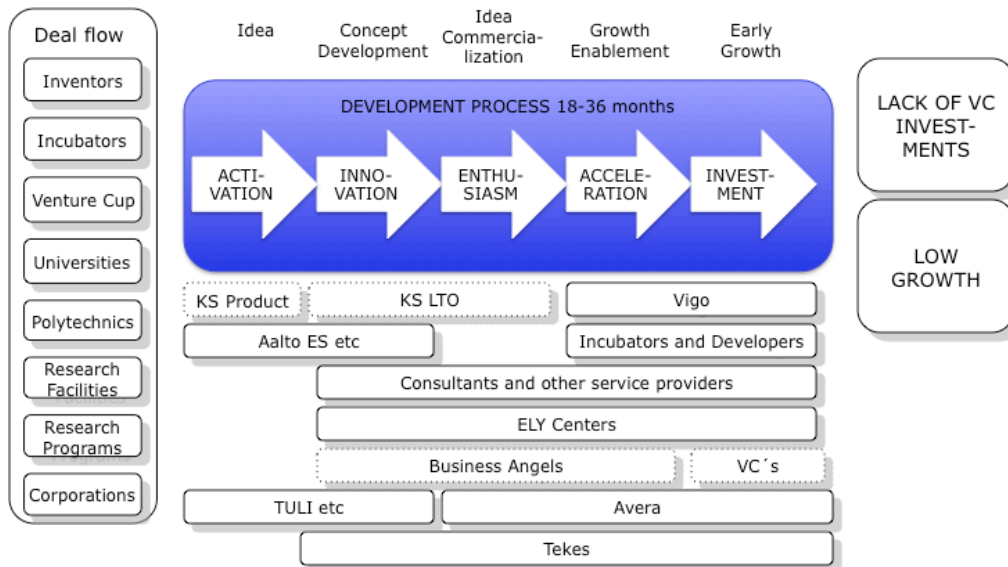
Since most of the innovations from universities are commercialized through their alumni, universities need also to build a feasible model for the business development and entrepreneurial education focused on growth. This requires out-of-the-box thinking since most universities are currently not actively boosting growth entrepreneurship.



### 3 The Current Status in Finland

#### 3.1 General

Finland invests heavily in the innovation system. It is currently number 2 globally (excluding MA) behind Israel in the R&D spending on per capita basis with 4,1% of GDP invested annually. The public R&D is around 2 bn € in 2010 (1,17% of GDP). About 50% of the public funding is aimed at research executed in universities directly or indirectly.



University-based ideas are regarded as an important asset to the future success of Finland. However, the whole impact of universities in the ecosystem is not well analyzed and understood. The fundamentals of the Finnish high-growth ecosystem are somewhat distorted. The short time-span of development activities, direct interventional funding by public sector players and the lack of international competence on growth entrepreneurship has created a vicious cycle of non-professional business development activities yielding low results.

The Finnish system is quite complex and focuses extensively on the structures, programs and projects designed to develop the system itself rather than the customers (companies and research groups) of the system. Current system is dominated with large number of funding components offered by several overlapping public organizations and dominated by service providers (consultants etc.) with no real competence or incentive to develop the companies to be successful. They are lacking the upside and downside. System is extremely cost-driven and the transparency is very low.

The current value-creation process (if there is any) for ideas originating from the university is heavily depending on public funding. There are several reasons for that:

- Lack of VC's actively investing in early stage
- Low number of value-adding business angels
- Internal focus of the universities instead of the ecosystem approach
- Cost-driven system with vague targets and measures

Finnish Universities are strongly focused on basic research. However, they do not excel at the ARWU listing ([www.arwu.org](http://www.arwu.org)) of the universities widely regarded as the most comprehensive listing globally. The ranking of ARWU is based on the following criteria reflecting the quality of the scientific research:

- Number of alumni and staff winning Nobel prizes and Fields Medals
- Number of highly cited researchers selected by Thomson Scientific
- Number of articles published in journals of Nature and Science
- Number of articles indexed in Science Citation Index
- Per capita performance with respect to the size of an institution

University of Helsinki ([www.hel.fi](http://www.hel.fi)) is listed at #73 in the global ranking and at #22 for Europe in 2010. Other Finnish universities are listed at 300-500 including Aalto University ([www.aalto.fi](http://www.aalto.fi)). This proposes a fundamental challenge for the value-creation activities since high-quality research is the key value driver.

## 3.2 Logic and Actors

### 3.2.1 University TTO's

University TTO-operations are currently mostly focused on the commercialization activities (licensing) of research-based ideas, not on building a viable ecosystem around universities. They are resourced with people having limited experience on business development or entrepreneurship. The targets for operations are mainly cost-driven with low emphasis on business results.

The TTO approach is heavily based on licensing with operational focus on IPR protection and legal issues (agreements etc). This approach is typically justified by the recently implemented Law on University Inventions (369/2006). However, the law assesses the invention disclosure process and provides rules for the ownership, compensation and management of the university-based IPR.

Licensing is mainly executed with a push model where research-based IPR is offered to potential buyers without comprehensive analysis on business potential and a solid business case. The commercial results of the licensing activities are very low.

### 3.2.2 TULI-Program

TULI –program ([www.tuli.info](http://www.tuli.info)) is the major source of funding for the commercialization and proof-of-concept of the research-based ideas currently in Finland. It is mainly aimed for universities and research institutions but has partly been providing funding to individual inventors as well. The program is managed by Tekes ([www.tekes.fi](http://www.tekes.fi)) and the annual volume of the program is around 10 M€ divided into 750 projects (2009). Tekes provides 60% of the funding while the participating universities and research facilities provide 40%. TULI provides research groups and inventors with the initial funding for POC (proof-of-concept) phase with the maximum funding per case being 55K€. Funding is distributed in 3 phases (5000€ 20 000€ and 30 000€).

The commercial results from TULI –program are quite low. The total commercialization revenue from research institutions and universities in Finland is less than 3M€ annually (2009) and the number of spin-off start-ups established is less than 10. The operating expenses of the program are currently higher than the revenue generated.

There have been several evaluations and studies on TULI –program indicating that the results achieved are not adequate. Program lacks a rating system to provide transparent system to analyze fairly large

number of cases. That would also help to rate different universities on their performance. The approach is also very "home-grown" without access to major markets globally.

### 3.2.3 Foundation of Finnish Inventions

Foundation of Finnish Inventions is an organization established to help private individuals and companies to commercialize their IPR. FFI recently changes their modus operandi to better support and service entrepreneurs with stronger business focus.

The funding provided by FFI is distributed under de minimis –rules with practical average being around 40 K€. FFI funding is risk capital with royalties. The maximum royalty is equivalent to the grant received. Maximum payback period is 12 years.

The general division between TULI –program and FFI is that TULI –funding is aimed at the research groups and university-owned IPR whereas FFI should take care of the inventions by individual inventors and alumni. In practice there seems to be some overlap.

### 3.2.4 Vigo –program

Ministry of Employment and Economy (TEM) launched a new accelerator program in 2009. The goal was to establish several Israeli –style accelerators resourced with experienced growth entrepreneurs acting as business developers for growth companies. Vigos also invest their own money into companies and that investment would be leveraged with selected governmental funding sources. 6 Vigos were originally selected.

Vigo –program Has some operational challenges due to:

- Lack of private investors (VC's, angels) in the program
- Limited international exposure within the Vigo teams
- Slow and bureaucratic decision-making by the public players involved
- Targets and metrics not transparent

Vigos could play a major role in the value-creation of the ideas originating from the university but due to lack of resources and bureaucracy they are struggling to do that. However, there is promising cooperation between Aalto Venture Garage and selected Vigos.

### 3.2.5 Investment Community

The status of the Finnish early stage investments is still critical. The number of active VC funds investing in early-stage is currently less than 10. There is also lack of active business angels providing active competence to companies. The total annual value of the early-stage VC industry is around 80 M€ (2009). Most of the funds have moved to more mature stages or MBO/MBI –investments. To compensate the lack of commercial players, governmental investment agencies led by Finnvera (Aloitusrahassto Vera) and Finnish Industry Investment (Start Fund) are actively investing directly into companies. They are committing into a large number of companies with average investment being low (In 2009, public investors invested 75% of the 80 M€ in seed and start-up). They fail to produce the value-added expected from the VC and in many cases seriously affect the feasibility of the next funding round. The same thing often happens with business angels as their investments are in a very low level and they do not understand the dynamics of the VC industry.

### 3.3 Key Findings

There are few key challenges in the current system for the value-creation for the ideas originating from the university in Finland:

- Lack of ecosystem view. Current operations in Finland are not executed from the ecosystem perspective. Actors have their own targets (mainly cost-based) leading to sub-optimization. Universities do not see themselves as major players in the ecosystem.
- High-quality Research. Finnish Universities can produce limited number of groundbreaking research in the global scale. They are also focused on basic research to protect their academic freedom. There is also a skill gap on the growth entrepreneurship education and research.
- Contract research and IPR. Currently the corporations involved in contract research as industrial partners get a first-right of refusal to the IPR developed in the project. Funding is mostly (up to 80%) provided by Tekes. This model significantly limits the opportunity for the university to commercialize the IPR.
- Competence Gap. The people currently working for university TTO's and related organizations do not possess extensive business competence. Their background is not from high-growth start-ups or from tech transfer operations in corporations.
- Inbound Approach. University TTO's see themselves mainly as officials in charge of IPR protection and licensing of the IPR. They do not actively promote universities as vital part of the high-growth ecosystem. They also fail to actively network with the major global hubs. They would also need to be the sole interface to the industry for the university.
- Cost-driven TULI -program. There are no targets to the outcomes of the program – not for licensing revenues or number of start-ups established. In addition even the costs are not comprehensively followed at the program. Lack of transparency is imminent.
- Complex network of actors and programs. In addition to TULI –funding there is a large number of different public or related organizations and programs offering funding for start-ups established based on university competence. Most of these organizations only provide funding, not any value-added services.
- Low efficiency. The current efficiency of the public funding for growth companies is very low. Complex structures and overlapping organizations providing funding without competence generate a high OPEX. It can be estimated that the OPEX for e.g. Tekes funding is more than 10%.

Finland needs a transformation. The fundamental pre-requisite for transformation is to accept and understand that Finland currently lacks the world-class competence needed for world-class results. This is highlighted in the case descriptions in section 4.

## 4 Case Descriptions

### 4.1 Israel

#### 4.1.1 General

The Israeli system is heavily geared towards developing VC –capable companies. It is widely accepted in Israel that high-growth start-ups are the critical resource for the survival of the state. Government works actively to provide better environment for growth companies. It is also accepted and understood that in order to succeed companies need VC funding and therefore VC fundability is the key target for all development operations.

The whole ecosystem supporting fast-growth companies is resourced with people possessing personal experience from serial entrepreneurship and/or VC industry. Even the persons working for the universities and government are experienced or at least semi-experienced business professionals. The University TTO –organizations among others are resourced with world-class professionals possessing strong business competence.

The majority of the growth companies are looking for VC investment. “Boot Strapping” is thus becoming more popular in Israel due to the harder access for VC capital. Strapping works in areas with low R&D capital demands (e.g. internet –based businesses) but cannot be applied into R&D and capital -intensive businesses.

Most of the successful companies are looking for growth in the US (or equivalent) markets and aim for an IPO in the US. The role of China and India is becoming more significant. Since the whole ecosystem is geared towards VC business mode, thorough understanding on the dynamics of the global VC industry is needed also in the university level.

#### 4.1.2 Logic and Actors

##### 4.1.2.1 University TTO’s

Universities and other research institutes play a major role in the Israeli ecosystem. However, the University research-based ideas represent only 15-20 % of the knowledge transfer by universities. The vast majority is done through students (alumni) when they graduate.

In Israel, University Tech Transfer Offices are the sole interface to external actors (investors, corporations, entrepreneurs). They organize contract research, manage licensing process and resource projects with external resources (entrepreneurs). The Israeli approach is based on building on strengths, not eliminating weaknesses. Therefore TTO’s are actively bringing in external talent to promote the commercialization of research rather than pushing for the researchers to become entrepreneurs themselves.

POC –phase is typically executed with university resources. Office of the Chief Scientist (OCS) provides funding for POC phase but also requires that projects are resourced with experienced growth entrepreneurs, not with corporate officers or university people. This “pull-out” model is quite dynamic offering market exposure to university ideas in a very early stage. It also exposes university researchers to market conditions in their vertical.

In some cases universities are actively cooperating with incubators to provide a clear path for commercialization for their ideas. They have a small equity stake in the incubators to generate the incentive to push the best ideas forward. In addition they normally retain a small stake in the company established based on the research.

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In the universities (e.g. MIT, Technion), academic entrepreneurship started booming when lecturers were changed into experienced business professionals.

#### 4.1.2.2 Incubators

Despite the phenomenal success of Israeli growth companies, there are still limited number of business angels or angel groups investing actively in Israel. Therefore a network of incubators has been established to provide the initial funding and access to global talent for the early stage companies. Incubators typically operate on the seed funding stage offering active advisory and management talent from their pool of experts.

Incubators are owned by VC's and other value-adding business partners along with the management teams. Incubators work like early stage VC's (or angels, really), only in very early stage of the process. A typical incubator portfolio company has the potential for VC investment but is too early for VC funds to invest in. For VC's the incubator model provides an efficient tool to leverage risk through government funding while having an access to high-quality deal flow.

A typical research-based case is pulled out from the university by an experienced entrepreneur and is then resourced further by the incubator. The cap table at the starting phase can be:

- Founders 40% (including the research group)
- University 10% (not every case)
- OCS (with the call option to VC's) 30%
- Incubator or the VC's 10%
- New Management 10%

Incubators are running the VC business model. There are 3 essential targets for incubator operations:

- To provide the necessary competence and networks in order to enable high growth
- To develop VC fundable companies
- To provide access to capital to enable the graduating companies to raise enough growth funding to access global markets (current average 3 M\$)

Incubator program has been quite successful with higher amount of VC funding raised by the graduates than other companies.

#### 4.1.2.3 OCS - Office of the Chief Scientist

The role of public sector is mainly to boost private operations. All interventions by the government are aimed to be indirect and temporary by nature. Public sector can play a major role in enabling a world-class ecosystem by leveraging risk and creating mechanisms to attract top talent.

The role of public organizations in Israel is quite clearly understood with little room for interpretation. Office of the Chief Scientist (OCS) is the sole actor from the government-side and is resourced with people having business experience and understanding on the market dynamics.

OCS funding works in cooperation with the private players by lowering the risk level in cases too early for commercial VC's (incubation program). The evaluation of the business potential is outsourced for network of business and academic professionals (currently about 100 key people).

OCS currently runs several programs with strong aim for funding to support the growth companies. The incubation program is one of the main programs with the following main characteristics:

- 26 incubators accepted in the program (25 private, mainly owned by VC's), 8 portfolio companies on average per incubator
- Approx. 80 new companies selected by the incubators annually, incubation period max 24 months (biotech max 36 months)
- Incubators are accredited by the OCS for a period of 3 years. Mutual targets agreed for the incubation period. Main outcome is the amount of VC funding raised by the portfolio companies.
- Incubators work based on VC criteria - companies incubated only if they have the VC potential but are not ready for VC's to invest. Not if they are not good enough.
- Incubator ownership on the portfolio companies max 30%, entrepreneurs/founders own min 30%.
- Average investment by OCS 500 K\$ (85%) matched by the private investments. Average total funding 775 K\$ for incubation period.
- OCS investment is supplied as a loan with share collateral including call option for incubators or their investors. ROI for Israeli government is generated through the growth of the companies, jobs and taxes.
- 6 OCS people manage the program with 40-45 M\$ invested annually
- 8300 business applications to incubators annually -> 130 selected by incubators and processed by OCS -> 80 accepted
- OCS uses their pool of 100 external industry and academia experts to screen the companies proposed by incubators
- Incubator companies raise 6/1 ratio of foreign VC investments on OCS funding received (in the best years more than 400 M\$ annually)
- Graduated companies raise average of 3 M\$ of funding within 24 months of graduation; survival rate 55%

The value for government in Israel is created indirectly through companies growing, not directly through direct investments or interest (loans etc.). Successful growth companies return the government investment through taxes and other payments but only if they can compete in the global markets and grow fast.

The Israeli incubation system is widely regarded as the most efficient in recent evaluations (PWC, IDC, Teubal & Morris). The key is the specific focus for growth companies only and the related competence of the people involved including the heavy involvement by the VC's.

#### 4.1.2.4 VC Community

The main source for funding for the growth companies in Israel are the world-class VC's. Israel has been one of the largest VC markets for a decade (currently #4) and when compared on per capita basis it is the most successful. Majority of the funding raised by Israeli companies is provided by foreign VC funds operating actively in Israel. Most of the leading VC funds have operations in Israel (Sequoia Capital, Draper Fisher Jurvetson, Benchmark Capital etc.). They provide the necessary competence and market access to Israeli companies.

Major challenge in Israel currently is the lack of growth capital. Israeli companies are bought before they can reach market cap of more than 500 M\$ (only 7 companies currently). Especially pre-IPO funding is missing. There are 2 trends visible in the Israeli VC market:

- VC funds will start to invest in earlier phase to get access to companies. Investments will be smaller

- Specialized players are emerging to provide growth capital and pre-IPO financing.

The challenges of the VC market reflect greatly in to funding opportunities for Israeli companies. Lack of capital has somewhat increased demand for incubators.

#### 4.1.2.5 Corporations

Global corporations play a major role in the Israeli ecosystem. They provide:

- Exit channel
- Access to talent
- Access to global delivery channels
- Funding and venturing opportunities

The Israeli government has initiated many activities to attract the leading global companies to the Israeli market. They have engaged new multi-national joint development funds, introduced new tax arrangements and offered special government grants and loans to multi-national companies.

There are currently almost 50 leading global companies operating their strategic research and development centers in Israel. Over 80% of them have been established through M&A activity – only less than 10 by Greenfield operations. Over 40 bn \$ has been invested in Israel through trade-sales, mergers and IPOs. There are 2 reasons for success:

- *Born Global approach.* Israeli technology companies are typically established solely to the global markets. Through the networks originating years back and especially created during the Yozma program, Israeli companies have been successfully relocating to global markets, mainly US. Israelis are willing to tolerate the risk required to create successful global companies. They also understand the value of critical mass and brand creation in global operations.
- *Continuous support from the government.* The government has actively engaged new initiatives to attract global companies to Israel. Tax benefits have been introduced, targeted R&D funding packages have been created and strategic partnerships (e.g. joint funds like the Bird Foundation) have been established to generate new business opportunities.

The Israelis have been successful in attracting the global companies to be a vital component of the *high-growth ecosystem*. Instead of just promoting the sales activities of the technology companies, the Israelis have been able to turn the tide resulting in a huge amount of invested capital in the Israel high-tech industry. Naturally the main reason here is the high-quality competence expressed by the successful companies, but the role of the Israeli government has also been vital.

#### 4.1.3 Key Findings

There are several key findings from Israel:

- Eco-system approach. The Israeli approach is very much based on ecosystem view. The operations are planned and executed as part of the system – not as sub-optimized separate operations.
- Exposure. Israeli entrepreneurs are exposed to the global VC model from the day one. Already as university students they are offered opportunities to spend time in one of the major global hubs to learn the basics of growth entrepreneurship.
- Competence is everything. Business development activities must be resourced with world-class talent. The basic principle applies to all players in the ecosystem including the university TTO's.

- Transparency of the system. The Israeli system is very transparent. Each actor has clearly defined role and most people involved can explain the logic of the system.
- Modus operandi. The value-creation activities are mainly based on spin-off approach. Licensing model works well in life sciences – it is less feasible to other verticals. The value-creation process for all other inventions must be based on establishing companies.

Although the direct impact of university-based research is less than 20% of the total deal flow for the VC community, the indirect (alumni) impact is much higher (more than 50% of the deal flow). Therefore universities are widely regarded as the hub for high-tech development in Israel. The universities in Israel have actively been networking with the major hubs in the world to provide leverage and access to major markets.

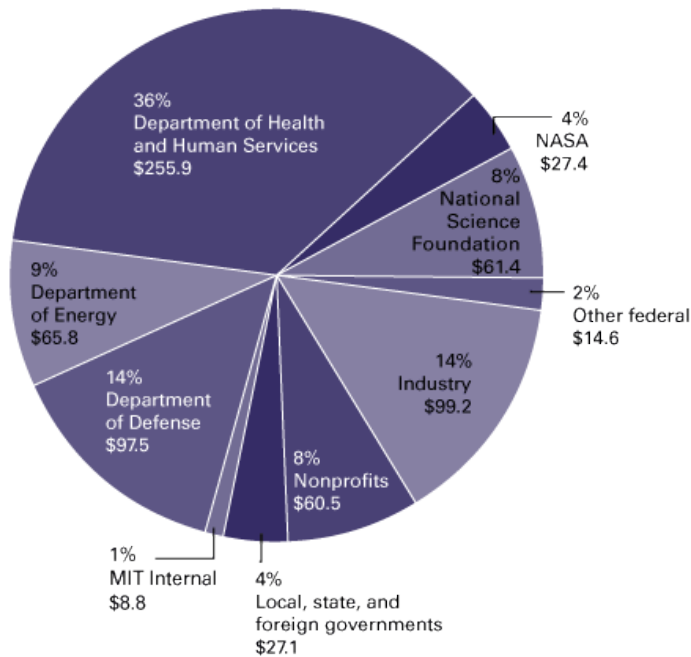
Universities cooperate actively with Israeli incubators to provide access to markets, necessary competence and access to funding. Universities do not operate separate funds or other funding vehicles.

## 4.2 Boston Area and Massachusetts

### 4.2.1 General

Boston Area is one of the hubs for high-growth venturing and is regarded as the birthplace for Venture Capital (Route 128). Greater Boston area hosts some of the leading universities in the world e.g. Harvard University ([www.harvard.edu](http://www.harvard.edu)) and MIT ([www.mit.edu](http://www.mit.edu)). Massachusetts (MA) is the leading innovation area globally with more than 7% of GDP invested into R&D. MA is also the leading US state in University Technology Licensing.

Since the Bayh-Dole Act ([http://en.wikipedia.org/wiki/Bayh-Dole\\_Act](http://en.wikipedia.org/wiki/Bayh-Dole_Act)) was implemented in the US, most of the universities have established their own TTO operations and have been focusing on the value-creation of the research-based ideas. However, only few universities can regard TTO activities as major revenue source for the operations. Even the best universities (MIT, Stanford, Harvard, Columbia) can produce ROI for research of less than 30% and the share of TTO operations out of total annual budget is quite low. However, these figures look different when the alumni ideas are added.



Above is an example of MIT research revenues for 2009. It shows that government is the major source for revenue on research.

New business formation is a key element of job creation and cluster growth—typically accounting for 30-45% of all new jobs in the US. In the Innovation Economy, new business formation plays a particularly important role in developing and commercializing emerging technologies. The number of spinout companies from universities, teaching hospitals, and nonprofit research institutes is a proxy for the entrepreneurial culture at these institutions to translate research outcomes into commercial applications. Research universities and other academic centers are pivotal in the Massachusetts Innovation Economy because they promote basic science, create technology that can be commercialized in the private sector, and contribute to educating the highly-skilled individuals that constitute one of Massachusetts' greatest

strengths. Funding from the federal government is critical to sustain academic, nonprofit, and health-related research.

## 4.2.2 Logic and Actors

### 4.2.2.1 University Organizations

#### 4.2.2.1.1 TTO's

All major universities in the US have established Tech Transfer Operations. For example, Harvard, MIT and Boston University (<http://www.bu.edu/>) run extensive TTO operations. TTO's provide the interface to the industry to the universities.

TTO's are resourced with people possessing experience from the industry. The key people have either a corporation background or experience from growth entrepreneurship. In some cases people have experience from successful incubational operations. The role of the TTO is seen as comprehensive interface to university. It manages the value-creation process internally and provides active networking to the industry creating collisions to promote new ideas. In the universities visited, TTO's are in charge of the value-creation of the university-research –based ideas whereas alumni activities are executed with other organizations within the university. However, these organizations are cooperating closely.

#### 4.2.2.1.2 MIT Deshpande Center

The Deshpande Center was established at the MIT School of Engineering in 2002 to increase the impact of MIT technologies in the marketplace. Founded with an initial donation by [Jaishree and Desh Deshpande](#), the Center depends on the financial and professional support of successful alumni, entrepreneurs, and investors to provide a sustainable source of funding for innovative research and guidance to help it reach the marketplace.

Since 2002, The Deshpande Center has funded more than 80 projects with over \$9 M in grants. 18 projects have spun out of the center into commercial ventures, having collectively raised over \$140 M in outside financing. Thirteen venture capital firms have invested in these ventures. The Deshpande Center supports a wide range of emerging technologies including biotechnology, biomedical devices, information technology, new materials, tiny tech, and energy innovations.

The Deshpande Center achieves its mission through several approaches: Grant Program, Catalyst Program, Innovation Teams (i-Teams) & Events. The operations are relatively small scale compared to the publicity of the center.

#### 4.2.2.1.3 MIT Entrepreneurship Center

The MIT Entrepreneurship Center is committed to fostering and developing MIT's entrepreneurial activities and interests in three primary areas:

- Education and Research. The MIT E-Center team educates and develops leaders of successful high-tech ventures by offering best-in-class educational courses and executive programs powered by MIT's leading-edge technology and business research.
- Alliances. The MIT E-Center facilitates business and technology partnerships by combining breakthrough academic research with practical, proven experience. Within MIT, the E-Center functions at the crossroads of technology and business, innovation and invention, new concepts and new products. We join forces with corporate and venture-minded allies to provide entrepreneurs with people, tools, and expertise to bring new products to market successfully.

- Community. The people of the MIT E-Center cultivate and nourish a thriving network that unifies academic, government, and industry leaders around the vision of entrepreneurial success. These efforts strengthen the entrepreneurial community and build momentum for emerging ventures through interactions among MIT students, faculty, recent alums, and other stakeholders. The goal is to inoculate people with the entrepreneurial virus.

Entrepreneurship Center is the key resource for MIT in developing the competence of growth entrepreneurship but it does not directly operate with spin-off companies.

#### 4.2.2.2 Business Angels

Business Angels are a major source for funding and talent in the US. The annual volume of business angel investments is around 18 bn\$ compared to the 7 bn\$ by early-stage VC's. In addition, business angels provide active help and guidance since they are mostly individuals with full upside and downside potential on their investments.

One of the success factors for business angels is the efficient access to deal flow. Therefore business angels in the US have recently formed groups referred as super angels. Angles actively network with university TTO's to get access to university-based ideas.

#### 4.2.2.3 VC's

Venture capital (VC) firms are an important source of funds for the creation and development of innovative new companies. Trends in VC investment can be predictive of emerging growth opportunities in the Innovation Economy. In addition, VC firms often provide valuable business strategy guidance.

From the VC perspective, university-based ideas are a double-edged sword. On one hand they have well-defined ideas, protected IPR and scalability, on the other hand they are very early stage and typically require a long time to be developed into 100 M\$ business. This is specifically a challenge for the traditional VC model where investment funds are typically run for 8+2 years.

In addition to traditional VC funds, there are several specialized players focused on the university-based IPR. These investors invest only into research-based IPR and have made MoU's with major universities. Their model is to provide funding already for research projects than can then lead to investment into spin-off. They deal with the university TTO's only – not directly with the research groups.

The recession has had a significant impact on the ability of venture capital firms to raise new capital to invest and on their willingness to make new investments, particularly in established companies. Nationally in the US, the dollar amount raised by venture funds dropped 57% in the last quarter of 2008 and remained low during most of 2009. Not surprisingly, the amount invested in Massachusetts-based firms was 35% lower in 2009 than in 2008. However, in the whole nation VC declined by 40%. Among the Leading Technology States, Massachusetts companies continue to attract the greatest amount of venture capital per capita, while California continues to lead in total venture investment. Investments in early stage Massachusetts companies have remained stable, while those in start-up/seed stage companies have reached record levels. Equally as important, the average deal size for these investments is now comparable to or larger than those in other Leading Technology States.

#### 4.2.2.4 Others

The Small Business Innovation Research (SBIR) Program is a highly competitive federal grant program that enables small companies to conduct proof-of-concept (Phase I) research on technical merit and idea feasibility and prototype development (Phase II) building on Phase I findings.

Unlike many other federal research grants and contracts, SBIR grants are reserved for applicant teams led by for-profit companies with fewer than 500 employees. The program is intended to address the technology needs of federal agencies while encouraging companies to profit from the commercialization of research. Participants in the SBIR program are often able to use the credibility and experimental data developed through their research to attract strategic partners and outside capital investment.

#### 4.2.3 Key Findings

The ecosystem in the Boston Area and MA has been developed through evolution. There is no single leading party in charge of the vision and strategy. Commercial players drive the process with public players having a limited supportive role. Also the system-level approach is partly missing.

Universities play a major role in the ecosystem. The university spin-offs represent an average of 10-15% from the VC deal flow in the Boston region. When the alumni projects are added, the share exceeds 50% as in Israel. It is safe to say that universities in the region represent a major talent pool. However, it must be understood that indirect (alumni) ideas are more vital source of value creation than direct (research) spin-offs. One of the challenges in the current value-creation of the university-based ideas in the US is the low number of truly disruptive ideas. Research is many times geared towards incremental technologies as the role of sponsored research as significant.

University TTO operations are run by business people, not by researchers. TTO's are seen as matchmakers between researchers, students and business people, not as bureaucrats focused on IPR protection. The same principle is applied to entrepreneurship education and training. For example in MIT 2/3 of the training and education is provided by external business people, only 1/3 by faculty.

This past year has seen a resurgence of start-up activity and the emergence of entrepreneurial and networking events like Mobile Mondays, Xconomy (<http://www.xconomy.com/>), Stay In Massachusetts, and TechStars ([www.techstars.com](http://www.techstars.com)) to name a few. Importantly, the return of angel investors and the emergence of new investment and mentoring models such as Founders Collective, Launch Capital, Start@Spark, and CRV QuickStart is also visible.

Universities cooperate actively business angels and early-stage VC's to provide access to markets, necessary competence and access to funding. In general, universities do not operate separate funds or other funding vehicles in MA as they do in some other parts of US.

## 4.3 Singapore

### 4.3.1 Role of the Government

The government of Singapore has active role in boosting the ecosystem of the high-growth companies. The main vehicles are Spring Singapore (<http://www.spring.gov.sg/pages/homepage.aspx>) and programs managed by National Research Foundation (<http://www.nrf.gov.sg/nrf/default.aspx>).

#### 4.3.1.1 Spring Singapore

Spring Singapore is the tool for Ministry of Trade to provide funding for start-ups. 3 major Spring initiatives to boost the high-growth ecosystem are:

- Business Angel Funds (<http://www.spring.gov.sg/Entrepreneurship/FS/FS/Pages/business-angel-funds.aspx>)
- Spring Seeds for development of the start-ups (<http://www.spring.gov.sg/entrepreneurship/fs/fs/pages/spring-start-up-enterprise-development-scheme.aspx>)
- TECS for the commercialization of technology (<http://www.spring.gov.sg/EnterpriseIndustry/TECS/Pages/technology-enterprise-commercialisation-scheme.aspx>)

The TECS –program provides funding for POC (Proof-of-Concept) and POV (Proof-of-Value) -phases of the development. In POC the funding can be 100% provided by the government to a maximum of 250 Ks\$ whereas in POV the maximum is 85% and 500 Ks\$. In addition Spring runs several CDP's (Capacity Development Program) in order to boost the companies to increase their competence in their selected business areas.

Spring also runs a newly established \$30 million Incubator Development Programme (IDP). It provides Incubators and Venture Accelerators a grant to enhance capability development programs for innovative startups. IDP provides up to 70% grant support to incubators and venture accelerators in areas such as:

- Programmes To Nurture Start-ups. Costs of introducing programmes that help start-ups develop new products/services, obtain business financing, improve market access, etc
- Mentoring Start-Ups. Hiring mentors to provide management guidance to start-ups
- Operating Expenses. Costs incurred to market services/events, hire incubator managers, train staff, provide shared services/equipment for start-ups, etc

The IDP program is very similar to the incubation program run in Israel by OCS. It has already helped to launch 9 new incubators such as iAxil (<http://www.iaxil.net/>), ODM (<http://www.odmsg.com/>), Nanofrontier (<http://www.nanofrontier.com.sg/>), Innovative Singapore (<http://innovativesingapore.com/about/>), Bansea (<http://www.bansea.org/>) and Mercatus Capital (<http://www.mercatus-capital.com/index.html>) to name a few.

#### 4.3.1.2 NRF

National Research Foundation is another major source of funding in the Singapore ecosystem – it can be regarded as Tekes equivalent player to some extent. NRF boosts the commercialization of research-based idea through several initiatives:

- CREATE. NRF is working with selected elite international research universities to establish a number of world-class research centres in Singapore that will have intensive research collaboration with Singapore-based universities and research institutions. This complex of research centres from world-class research universities and corporate labs, together with the talent they train and their technology transfer activities, form the Campus for Research

Excellence And Technological Enterprise (CREATE). The research centres in CREATE host professors, research investigators, doctoral and postdoctoral researchers who form research groups to pursue research programmes in areas that are aligned both to Singapore's strategic interest and those of the respective institutions. CREATE also hosts technology transfer activities to push research results towards commercialisation. Corporate labs of multi-national corporations (MNCs) generate cutting-edge knowledge for products that do not yet exist. The presence of such corporate labs in Singapore adds to our knowledge creation capability and creates more research career opportunities in Singapore.

- SMART. The SMART Centre serves as an intellectual hub for interactions between MIT and global researchers in Singapore at exciting frontier areas of science and technology. The SMART Centre allows faculty, researchers and graduate students from MIT to collaborate with their counterparts from universities, polytechnics, research institutes and industry in Singapore and Asia. The SMART Centre also started an Innovation Centre in 2009, whose mission is to assemble and manage activities that foster the growth of an innovative and entrepreneurial culture both within the SMART Centre and the wider business, entrepreneurial and research community in Singapore.
- CRP. The CRP Funding Scheme will support R&D programmes, each comprising multiple related projects under a unifying theme. Each CRP Funding Scheme award is for a maximum of S\$10 million per programme, over three to five years. There are expected to be two rounds of grant calls each year. While the CRP Funding Scheme is open to all areas of science and technology, preference will be given to areas that fall outside of the focus of existing NRF Strategic Research Programmes, such as the Biomedical Sciences Translational & Clinical Research (BMS), Environmental and Water Technologies (EWT), and Interactive and Digital Media (IDM).
- IDM. The IDM Jump-start And Mentor (i.JAM) initiative aims to grow a self-sustaining capacity for continuous grassroots innovation in the IDM (Interactive Digital Media) sector. Individuals and start-ups with breakthrough ideas that can be developed into innovative products and services will be matched with appropriate mentor support and funding, to bring about their realisation. The i.JAM initiative marshals support from industry players, business mentors and technology suppliers to provide bottom-up support to the transforming of innovative ideas into useful applications and breakthroughs.

#### 4.3.1.3 Others

#### 4.3.2 Universities

There are currently 3 universities in Singapore. National University of Singapore (NUS <http://www.nus.edu.sg/>), Singapore Management University (SMU <http://www.smu.edu.sg/index.asp>) and Nanyang Technology University (NTU <http://www.ntu.edu.sg/Pages/default.aspx>). A fourth university, Singapore University of Technology and Design (SUTD <http://www.sutd.edu.sg/>) will open at 2012.

##### 4.3.2.1 NUS

NUS is one of the leading universities in Asia with 30 000 students from 100 countries along with 2000 faculty and 5000 staff. NUS has 3 Research Centers of Excellence and 22 university-level research institutes and centers. It also shares a close affiliation with 16 national-level research institutes and centers. Research activities are strategic and robust, and NUS is well known for its research strengths in engineering, life sciences and biomedicine, social sciences and natural sciences. Integrating its core competencies of education and research with an entrepreneurial dimension, NUS strives to create a supportive and innovative environment to promote creative enterprise within its community.

NUS also runs their own entrepreneurial activities including TTO operations under the brand of NUS Enterprise. The core operations of NUS Enterprise are:

- Experiential Education. NUS Overseas Colleges (NOC) offers an experiential education programme that provides NUS students opportunities to immerse themselves in the strategic and operational activities of high-tech start-ups located in leading entrepreneurial

and academic hubs around the world. Their hands-on internship experiences contribute to the development of an entrepreneurial NUS community with a global mindset.

- Industry Engagement and Partnerships. The Industry Liaison Office (ILO) serves as a channel through which companies, research organisations and government agencies can access the knowledge, expertise and technologies residing in the University. ILO protects and manages NUS' intellectual property. It helps to translate new discoveries and innovations by NUS researchers into useful products and services by licensing these technologies for commercial applications.
- Entrepreneurship Support. NUS Entrepreneurship Centre (NEC) conducts a wide range of activities to promote interest in entrepreneurship within the NUS community, and nurtures entrepreneurial start-ups by NUS professors, students and alumni. These include monthly techno-venture forums, a business incubator programme, a number of seed funding schemes for early-stage start-ups, a CEO mentoring programme, and other support services such as networking with venture capitalists and angel investors.

R2M (<http://r2m.nus.edu.sg/cos/o.x?c=/wbn/pagetree&func=view&rid=5236>) is the Tech Transfer Office for NUS under NUS Enterprise. It acts as a sole interface to all external parties and manages all tech transfer operations. The core of the TT operations is POC / business case evaluation which acts as basis for e.g. decisions related to IPR. R2M works in close collaboration with all other NUS Enterprise resources.

NUS has an active role on the ecosystem also through Entrepreneurship Society <http://www.nes.org.sg/> among other things in <http://www.startup.org.sg/>

#### 4.3.2.2 SMU

Singapore Management University is relatively new university established in 2000. It is the first private university in Singapore funded by the government. It currently has about 7000 students in 6 schools. The Office of Research (OR) is the central unit tasked at the university level to establish, enhance and nurture the research culture at SMU. As a catalyst in the conduct and visibility of high quality research at SMU, OR manages the internally funded research grants of SMU faculty. OR also has the main responsibility of administering the Wharton-SMU Research Centre (WSRC) and coordinating Wharton faculty's research funded by WSRC.

As all universities in Singapore, SMU is heavily networked with foreign players, mainly Wharton and Carnegie-Mellon (CMU).

SMU also runs it's own incubational operations (SMU Business Innovations Generator). It provides the basic facilities to start-ups along with networking to industry competence. The main activities are:

- Promote and nurture entrepreneurial initiatives in SMU.
- Manage the Entrepreneurial Talent Development Fund (ETDF) and Micro Funding Scheme (iJAM) for investing in promising business proposals.
- Administer the incubation space in the Bras Basah campus.

BIG runs a network of experienced entrepreneurs and organizes business plan competitions.

#### 4.3.2.3 NTU

NTU is the leading technology university in Southeast Asia. IT currently has 30 000 students, 1100 faculty and 3700 staff. NTU has four colleges, comprising 12 schools. The College of Engineering, with six schools focused on technology innovation, enjoys wide renown and ranks fourth in the world in engineering publications. The College of Humanities, Arts, and Social Sciences has Singapore's first professional art school, the Humanities and Social Science School, and the Wee Kim Wee School of

Communication and Information. The school is named after the late Dr Wee Kim Wee, a former President of Singapore who was a journalist and diplomat.

NTU has multi-national programs and initiatives with institutions worldwide. Some examples of key partners include MIT, Stanford University, Cornell University, Caltech, University of Washington, Carnegie Mellon University; world-class universities in Asia such as Beijing University, Shanghai Jiaotong University, Waseda, IIT of India; and European universities like Cambridge University, Imperial College London, Eidgenössische Technische Hochschule Zürich, Karolinska Institutet and Technische Universität München.

NTU runs a business accelerator called NTU Ventures ([http://www.ntuv.com/about\\_us.html](http://www.ntuv.com/about_us.html)). The core of the operations is around facilities, mentorship, funding and industry partnership.

NTU has guidelines to the industry collaboration <http://www.ntu.edu.sg/itto/pages/research-collaboration.aspx>

#### 4.3.3 IPR –related issues

If a company sponsors research at Singapore Universities, the usual position is that it will retain ownership of all Intellectual Property (IP) that it develops or creates. The company will have a first right to obtain either a non-exclusive or exclusive fee-based license to use the resulting IP commercially. Such license will be negotiated on commercial terms. An exclusive license may not however be available if a key platform technology is involved.

For example NTU does consider joint ownership of the resulting IP if the company will be contributing its background IP to the project and will also be involved in creating or developing the IP together with NTU researchers. The company must also be contributing significantly to the total project costs. In this case, the company will have a non-exclusive royalty-free right to commercially exploit the resulting IP but will be required to account to NTU a percentage of any licensing revenue it receives should it license the resulting IP to third parties. The company will also have the first right to negotiate a royalty-bearing license to exclusively commercialize the resulting IP.

NTU does consider sole ownership of IP by the company but only on a case-by-case basis and if the following criteria is first met:

- The project is focused mainly on product development or improvements to the company's existing products or services.
- The project has unambiguous known objectives and the company lays down a defined way of performing the study.
- Only the company's background IP is involved. The project does not require the use of any existing NTU IP but only the expertise and know-how of NTU's researchers.

The company will also be required to bear the full cost of the project to be carried out at NTU. The company's ownership of resulting IP will however be limited to the company's stated field of application.

#### 4.3.4 Business Angels and VC's

Singapore is trying to boost investments from business angels with several initiatives. SPRING SEEDS Capital works closely with three pre-approved private business angel funds to co-invest and nurture growth-oriented, innovative start-ups. Similar to the Startup Enterprise Development Scheme ("SEEDS"), this is an equity-based co-financing option for Singapore-based early-stage companies. If the start-up is able to obtain investment interest and commitment from any of the three business angel funds, SPRING SEEDS Capital could potentially match the intended amount (dollar-for-dollar) of up to a maximum of

S\$1.5 million. Both SPRING SEEDS Capital and the business angel group will take equity stakes in the company in proportion to their investments.

Government also provides tax breaks for the angels. The Angel Investors Tax Deduction Scheme (<http://www.spring.gov.sg/Entrepreneurship/FSP/Pages/Angel-Investors-Tax-Deduction-Scheme.aspx>) is a tax incentive, which aims to stimulate business angel investments into Singapore-based start-ups and encourage more angel investors to add value to these start-ups. Under the scheme, an approved angel investor who commits a minimum of s\$100,000 of qualifying investment in a qualifying start-up within a given year shall enjoy a tax deduction at the end of a two-year holding period based on 50% of his investment costs, subject to a cap of s\$500,000 of investments in each Year of Assessment (YA). The tax deduction will be offset against total taxable income.

VC's play a smaller role in the Singapore eco-system. There are a limited number of VC's currently investing in the early stage. The government is planning a special program to attract foreign VC funds to Singapore along the lines of Yozma –program executed in Israel.

#### 4.3.5 Key Findings

Being an autocracy, the high-growth ecosystem in Singapore is heavily led and managed by the government. Government uses its funds to attract foreign talent to the market and is working actively to boost the ecosystem e.g. with tax arrangements. The Singapore system has adapted a lot of characteristics from Israel and US.

Universities cooperate actively with the existing business angels to provide access to markets, necessary competence and access to funding. Universities operate separate funds to provide part of the POV –phase funding for cases due to the lack of business angels. However, since these funds are managed by the universities, they cannot provide the companies with necessary competence.

The universities in Singapore are heavily networked with the leading universities globally, mainly to the US. They provide access to the major markets and exposure the growth entrepreneurship to their students and entrepreneurs. Active networking to the major players is essential.

**5 Conclusions and Recommendations**

**5.1 General and Rationale**

University-based TTO’s - mainly technology licensing and spinoffs – are generally over-hyped as a revenue generator. Especially so when analyzing the top tier, high budget universities. However, it does not mean that technology transfer, licensing, and spinoff activities are meaningless for universities and the surrounding economy. In the contrary, there is strong evidence proving that university-based ideas have generated huge amounts of value and wealth for both the economies and mankind. This is especially true if the value-generation is analyzed from the ecosystem perspective.

It is still important to ask two questions:

- During past couple of decades, how many of the most valuable, practically meaningful and commercially viable inventions (e.g. in Finland) have been discovered based on scientific research at the universities?
- Which is the horse and which is the carriage – world-class research vs. world-class IP commercialization services and how to build incentive schemes for generating commercially viable inventions at the universities?

Our evidence, both literature and interviews, suggests that the biggest impact has been created through corporate spinoffs and university students and alumni, rather than university-based scientific research. There is also quite clear evidence that the licensing model basically only makes sense in biotechnology, pharmaceutical and other sciences where development and go-to-market times are extremely long and require a lot of capital. Based on these aspects, universities should think carefully how much they emphasize and invest their resources in technology licensing and spinoff operations, and what can be the expected ROI.

When assessing the recommendations and the new model for the value-creation of the university-based ideas, it is vital to comprehensively understand the major value-drivers. The current ecosystem in Finland lacks several key components and therefore cannot be transformed just by using the existing resources.

**5.2 The Major Value Drivers**

The chart below illustrates the major value-drivers of a successful high-growth ecosystem and a comparison of benchmarked regions.

Value-Driver	Description	Key Issues	MA	ISR	FIN	SIN
<b>The role of high-growth ecosystem</b>	How important the high-growth ecosystem is to the society?	The role requires critical and thorough commitment by leading politicians to create the structures to enable growth	The major driver for wealth creation with huge number of people employed by the growth companies	Crucial to the survival of the country and the existence of the Israeli way of living	Not crucial since the current success mainly based on corporations	Major source for global competence since the local resources are very limited
<b>Management of the high-growth ecosystem</b>	How is the ecosystem managed? Who are the major players?	The strategic targets of the ecosystem should be clearly managed and the logic of the system should be transparent.	Ecosystem evolutionary – no public, central management Business Angels, VCs and universities as major players	Ecosystem is managed centrally by OCS # of public officials: 40+ persons Commercial actors (incubators, VC’s) are the major players in the system	Ecosystem partly managed centrally Very large number of actors with mostly limited competence # of public officials: almost 500 persons.	Ecosystem managed centrally – key players private actors Universities play a key role

					Public sector players as only resources	
<b>Role of the universities</b>	What is the role of the universities in the ecosystem?	Universities should be seen as the major talent pool. They should also be the hub for growth entrepreneurship education and activities	Central source for talent Major hub for development of new ideas	Central source for talent Major driver for development of new ideas	Major source for development resource. New ideas mainly developed in corporations	Central source for talent Major driver for development of new ideas Central role in creating global connections.
<b>System targets and measures</b>	What are the main targets of the system? How transparent are the key measures?	System should have concrete strategic targets along with clear measures shared by the major actors. Measures should be actively monitored.	Key measures monitored and developed in the MA Innovation Index Focus on return on investment	Key targets and measures assessed and followed-up by OCS Focus on employment and taxes	No shared key targets Management divided into several organizations with limited transparency Focus on cost generation and investment returns	Key drivers measured by the government. Focus on return on investment Lack of transparency in the system
<b>High quality research</b>	How is high-quality research defined? How are the major areas described?	An ARWU criterion describes the level of academic competence. Ground research vs. applied research Research should be guided more towards ground-breaking than incremental Commercial outcome should be measured internally and externally Strategic research areas should be world-class.	Major universities topping the ARWU rankings Extended focus on ground-breaking research Applied research seen as value-adding component in university strategy providing market knowledge and access	Improved ARWU rankings – still room for improvement Strong focus on ground-breaking research Major competence areas well-defined Applied research seen as value-adding component in university strategy providing market knowledge and access	Low ARWU rankings Mostly incremental research with low critical mass Lots of overlapping within the universities Applied research seen as a threat for academic freedom, not as value-adding function	Improved ARWU rankings – still room for improvement Major competence areas well-defined Universities have quite few overlapping competence areas Applied research seen as value-adding component in university strategy providing market knowledge
<b>Access to talent</b>	Where are the major resources coming from?	Universities should be able to attract best resources in their strategic competence areas. Active partnerships to major hubs should be established	Universities attract the best talent from all around the world Large number of experienced entrepreneurs available One of the global hubs	Growing number of experienced entrepreneurs available Access to global hubs	Very limited access to experienced talent Local business developers – limited access to global hubs	Active networking with the global hubs. Low but growing number of growth entrepreneurs Nearby business angels
<b>Access to major markets</b>	How is the networking with and expansion to the major markets organized?	A process to expose entrepreneurs and researchers to the major market areas should be implemented	Inside one of the global major markets Leading corporations as active players in the ecosystem	Access to major markets through active networking and joint development programs Leading	Limited (or no) access to major markets Lack of world leading corporations as active players in the	Access to major markets through active networking Growing number of world leading corporations

		The leading corporations should be attracted with tax benefits and other incentives to become a major part of the ecosystem.		corporations as active players in the ecosystem	ecosystem	as active players in the ecosystem
<b>Access to capital</b>	How is the local early-stage investment market developed? What is the level of access to major capital markets?	Hurdles for the vibrant early-stage investment market should be removed. Public resources should be used to attract global investors	One of the global hubs for VC investments Large number of active business angels	One of the global hubs for VC investments Growing number of active business angels	Virtually no VC activity Limited number of active business angels Limited access to major hubs for VC funding	Low VC activity Limited but a growing number of active business angels

Table 3. Major value drivers

There are several key issues to consider when implementing a new model for the value-creation for the university-based ideas in Finland:

- The starting point. Finland has one the best educational systems in the world, if not the best. It also invests heavily in the R&D and is regarded as one of the leading technology countries in the world. However, the Finnish universities fail to compete successfully in the global rankings and the number of successful growth companies is quite low.
- Local class vs. world class. Finnish universities need to decide which game they want to play in. If they want to be world-class, a complete revision of the modus operandi is needed. Operations must be resourced with world-class resources, not with local actors with limited experience. Key Finnish universities must aim for TOP 50 in the global and TOP 20 in the European ARWU ranking.
- Critical mass. There is a very large number of universities in Finland scattered around the country. It is very difficult to achieve the critical mass required for world-class operations. There is also a lot of overlapping focus in the research areas of different universities. Urgent consolidation and transparency is needed. Number of universities should be reduced.
- Entrepreneurship vs. growth entrepreneurship. Entrepreneurship education and research in Finnish universities is focused on basic (lifestyle) entrepreneurship aiming to increase the number of entrepreneurs. Finland does not really need more entrepreneurs, it needs more growth entrepreneurs. This is both an opportunity and a challenge for universities since they represent the largest single competence pool for growth entrepreneurs but cannot currently extract value out of it. However, it must finally be acknowledged that growth entrepreneurship is a specific competence area and has little to do with lifestyle entrepreneurship.
- Research-based ideas vs. alumni ideas. Universities need to adopt the more comprehensive ecosystem approach for value-creation. It is not enough to focus on the research-based ideas. TTO activities must be expanded to include education, research and business development for growth entrepreneurship. TTO resources must be geared more towards business developers, not civil servant project managers.
- High-quality research as a driver for change. Finnish universities need to analyze thoroughly their key competence areas. High quality research activities must be focused around those areas and those areas only to create critical mass. Foreign high-quality researchers need to be attracted to provide leverage. The performance and output of current research activities needs to be improved towards world-class.
- IPR management (in-house vs. outhouse). University TTO's are currently focused on managing the university IPR. It is a feasible alternative to outsource IPR management to professional partners and focus internally on managing the tasks assessed by law and fostering the high-growth ecosystem within and around the university.

- New targets and metrics. The current metrics for value-creation are cost-driven. New metrics focused on value-generation must be implemented. Key metrics should be related to the number of collisions, the ability to raise VC funding and company growth.
- Talent attraction. Finland needs to attract foreign talent with extensive growth entrepreneurship experience. It is not enough to attract people from the local corporations with limited or no growth entrepreneurship experience.
- Proof-Of-Concept funding. POC funding is a major driver in successful business cases and the base for high-quality deal flow. The current POC funding (TULI) is divided into very small pieces of funding to a very large number of cases, with a low success rate. The role of TTO's should be to initiate the process and to partner with external professionals – not to be involved in the decision-making process or the business development.

For a small country with lack of world-class players (like Finland), a centrally managed system is the only feasible solution whereas for leading regions in US (like MA) an evolutionary system with loose central control is the best option. Israel, Singapore and some other smaller countries and regions have shown that a system carefully planned and managed by public leadership targeted to attract world-class players can yield great results. Currently, the system in Finland is not centrally managed. In fact, it is not managed by anyone.

### 5.3 Recommendations

#### 5.3.1 Rationale Behind the Recommendations

The recommendations are based on the findings from the benchmarking and the analysis on the extensive materials available. The major trends found are:

- Holistic approach for the universities on the value-creation including the new role of TTO's
- Business case development as the foundation for value-creation
- Importance of market access to major markets – already in the early stage
- VC business model is still strong although revised (less with more)

Major universities globally are implementing a holistic approach to value-creation. They are moving from the internal approach towards the ecosystem approach including the entrepreneurship activities. The role of TTO is evolving from bureaucratic IPR management into business networking and managing the external connections.

A solid business case is the foundation for value-creation. University-based cases should not be driven based on IPR protected or the investments committed into research.

It is crucial for universities to build a presence in the major hubs globally. This applies for both research and business activities. Even traditional licensing activities are difficult to execute without strong foothold in the marketplace. From value-creation perspective only the major global hubs are feasible. Start-ups cannot be developed far away from markets – they need to be exposed to main markets from the day one.

It is still obvious that most of the research-based inventions will be VC-driven, also in the future. However, the VC industry is changing to provide more with less. In practice, the amount of money available will be lower, but the requirements for successful business will be the same. This again requires active networking to the major VC hubs in order to provide the necessary funding for university-based startups.

Finnish universities should aim for a small stake in the companies established based on university research and IPR. This is to:

- Create upside

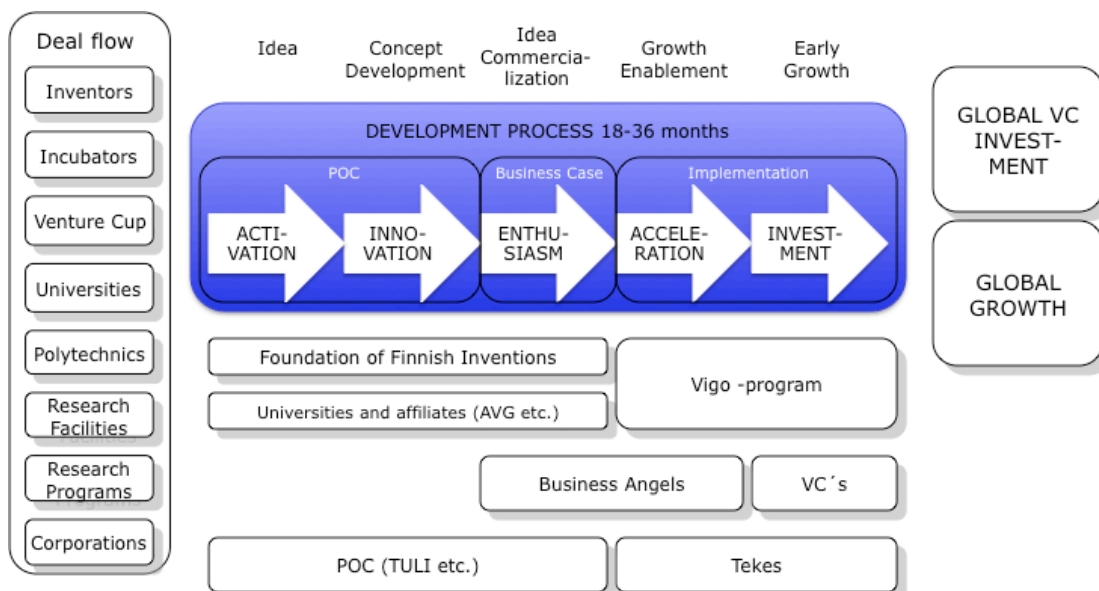
- Provide access to markets
- Increase the cooperation with the industry

It is more vital to provide upside opportunities for the university researchers since that will boost high-quality research. The basic approach should be on 50/50 basis between university and research group. The actual valuation and cap table is decided case-by-case. It is also not feasible for universities to manage any investment funds since it is not their core competence and the incentive structures do not support such activities.

### 5.3.2 Recommendations In Detail

The whole approach towards the value-creation process of ideas originating from research organizations must be streamlined. Finland needs a system-level approach to extract value from universities. The role of different organizations must be clarified and the overlapping operations cleared, services and financing must be developed from process perspective. The business development services offered must be world-class with shared incentive for growth.

The model described below describes the essential activities as development process.



The logical steps required to implement the new model and transform the approach in Finland include:

1. Apply the holistic approach. Universities must acknowledge their role as the major hub in the ecosystem and the importance of alumni-based ideas.
2. Transform the TTO operations. Universities must re-focus their TTO-operations to provide value to the ecosystem.
3. Establish partnerships with external commercial players. Universities must build on their core competence and outsource the business development activities to commercial players with world-class competence.
4. Build the competence. Universities should introduce new training programs and high-quality research focused on growth entrepreneurship together with selected international partners.
5. Implement the targets. Universities should implement new targets and corresponding measures for the value-creation activities.
6. Adapt the incentives. The incentives of people in the value-creation process should be streamlined to match the targets for the operations.

7. Execute vigorously. Operations should be executed with high commitment on results.

There are 3 strategic key areas in the system:

- Business Development Services
- Business Competence Development
- Access to Funding to support the development

They are described in detail below.

### 5.3.2.1 Business Development Services

#### 5.3.2.1.1 POC and Business Case Phases

Business development services should be organized around universities and research organizations with the expertise provided by external experts. There are 3 major sources of the deal flow:

1. Ideas based on university IPR
2. Ideas developed by university alumni
3. Ideas developed by non-university people

Proof-Of-Concept (POC) and Business Case Development (PROOF-OF-VALUE POV) should be the key offering in the first phase. Experienced entrepreneurs are the key resource in analyzing and developing the cases. This development should be organized close to universities - but not managed or operated by the university - as a boot camp or similar concept described in more detail in the next section.

TULI funding should be transformed to provide the Proof-Of-Concept funding for all ideas originating from the university (both university IPR and alumni). It is vital to provide adequate funding already in the POC phase. 50 K€ is generally regarded as adequate for the first phase, 100-150 K€ for the Business Case (POV) phase. The number of cases accepted on the POC phase should be lower (max 100 funded annually with the average of 50K€) and the decision should be done by network of external experts.

The logic on the management of the university IPR should be revised. IPR decisions should be deferred to the business case evaluation performed by selected industrial, business and scientific experts managed by commercial players. IPR management should also be outsourced to selected commercial players since it is not the core competence for university to manage IPR. The IPR clauses in contract research should also be reconsidered. Currently corporate partners can quite freely utilize the university IPR due to the first right of refusal –approach commonly used. Universities should aim for keeping some IPR in-house with the help of Tekes on the funding provided to the projects.

Foundation for Finnish Inventions will take care of the non-research based inventions (3) along the same principles. The necessary resources for FFI operations should be secured.

All of the above means significant changes to the TTO operations of the university. University TTO's should manage the activities required by law in the value-creation process – mainly for ideas based on university IPR (1). The value-creation activities should be outsourced to commercial players to provide the required market understanding, access to markets and necessary competence. University should also boost the growth entrepreneurship aspirations of the alumni as part of their operations to increase the deal flow of alumni cases (2). TTO's should take an active role as gatekeepers for the external networks in the universities. They should be the sole interface to companies, partner universities and investors. TTO's should implement processes to import the market knowledge in the key research areas of the universities as an input to the research strategy.

The parties in charge of the outsourced management of the value-creation process should have a network of experienced entrepreneurs evaluating the solidity of the business cases and to develop them in to feasible businesses. These experts should possess 10+ years of growth entrepreneurship experience with solid track record on raising VC funding and preferably on executing exits. They should also be well connected internationally in order to provide access to main markets for companies.

To recap, the role of the university TTO should be:

- To manage the invention disclosures as required by law
- To manage all external commercial connections to the university including sponsored research
- To provide input to the university research strategy from the networks at the marketplace
- To develop and operate world-class growth entrepreneurship research and education

#### **5.3.2.1.2 Implementation Phase**

In the Implementation phase, Vigo accelerators should be the key service provider when preparing for growth. Vigo program should be further enhanced to provide more efficient leverage. Naturally, some of the cases have the potential and maturity for VC's to invest directly without the Vigo acceleration. Tekes and Avera should implement a fast track for funding Vigos and Vigo portfolio companies. Portfolio companies should receive a 500-800 K€ finance package by single decision and finance should be tied to jointly agreed milestones. Number of Vigos should also be increased to provide the critical mass and the leverage to all verticals. People with international experience and networks should be imported to the existing Vigos. This should be catalyzed with government funding.

#### **5.3.2.2 Business Competence Development**

Business competence development should be focused on high-growth venturing and venture finance, and it has three major elements:

- Leading edge research with global partners, in global markets
- Growth entrepreneurship education for students at the university
- Professionally managed 3-4 month bootcamp / development program for new business creation – targeted for students and researchers

##### **5.3.2.2.1 Leading Edge Research**

Establishing new high growth ventures and launching those for the global markets requires specific understanding, skills, knowledge, and tools. In Finland there is a major shortage of all these, and most of our business and entrepreneurship research are not relevant for building and understanding how to create and manage global high-growth companies. There is also overlap on the strategic research areas of different universities in Finland leading into scattered competencies and the lack of critical mass.

We have to generate new, focused, high-quality research on the competencies required. Research teams should be formed and data collected at global market places, with top tier experts. This cannot be done in Finland. The major markets are far from Finland, Finland does not have enough relevant examples (high-growth companies or venture financiers) to be studied, and Finland does not have enough required competencies in our researcher community. An example program is described in section 6.

##### **5.3.2.2.2 Growth Entrepreneurship Education**

High-growth entrepreneurship and venture finance education are both extremely underdeveloped at Finnish universities. In our business schools, education is mostly geared towards corporate or lifestyle entrepreneurship, business development and management. High-growth entrepreneurship is almost non-existing contextually in our business schools. This is quite understandable because of our history. Finnish economy, especially export of goods and services, has been mostly driven by large corporations in mature industries. There has also been very few globally acknowledged high-growth ventures, and because of that there are no examples and experience how to build successful such companies. One important aspect is also that in Finnish universities there are only a small portion of business researchers and teachers focused on high-growth entrepreneurship and venture finance.

To change this, new growth entrepreneurship education program (masters degree or equivalent) should be established. The program should attract the most prominent high-growth researchers and students and they should be exposed with the major markets, top tier growth entrepreneurs, financiers, and business partners. In practice, they have to spend lot of time abroad, in the hot spots of growth entrepreneurship and venture finance. The goal is naturally to build their market understanding, assist them to learn how to play the global business games, and to build relevant and valuable networks. 2/3 of the education should be offered by the experienced entrepreneurs, not by the academia. There is strong evidence from e.g. MIT and Technion to support this approach.

#### 5.3.2.2.3 Development Program

Professionally managed 3-4 month bootcamp / development program for new business creation is the third required element. Program should be targeted for students and researchers with breakthrough technologies, business ideas, and/or aspiration to create new high-growth businesses. There are few very good examples of the programs connected with scientific community (i.e. UCSD Connect or LaunchPad by EnableVentures) providing the guidelines how to focus, organize, and what are essential resource requirements for successful programs.

Proof-Of-Concept and startup phases seem to be extremely challenging in current economic climate - all around the world - and because of that many countries have established new initiatives to overcome those challenges. But, the major obstacle seems to be recruiting relevant competencies (people) for managing initiatives. This came up clearly in the benchmarking interviews.

Running a successful high-growth entrepreneurship or venture finance program requires very specific skills, experiences, and competencies. Traditional corporate managers, small business lifestyle entrepreneurs, investment banker or scientist experience are not relevant for these purposes. Why? Because the very nature of building new high-growth ventures and financing those to global markets is just a different game.

New targets and measures should be implemented for these operations. The main target should be the ability for the companies to raise VC funding. Average of 2M€ per company is a feasible target along with additional targets for company growth and market access to main markets.

#### 5.3.2.3 New Funding Mechanisms

The market for commercial investors in Finland needs to be re-organized. The number of active business angels should be multiplied using tax incentives and organizing the network efficiently. Business angels actively investing into early-stage should be given a tax deduction along the lines of The Angel Investors Tax Deduction Scheme running in Singapore. The number of active business angels should be increased by 100% and the amount invested 75% in 3 years. The angel networks should be managed by commercial players, not by government.

VC market also needs special attention. Finnish government needs to implement Yozma-type program aiming to launch 4-5 new early-stage VC funds managed by professional business developers. Each of these funds should be around 40-50 M€ providing a new start for the local VC market. Government should leverage these funds with a 50% commitment to the funds including a call option for 6 years (5% annual interest rate). That could then again attract the international VC's to the Finnish market.

At the same time, the direct investments by the government should be terminated. They seriously distort the marketplace and there is no evidence to support the direct intervention. The model currently produces a large number of VC funded companies with no follow-on investment potential. That is not good for the dynamics of the market – it actually partly prevents the commercial players from raising new VC funds.

## 5.4 Summary of the recommendations

Finally, few key issues to bear in mind:

- Organizational and operational aspects. When building successful value-creation process for research-based ideas, there is a need for focused and independent organizations resourced with world-class talent. Building operations inside the university can create mismatch and internal friction because required metrics, earnings logic, operational culture, and incentive models for successful value creation services. Our universities should manage only part of the required operations described previously. Most should be built as independent organizations and operators (e.g. business development services).
- Competence is everything. This issue has been systematically underestimated or misunderstood in Finland. Our evidence (both interviews and literature) highlights that talent and competencies are vital elements for successful value-creation model. People involved in this process must possess extensive experience from growth entrepreneurship, new business finance, and/or international business. There are no shortcuts on this. We have significant shortage of such talent in Finland at all layers and all interest groups, not only at the universities. Because of the current business model, recruiting culture and incentive systems, universities cannot attract necessary talent for these operations.
- Business Model. New business models must be created and implemented; our universities have different earning logic than what is required. The current earning logic for universities is based on two paths of finance provided by the Finnish government: fees based on the quantity of graduated students, and governmental research grants and subsidies that are tightly tied with academic metrics. These are not connected to the business metrics and therefore the existing business model is not suitable for value creation -process. Relevant and logical organizational and operational structure should mostly be built outside the university, and incentives for these operators must be defined based on specific targets and success metrics.
- Focus and goals. The goals for the value creation -system must be set from the ecosystem perspective. Operations should not be focused on optimizing role of the universities or their direct incentives. On the contrary, operations should be designed ecosystem view and focus on the impact to the surrounding community. For independent operators roles and incentives should be designed based on specific value-creation goals (raised VC funding etc.), but roles and goals should be aligned. Role of the university should be a hub for knowledge and competence creation for the surrounding society, and it can create value by direct and indirect operations.

There are many areas needing a fix in Finland, but there is also an opportunity for Finns to excel. Establishing the new Aalto University is a huge opportunity and the first steps have been taken into the right direction. Brave, strong decisions are needed, but the upside is also significant. Founding, developing and executing the value-creation process for university-based ideas is a professional and competence based business, and incentive schemes should be built accordingly.

## **6 Appendix 1: Example programs with global leading edge partners**

A high-level example of programs required.

### **6.1 Launchpad for university based new business creation – for students and scientists**

A new business creation program (boot camp) to be organized 2-3 times annually, each lasting total of 4 months with a 2-3 week intensive period. Program is designed for entrepreneurs and businesses, which are targeting to global technology markets. Participants will be exposed to global technology markets for building their market understanding, positioning their business case, building competent strategies for go-to market, and finding the best clients and business partners.

Coaching is executed by most competent new business creation coaches from the U.S. and Israel. 30-35 companies, two persons from each, graduate annually from the program, and their final test is presenting their business case to globally acknowledged VCs, business managers and business development in the U.S. or Israel. Annual budget is 850-900 K€.

### **6.2 Research group for high growth venturing and venture finance**

Research team of 5-6 researchers should be formed for globally leading edge research on high growth venturing and venture finance. Positions and finance should be secured for 4-6 years at minimum. Part of the research group needs to be recruited from abroad because Finland is lacking researchers, who have the understanding and/or professional background related to these topics. Researchers must be focused on top-tier research conducted at the global hubs, with top tier partners (research universities, scientists, business people and financiers). We can not recruit from Finland or focus on Finnish companies, because we do not have enough required competencies in our researcher community, and we have not enough experienced business people who have relevant experience (high growth companies and venture financiers). Annual budget should be organized through dedicated research program (see the next one).

### **6.3 Research program for high growth venturing and venture finance**

Research group should be established with resources to make globally leading edge research on high growth venturing and venture finance, and their positions and finance should be secured at minimum for 4-6 years. Data will be collected from the most important hubs of high growth venturing and venture finance (i.e. Silicon Valley, Boston, Tel Aviv, Singapore, London, Shanghai), and research partners will be leading edge partner from scientific, business and finance communities. Annual research program budget should be 1,2-1,5 M€.

### **6.4 Global business exposure program for entrepreneurship students**

Annually university will invite 20-25 students for high-growth entrepreneurship master level program, which is totally new path for master level entrepreneurship students. Students will be selected through selection criteria based on three elements: 1) previous references: entrepreneurship experience and/or studies, 2) personal interview, and 3) case exercise / practical tests. Students will be selected by group of scientific and practical business and finance experts.

During two year masters studies students will be taken to the global hot spots (of high growth venturing and venture finance) for expanding their understanding of the markets, business challenges and the way of building highly successful high tech companies to the global markets. Each semester, twice a year, they will go for 1½-2 week visits to these hot spots (i.e. Tel Aviv, Boston, Silicon Valley, Singapore, Shanghai) to visit top tier business and finance experts, and events. Annual budget for visits is 350-400 K€.

## 7 Appendix 2 Interviews and Reference Material

### 7.1 People Interviewed

Oren Zuckerman	IDC, Hertzliya, Israel	Head of Interactive Communications Program, Media Innovation Lab (miLAB)
Uzi de Haan	Technion University, Haifa, Israel	Professor, Entrepreneurship & Strategic Management
Miriam Erez	Technion University, Haifa, Israel	Professor of Organizational Psychology
Yifat Oron	Technion Seed Incubator, Haifa, Israel	BOD Member Partner, Vertex VC
Moshe Katzelson	Technion Seed Incubator, Haifa, Israel	CEO
Yaacov Michlin	Yissum, Jerusalem, Israel	CEO
Michal Kainan-Koren	Yissum, Jerusalem, Israel	VP Marketing
Oren Gershstein	Van Leer Technology Ventures, Jerusalem, Israel	CEO
Tsahy Shascha	Docor	Portfolio Managing Director
Adi Goldin	Docor	Director of Business Development
Barak Ben-Avinoam	Iris Ventures, Beer-Sheva, Israel	CEO
Itay Beck	Office of the Chief Scientist, Tel Aviv, Israel	Deputy Director, Incubator Program
Israel Shamay	Tel Aviv, Israel	Director, International Projects, MATIMOP, Israel
Azi Hemar	Tel Aviv, Israel	Ex-Director International Projects, OCS
Miri Yemini	Sami Shamon College of Engineering, Beer-Sheva, Israel	Head of entrepreneurship and innovation center
Yossi Shavit	University of Ben Gurion, Beer-Sheva, Israel	Head of Entrepreneurship program
Ora Horowitz	University of Ben Gurion, Beer-Sheva, Israel	Head of TTO, Ben Gurion University
Kim Blair	Cooper Perkins, Boston, USA	VP Business Development Founder of MIT Center for Sports Innovation
Karen Copenhaver	Choate, Hall & Stewart LLP, Boston, USA	Partner
Leon Sandler	MIT Deshpande Center, Cambridge, USA	CEO
Jeffrey Sohl	University of New Hampshire	Venture Partner, Austin Ventures Ex-CEO Nokia Inc.
Vinit Nijhawan	Office of Technology Development, Boston University, Boston, USA	CEO
Isaac Kohlberg	Harvard University, Office of Technology Licensing, Cambridge, USA	CEO
Elaine Reiter	MIT Enterprise Forum, Cambridge, USA	VP Bus Dev
Trish Fleming	MIT Enterprise Forum, Cambridge, USA	CEO
Bill Aulet	MIT Entrepreneurship Center, Cambridge, USA	CEO
Vincent Chun	Allied Minds, Boston, USA	Partner
Josh Lerner	Harvard Business School	Professor
Larry Bohn	General Catalyst Partners, Cambridge, USA	Partner

Abigail Barrow	Massachusetts Technology Transfer Center, Boston, USA	Founding Partner
Vivek Chandrasekaran	SMU Incubation, Singapore	Incubation Manager
Shirley Lim	NUS Enterprise, Singapore	Entrepreneurship Center, Manager
Ma Mun Thoh	NUS Industry Liaison Office, Singapore	Manager
Hock Chye Lim	Finpro Singapore	Head of operations

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