

Innovation ecosystem model for commercialization of research results

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Abstract. *Innovation means Creativity and Added value recognise by the market. The first step in creating a sustainable commercialization of research results, Technological Transfer – TT mechanism, on one hand is to define the “technology” which will be transferred and on other hand to define the context in which the TT mechanism work, the ecosystem. The focus must be set on technology as an entity, not as a science or a study of the practical industrial arts and certainly not any specific applied science. The transfer object, the technology, must rely on a subjectively determined but specifiable set of processes and products. Focusing on the product is not sufficient to the transfer and diffusion of technology. It is not merely the product that is transferred but also knowledge of its use and application. The innovation ecosystem model brings together new companies, experienced business leaders, researchers, government officials, established technology companies, and investors. This environment provides those new companies with a wealth of technical expertise, business experience, and access to capital that supports innovation in the early stages of growth.*

Keywords: Innovation, Innovation Ecosystem model, Technology Transfer Centres, Technology Transfer Value Chain, Technology Readiness Level (TRL).

Introduction

When we talk about innovation, we often focus on individuals. In business, we identify good innovators and nurture their ability to generate creative practical solutions to new problems. If your organization relies heavily on individual innovation or institutional innovation, consider creating your own innovation reef, where creative problem-solving experts develop a network of individuals skilled in bringing new ideas to market. See Figure 1.

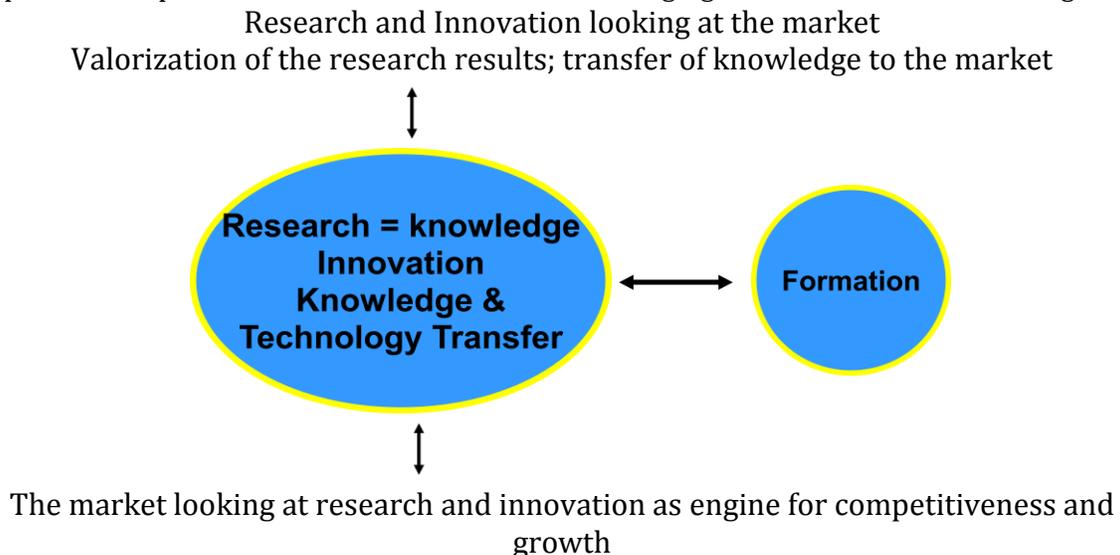


Figure 1. Relationship research-business environment.

Source: Authors' own research results.

There are essential elements to creating this in your company:

Get the right people involved. The innovation network has to include upper-level management that can fund projects, leaders who have had success with past innovations, technical experts, and external consultants.

Cultivate the network. This extended group should have opportunities to mix together in productive ways. Hold regular meetings, events, and talks where innovators from across an organization can get together and share their experience. Lead innovators need to meet regularly with a variety of groups within a company that are working on innovative projects to help connect together groups that are undergoing similar problems (Fukga et al., 2016).

Educate others. In order for best innovation practices to diffuse through an organization, it is important to develop those ideas before projects begin. The innovation network should implement a company-wide education program on how to develop good ideas and how to transform good ideas into actionable plans to bring those ideas to market. These lessons should be delivered both to the future leaders within the company (which many companies do well) as well as broadly to the rank-and-file who will ultimately play a significant role in innovation success (which fewer companies do well) (Markman, 2012).

Measure the results (with clear indicators). Innovation is a process that is best managed with a long term perspective, not necessarily measured in long time increments (e.g., months, years) but rather in completion of targeted goals. This requires separating the innovation process into three implementable stages: 1) identification of goals and exploration activities, 2) short term deliverables and 3) near term development (<http://www.innovationmanagement.se/imtool-articles/how-do-you-measure-innovation-results-and-outcomes/>).

The necessary steps to establish the financing instruments afferent to the innovation and technological transfer entities:

- Defining the assessment indicators for the ITT entities accredited in accordance with the stated regulation, from the point of view regarding to innovation, technological transfer and trading/commercialising the financing research results from public funds.
- The activity analysis of the ITT entities accredited under the defined indicators.
- Identifying the type of ITT entities missing (e.g. HUBs/co-working spaces, business accelerators, technological development centres, techno-pools/cities of science, etc.)
- Coherent mapping of development regions with RIS /SMART specialization strategy nationally / regional, underlining the existent entities and the need for new ones.
- Defining the functioning indicators under which the activity of these entities will be monitored (supervised).
- Proper amendment of the current regulation.
- Development and implementation of training (induction) programs for the staff within the selected ITT entities in order to provide specific ITT services.

- Development and implementation of a coherent funnel type financing program for the ITT entities based upon marked achieved results from public funds financed research results traded point of view.
- Implementing the open innovation concept and specific instruments afferent to efficient and effective functioning of open innovation arena type platforms.
- The study underlined special programs (financed by INFRATECH program - 2004-2008) dedicated to these ITT entities have allowed their staff to enter in contact with similar existent organisations at European level. The financing stopping from the INFRATECH program interrupted these links in the case of some ITT entities.

The necessary steps in the innovation development:

- Creating a functional and efficient innovation ecosystem.
- Developing a continuous entrepreneurship training system
- Functional links between the ministries on one part and between the central and regional level on the other part (in coherence with The National Strategy RDI 2014-2090, RIS3 and Smart Specialization Strategy).
- Creating some effective and efficient partnerships, including the public-private ones between actors competing to innovation at central and regional level (Ministries, Regional Development Agencies, City Halls, County Councils, ITT Entities, Technological and Scientific Parks, Universities, Research Centres, Patron and Professional Associations, Competitiveness Clusters/Pools).
- Developing a real business environment partnership – Research-Development-Innovation which should identify the opportunities and necessities (Morgan, 2015).
- Concrete action plans for Smart Specialization Strategies implementation at the level of all the development regions of Romania.
- Specific financing instruments for commercializing the public funds financed R&D results.
- Market indicators regarding the efficiency of innovation and technological transfer which should be found in the functioning indicators of the entities.
- The innovation should address firstly to the development necessities of the innovating SMEs with the activity based on a large added value contributing to economic growth, export development and establishment of new jobs.
- Stimulation of innovative and creative enterprise development, start-ups, spin-offs and competitiveness clusters/pools in order to support those becoming robust, mature, generators of jobs, resistant to economic risks and sustainable.
- Supporting the technological and knowledge transfer towards the innovative firms.
- Stimulating the testing of invention patents (better before patenting).
- The research and innovation should be addressed to the real needs of the market; the markets to be oriented towards R&D, as means to increase competitiveness.
- The research should offer solutions to market needs, to develop knowledge, innovation should be applied and transfer the results for economic units use.
- Motivating people to innovate; Promoting the entrepreneurial spirit and innovation in small and middle sized companies/firms, especially in new ones.

- Regional development policies through innovation, RIS and 3S.
- Reinserting vouchers for innovation as development instruments.

Value chain of value-added services

In order to increase the efficiency of the TTC's, meaning every TTC to efficiently use its specific key resources (physical, intellectual, human and financial), the Business Models of the corresponding TTC must be centered on one of the three stages of the value chain of value-added services depending of their own resources (Ryzhonkov, 2013).

Technology readiness levels (TRL) are a method of estimating technology maturity of Critical Technology Elements of a program during the acquisition process. They are determined during a Technology Readiness Assessment that examines program concepts, technology requirements, and demonstrated technology capabilities.

The use of TRLs enables consistent, uniform discussions of technical maturity across different types of technology (see Figure 2).

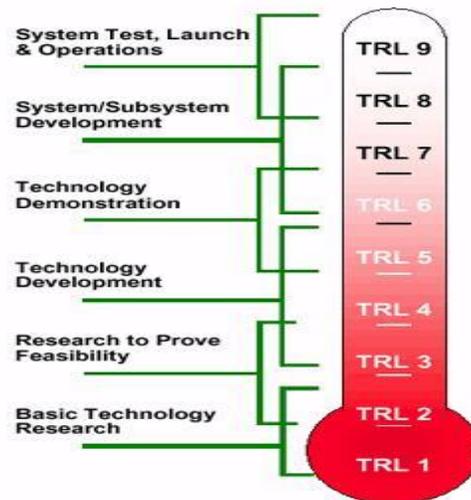


Figure 2. The stages of the value chain of value-added services, respectively the knowledge and TT value chain in comparison with the Technology Readiness Levels (TRL)

Transferring the results to the market

- Indicators regarding the efficiency of technological transfer and innovation
- Accredited (certified) and trained staff (Technological Transfer and Innovation, technologies brokers, intellectual property)
- Entrepreneurial training program
- Promoting, training a culture of innovation, of mass.

Policies for competitiveness growth through R&D&I and technological transfer

The necessary mechanisms for a minimum innovative system functioning are presented in figure 3 (eco-innovative system). With black – what is very well integrated; with purple – what we need to increase. A transfer centre of research

results towards the market may function only in an ecosystem with all the links being functional.

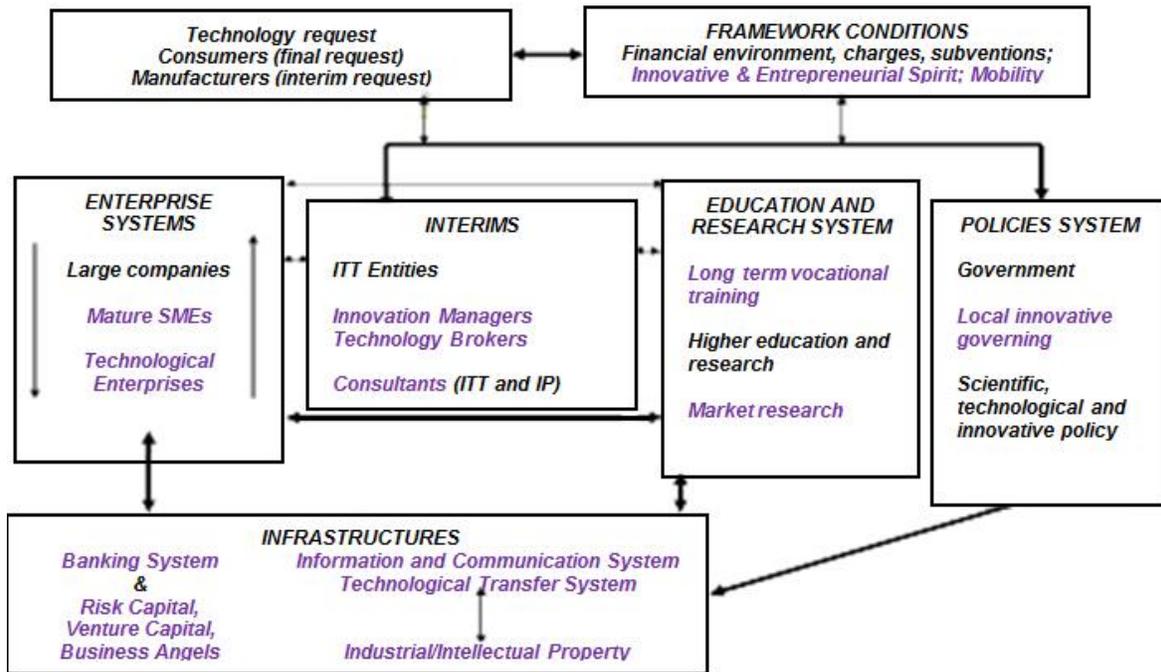


Figure3. The necessary mechanisms for a minimum innovative functioning ecosystem

Ecosystem model for the transfer of research results towards the economic environment

No interpretation of the concept regarding to *technologic transfer, spin-off entity or entrepreneurial university* may be used against the idea that the university is an "Alma Mater" for its students, researchers and professors functioning on academic freedom principles in what regards to knowledge exploitation and access to idea distribution towards the students and the business environment (Hamburg et al., 2016).

The main challenges approached, are linked to insufficient concentration of R&D&I in the excellencies pools capable to compete globally, those of weak element integration within the R&D&I triangle, insufficient trans and inter disciplinary research focused on the innovation needs, lack of some governing and managing models for the European level education and research, by high costs of EU patenting and low mobility of researchers.

One of the pursued objectives consists in the encouragement of partnerships for addressing the local business communities.

Partner/Supplier Innovation

Many organizations around the world today don't stand alone as independent entities. Pretty much any organization you can think have today is somehow aligned with or supplied to another organization. Suppliers and partners will be able to provide better products and services that customers are asking for and the organizations will be able

to dramatically improve forecasting while dramatically reducing wasted resources and time spent.

I personally believe that without innovative culture institutions, based on a functional and efficient eco-system, with infrastructure and funds, the business incubators, clusters, science parks, technology centres, companies simply will not work.

Understanding the Innovation Economy

The innovation economy is the economy that transforms knowledge into products, processes and services that fuel competitiveness and economic growth, create employment and wealth, and generate significant improvements in the region's standard of living.

It describes the large and diverse array of participants and resources that contribute to and are necessary for ongoing innovation in a modern economy. This included entrepreneurs, investors, researchers, university faculty, venture capitalists as well as business development and other technical service providers such as accountants, designers, contract manufacturers and providers of skills training and professional development. Sustaining an innovation economy means evolving, adapting, re-imagining and reinventing to create and utilize new ideas and information into both existing and new products and services.

Innovation Ecosystem model - Principles and considerations

The model has at its basis the following principles and considerations:

- The establishment/generating of start-ups and spin-offs based upon some developed technologies within Universities and RDI Institutions/Organisations, continuous training, business development methods. See Figure 4.
- Banking" department organised as a foundation, to finance the activity by venture capital and business angels.
- A "finance magnet, project generator" department
- All departments need to collaborate with a unitary strategy under a tightly linked University/R&D Entity management.
- The management also ensures the interfacing with the Universities, R&D Entities, Business Environment, Central and Local Administration.
- The departments (total or by fields) may function independently also as profit centres or in a collaboration form under a University/R&D Entity regulation.
- The ITT Entities correlation with the place and attribution defining:
 - Technological development
 - Technological and business incubator
 - Virtual Centre, expanding ITT communication and services towards companies/firms by internet techniques.
 - Technological and Business Park; Competitiveness Cluster; Technological transfer and innovation.

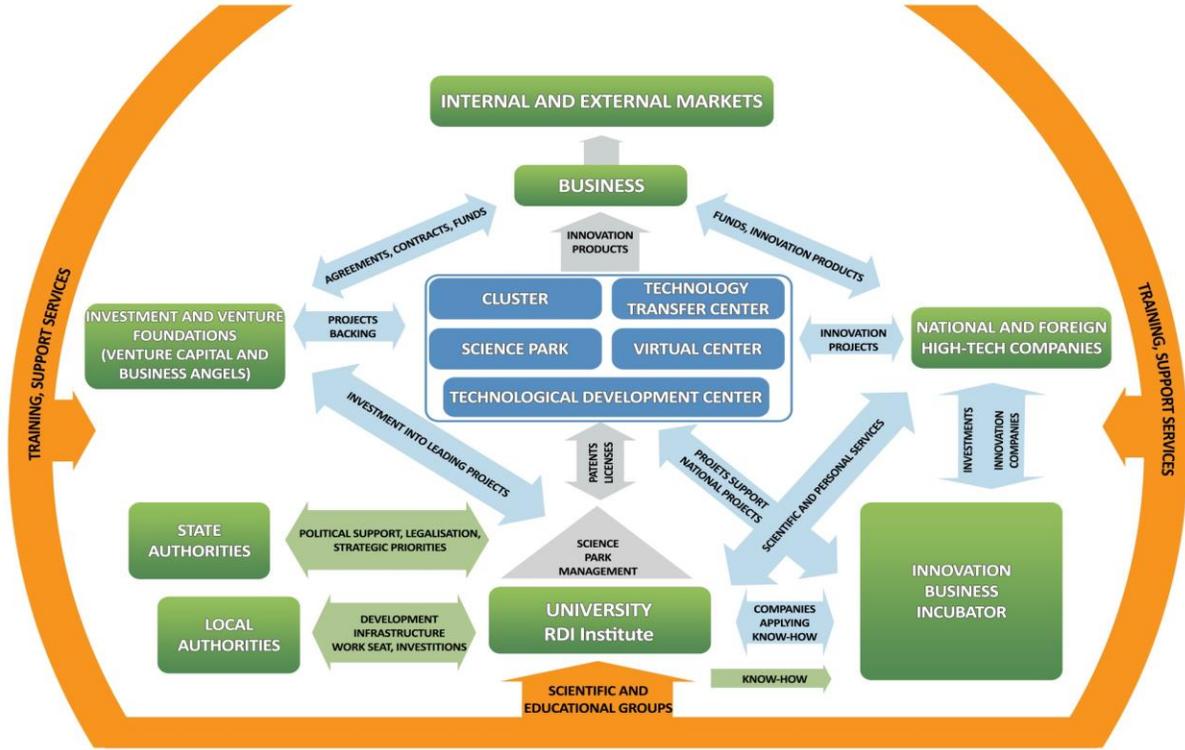


Figure 4. Ecosystem model for research results transfer towards the economic environment

The link, ITT Entity – Scientific Park – Competitiveness Cluster/Pool with Specialists, High-Tech Companies / with export capacities, Investors, is presented in the figure 5.

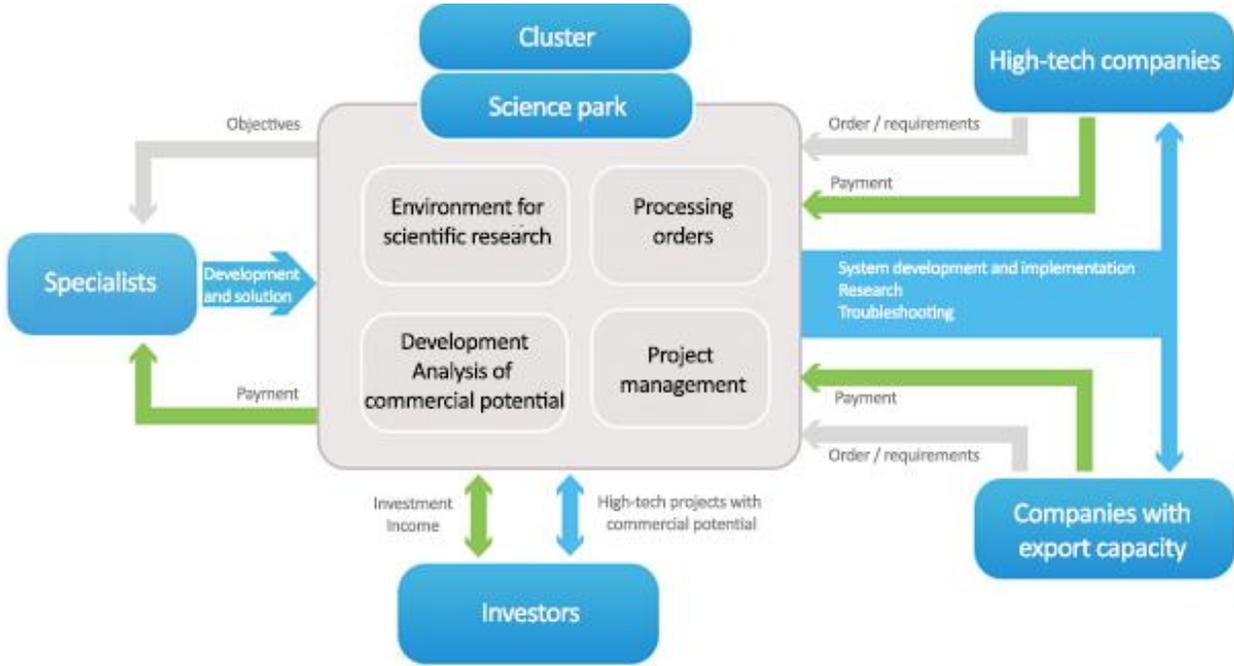


Figure 5. The link of ITT Entity – Scientific Park – Competitiveness Cluster / Pool with Specialists, High-Tech Companies / with export capacities, Investors

The flexibility of these ITT Entities from the perspective of offered services and permanent adaptation to market requests, including the staff training requirements, is essential for the efficiency of these ITT Entities and for the commercialization of market results.

The presented structures may also work complementary, separately but with a common strategy.

Technological development centre

Are specialized centres (as infrastructure and expertise in staff) for developing new technologies based upon research results (sometimes even from the fundamental research phase). Collaboration with the business environment is essential for the development and commercialization of new solutions.

Technological transfer centre

The technological transfer and commercialization centre plays a major role in the protection and commercialization (trading) of industrial property goods from the Universities and R&D&I Organisations / Institutions, awarding licenses for technology developers and innovative firms, as well as assisting in start-ups initiations, companies which commercialize or produce upon new technologies.

From economy perspectives, as a whole, there's a risk that a valuable industrial property to remain unused without specific market transfer mechanisms. The technological transfer offers a great potential for additional incomes.

Technological and business incubator / park

A technological and business incubator represents a company/department which helps new companies and start-ups to develop their business, helps in business by providing support services in technologies, information, management support, business internationalization, innovation and office spaces.

The technological and scientific parks are large scale projects which host already matured companies on the market having development services integrated in order to expand companies including the laboratories.

They make available delimited terrains/areas, with the necessary infrastructure (water-sewage, electrical energy, gas) and spaces for transportation and warehousing.

Innovative Cluster / Competitiveness Pool

The innovative cluster represents a group of legal personalities constituted upon an association agreement, concluded between organisations from the science and innovation field and/or higher education institutions, on one part, and economic agents, local public administration authorities, paternal or professional associations, on the other part, having the purpose of developing the scientific research activity regarding knowledge and technological transfer of scientific results, valuing them through economic activities.

Project and program department

Starting from the participating companies' structure, the development needs on both sides considering the regional / national / international calls, the department brings up the awareness in what regards the partners, achieves partnerships and attracts financings.

Scientific and educational groups

They have the role to know the real state on the market and in research, forming trends and methodologies, identify research themes which once outsourced may be applied on the market, research groups, identifying the research results and communicating them to the business groups.

It's essential to train all specialists working in all of these entities and infrastructures with the business environment included as well (both professional and entrepreneurial). The continuous training, practical activity and specialists selecting may be interest themes of the business environment.

Learning in SMEs

As environmental problems came more and more into focus, concepts as eco-innovative entrepreneurship, new business strategy that incorporates sustainability throughout all business operations based on life cycle thinking and in cooperation with partners across the value chain.

SMEs are restricted in the efficient use of technology for learning and in adequate management learning approaches. The managers should understand the importance of using other forms of learning like mobile ones, webinars, access to on-demand learning resources and social learning supported by social media.

Problem-based learning-PBL is an exciting alternative to traditional classroom learning. With PBL, the teacher presents you with a problem, not lectures or assignments or exercises. Since you are not handed "content", learning becomes active in the sense that you discover, work with content that you determine to be necessary to solve the problem. (Hamburg et al., 2016). The teacher acts as facilitator / mentor, rather than a source of "solutions"

R&D Entity /University

Have two collaboration paths with this structure by The Entity Management Department – offering research results and receiving research-innovation themes as necessity, respectively the scientific and educational groups – offering scientific and educational services and receiving scientific and educational themes as necessity.

The R&D Entity / University is the organism which manages the activity, measures the results on the market, creates methods and functioning regulations, and controls the activity.

National and International High-Tech Companies

Usually they have their own research-development and innovation groups.

At the same time, they need a powerful training component to know and offer research themes sometimes fundamental and of large perspective. These companies may be interested by research results, technological transfer and new themes

generators with potential market results. These companies may also be members in the competitiveness clusters / pools or may conclude partnership agreements with the R&D institutions / organisations or may activate independently and collaborate punctually in accordance with the necessities.

A partnership agreement foresees:

- The mutual participation to the achievement of innovative projects in the field of high-end technologies, new efficient ways to manufacture and implement competitive high-end technology products on internal and international markets.
- Development of mutual investment programs in the innovation sectors of the economy in order to magnetise direct foreign investments
- Promoting the efficient development of innovative structures in the technological and scientific park.

Innovation promoting activity – Innovative projects competition

The competition is organised in collaboration with the entities from the eco-innovating structure, innovative companies, business development and innovation funds and professional associations.

The purpose of the competition is to find the best suited technological activity for commercializing and developing the innovative activity, to create partnerships, to attract young people, students, the scientific and business community to participate at the technological transfer promoting cooperation between scientists, businessmen / businesswomen and government for the innovative development of economics and its integration in the European and global space with high-end technology.

The competition focuses on innovative businesses oriented projects which have a scientific and practical value and which can be introduced in production and used in the economic activity with the proper social or economic effect.

How do you Measure Innovation Results and Outcomes

If we define innovation as “people creating new value and capturing value in a new way,” there are basically some focal points to measure it:

- Past / current innovation performance
- The demonstrated ability to create and capture sustainable and profitable value from innovation
- Future/expected innovation potential
- Effective/efficient innovation capacity
- The activated capacity to realize the firm’s full growth and innovation potential

The Assessment report provides a comprehensive picture of your firm's innovation management performance and capacity. The report has a main section with key information on firm's innovation management performance and a section with valuable detailed information on the company. It presents performance scores and compares them with the scores of the Growth Champions and the average for your benchmarking class (Teodorescu and Vladut, 2016).

The evaluation assesses five dimensions: Innovation Strategy, Innovation Organisations and Culture, Innovation Life Cycle Processes, Enabling Factors and Innovation Results. The “spider” diagram shows your performance on each dimension.

Based on standard compliant assessment tools and the largest benchmarking database on innovation management, companies can compare their innovation management capabilities and performances against the average scores of thousands of direct or indirect competitors.

In the Figure 6. we present the steps for the entrepreneurial and skills formation of the start-ups/spin-offs.

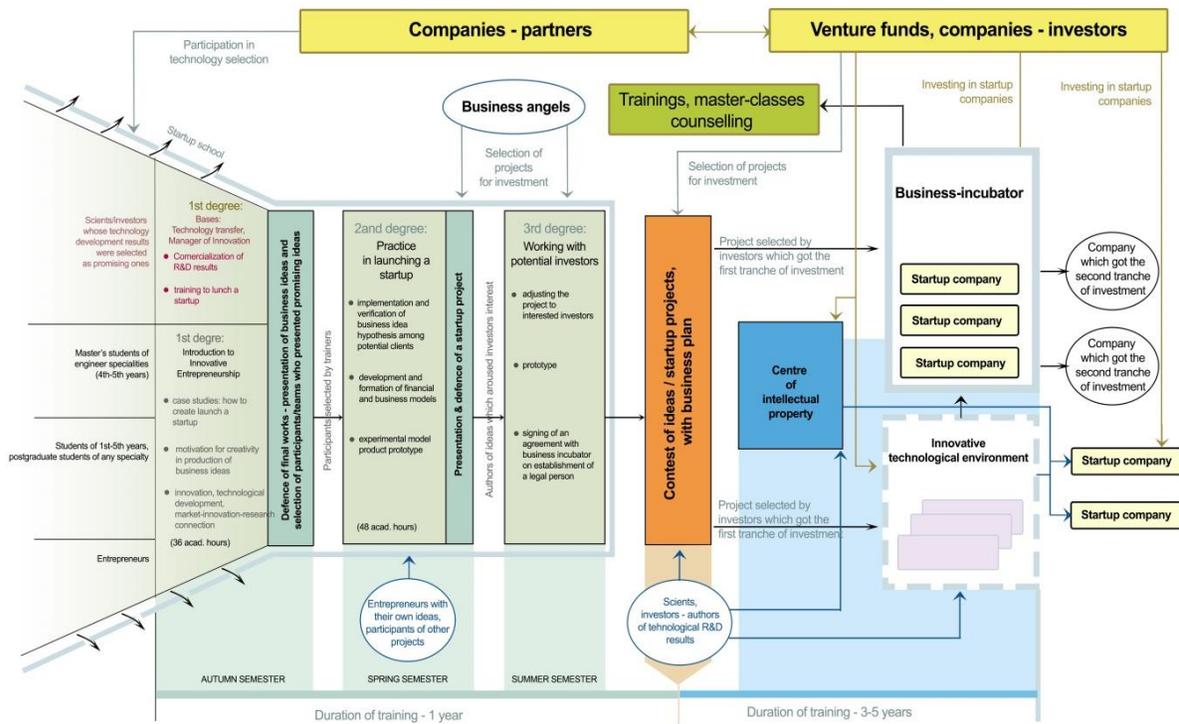


Figure6. Forming entrepreneurs; selection of projects to create start-ups/spin-offs

The advantages:

For high-end technology companies:

- Development of new technological solutions and creating new competitive products
- Reducing the innovative cycle and implementing the idea into the product
- Reducing the risk of creating and manufacturing non-competitive products
- Attracting competitive specialist to promote intensive scientific products

For investments and risk funds:

- Availability of implemented innovative projects ready to be promoted on the market
- Availability of innovative projects in an incomplete implementation phase
- Innovative development "bank"; Profitable developments fields

- High-end technology logic efficiency warranty and profitability of invested developments
- Reducing the invested funds, full payment period
- Implementation potential of the end result on large scale
- Interaction with the state at governmental level

For research-development entities and scientists:

- Financial and technological conditions to achieve and promote innovative ideas on the market
- Obtaining the copyrights – remuneration for the developed and patented use, popularity amongst business and scientific circles

For faculties and departments:

- High certification training and graduating specialists with practical and theoretical knowledge application.
- Developing a laboratory scientific basis with high-end equipment
- University and students' involvement in innovative businesses.

For government / Local Administration:

- Accelerating the innovative economic development
- Preventing the "brain exodus"; Increasing the nation's life quality
- Increasing the foreign investments and possibilities of exportation
- New high-end tech jobs
- Increase the standard living level
- Consolidating the staff component in the technical and scientific potential of the region
- Attracting regional investments; improving regional infrastructure.

Conclusion

The first step in creating a sustainable commercialization of research results, Technological Transfer – TT mechanism, on one hand is to define the "technology" which will be transferred and on other hand to define the context in which the TT mechanism work, the ecosystem.

The innovation ecosystem model brings together new companies, experienced business leaders, researchers, government officials, established technology companies, and investors. This environment provides those new companies with a wealth of technical expertise, business experience, and access to capital that supports innovation in the early stages of growth. It is necessary to develop an IT system to allow ecosystem to insert data and connect each to other. The monitoring and measurement of the performance of the ecosystem is mandatory.

It is necessary to consider education, entrepreneurial culture, and personal formation, on each stage of development of eco-innovation models. Meanwhile development models should work in innovative eco-systems, and functional complex that creates competitiveness and added value.

I want to remember a quote by Victor Hwang (author of Innovation Rainforest) who said that “*Economies thrive when culture overcomes social barriers and fosters connectivity, trust, and collaboration between diverse people...*” Think about that.

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