

Public Version

Guidelines for networking and clustering at territorial level

Improve of research capacities of the centre of Biotechnology of Sfax in
Bio-Processes for biotech applications, tying up with the European
research area

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Guidelines for networking and clustering at territorial level

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The innovative process and the acquisition of technologies in life sciences: guidelines for the technology transfer

0. Introduction

The project **BioProtech** aims at supporting the CBS to improve research capacities in bio-processes for biotechnology applications in food, health and environmental sectors. Through this European project the linkage to the European Research Area will be improved and enabled a bigger impact on the regional development through improved research and innovation activities in the domains of biotechnology.

In particular, the BioProtech project is organized into six work packages, five of which target the development and improvement of the CBS in bio-processes research and development, incubation, transfer and dissemination.

These goals will be achieved by implementing a set of coherent , such as exchange of know-how and experience, development of joint research ideas, collaboration with EU technology transfer and regional companies / incubators and training, organization of workshops and conferences related to research and management topics, preparation of strategy report and the project evaluation well as dissemination and promotional activities. The evaluation will be implemented by an independent Evaluation Board. The work package six deals with the project management and administration of BioProtech as a whole.

One of the main objectives addressed by Bioprotech deals with the improvement of research capacities of the Centre of Biotechnology of Sfax in Bio-processes for biotech applications, tying up with the European Research Area. The WP2 – Technology transfer and incubation – is included in this objective, with the following expected results:

- To assess the state of the art in exploitation of scientific results in life sciences.
- To build up the knowledge base for commercialisation of research results proposing a specific plan in CBS by the organisation of 3 two-day training sessions on valorisation of scientific results.

To contribute to the regional development and to improve the national economic situation through the creation of spin-offs and start-ups starting a pilot plan.

Promoting the activities of the existing start-ups and spin-offs.

The planned activities included in WP2 are structured in 3 Tasks:

- Task 2.1 Map technology transfer activities

Task 2.2 Training and awareness to commercialisation of research results

Task 2.3 Build up local customer and supporter/collaborator network,

And the expected deliverables, concerning 5 main topics, are:

- D2.1 Report of mapping of technological potential in technology transfer
- D2.2 Training session programme
- D2.3 Collection of Training session into a report
- D2.4 Technology transfer & commercialisation practical guide
- D2.5 Report on network and cluster implementation

Table 1 shows some data on WP2 in terms of expected efforts from the partners.

Table 1. WP2: expected efforts

At the date of the first BioProTech meeting, the project resulted to be 4 months late compared to the original schedule, this due to a somehow late start. Table 2 shows the project timeframe and highlights WP2 and its deadlines.

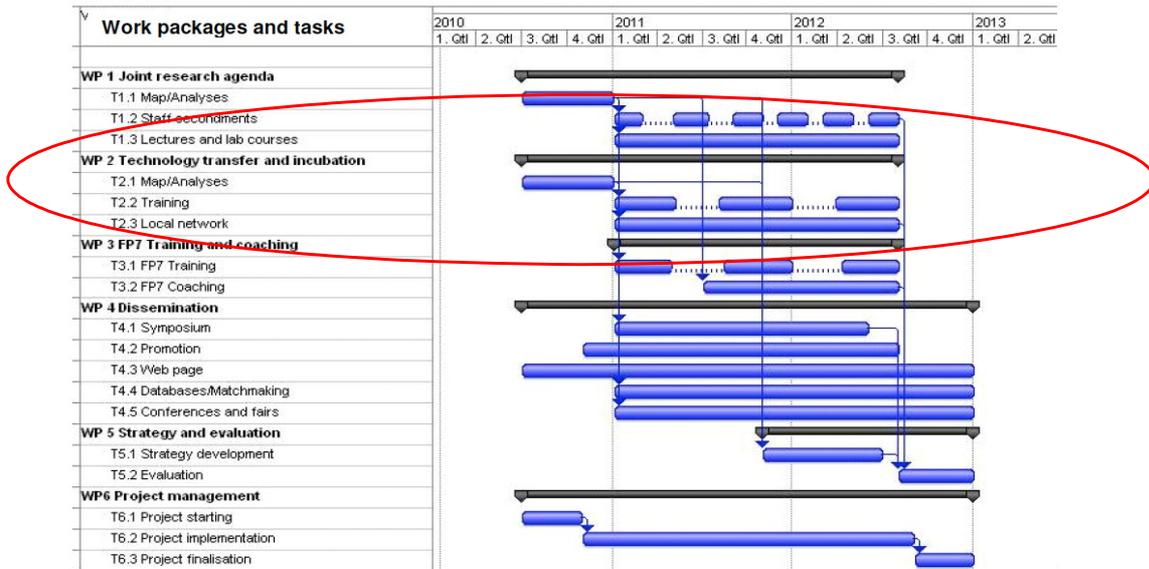


Table 2. the WP2 timeframe

An operational structure of WP2 is shown in Figure 1, where a detailed scheme of tasks and deliverables distribution is reported.

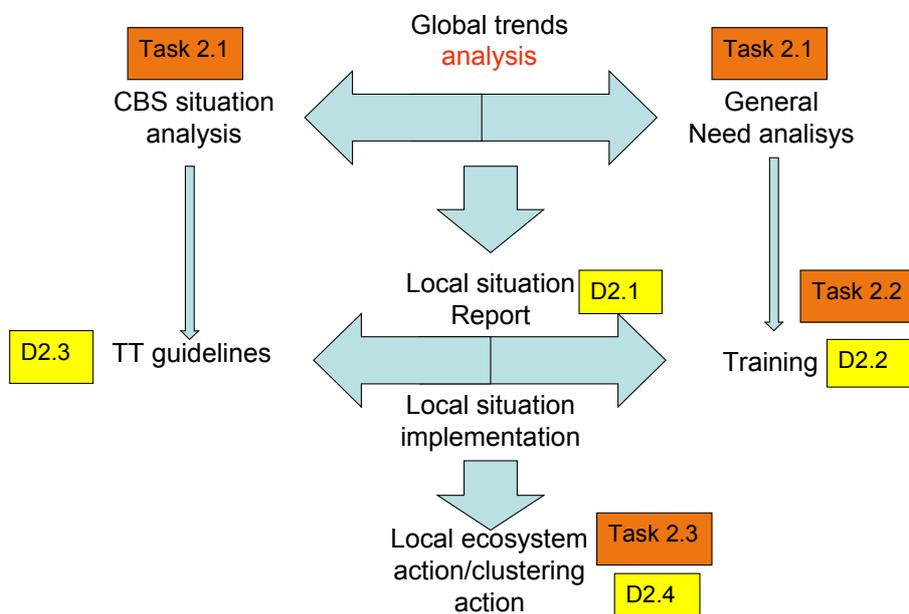


Figure 1. WP2 operational structure

1. Life science sector

The life science sector based its growth processes on the aggregation of the actors. The goal is to involve the most of actors as possible, like University, enterprises, foundations, public and private authorities, governments. The involvement of these actors must respect the specificity and the autonomy of each institutions but is based on an organic and systemic approach.

The growth of the network that is the basis of such system became for an institution that's is interested in realizing technology transfer activities a key interest. If the system will growth, the R&D institutions will have more possibilities to identify TT opportunities, more opportunities for their students and more options to develop cooperative R&D activities with companies. But to reach such result the system and the network that is its basis has to be:

1. Known
2. Defined
3. Accessible

In other words the R&D institution have to know the actors that are achieve in the field of interests, both private and public, it has to define wich segment of such system it is willing to target and it has to be in the condition to be able to access such segment. It is easy to understand that the knowledge and the support to the growth of such system became strategic not only for the R&D institution concerned but also for the territory where the R&D institution is located in.

A really important factor that It is necessary to take in consideration is that Life sciences are in reality a "smart sum" of different technologies that are enabling factors for different industrial sectors (e.g. health care, agro-food, energy, textile, etc) so the effort to identify, understand and access the local system could be complicated by the fact that immediately, particularly in case of TT interest, the concept of cross fertilization and multiple use of a single technology became important.

The knowledge of the local system and the launch of activities to create/reinforce/animate and access such system have to be based not only on a deep knowledge of local actors and industrial dynamics but also on the presence inside the R&D organizations of specific marketing and business development skills and of a real commitment. If such conditions are present and the a primary goal is to act in order to :

- 1) facilitate contacts with University in order to permit access to scientific services and to research results and to develop common R&D activities;
- 2) increase the attention to the protection of intellectual results;

- 3) develop monitoring system for innovations and thus analysis of technological feasibility or market of such innovations;
- 4) create a support mechanism for sharing knowledge and skills with the aim to reduce the costs for actors present in the system;
- 5) supply integrated infrastructure and services that allow the reduction of costs for actors present in the system;
- 6) ensure the possibility of access to funding for the research through the contacts with financing institutions (e.g. UE);
- 7) create a strong internationalization strategy with the aim to allow a strategic and competitive comparison; and a market positioning of the system;
- 8) design and animate a network and a cluster at the local level in order to reinforce the competitive positioning of the system.

2. Science and Technology Parks as hot spot and enabling factors of a cluster

Science and Technology Parks' role are like a hub between market and global knowledge economy. They are an useful tool to facilitate and to reduce costs of the journey between support needs and possible solutions. They allow a strong communication among scientific research and production of goods and services.

Within the Science and Technology Parks there are both services and incubation facilities for the development of new enterprises that are incubated with the Park.

The Parks develop activities in order stimulate innovation production and to identify technological and innovation needs in companies, particularly SMEs.

To achieve this goals the Parks coordinate the flow of knowledge e technologies between Universities, research centres, enterprises and markets. Science and Technology Parks promote the economic development and competitiveness of regions and cities by creating business opportunities, generating knowledge-bases jobs, creating synergy between universities and companies, assisting small enterprises.¹

In such perspectives science Parks, or organisations that are covering such role, are enabling factors for the growth of territorial and local networks focused on innovation and technology transfer.

The main activities of Science and Technology Park have the aim to supply advanced services, informations and technological supports.

The "ideal" Science and Technology Park should play these activities:

1. Produce knowledge: through the creation of laboratories for the Universities and research centres within of the Park or linked at the Park. The Park can be a

¹ Definition by "Associazione Parchi Scientifici Tecnologici Italiani", www.apsti.it

catalyst of research activities, and could be the initiator of research activities on behalf of enterprises. Either it can be promoter to heap deficiencies which it've identify through the interaction with other enterprises through e.g. the delivery of scientific services. Usually such last activities are realised in order to overcome the so called "market failures" in order to avoid to have bad influences on the growth of the local market.

Spread knowledge: facilitating contacts between R&D centers, Universities and industries, performing TT activities but also supporting a better relations between research, industry and society.

Create external technological economy: the Park has to activate relations between enterprises encouraging the spread of results also out of the "physical" boundaries of the Park. In such way it acts as enabling factor of the creation of a local network/community

Attract high-tech enterprises: trying to involve new innovative enterprises, to improve and create a technological development in the territory.

Support the growth of new innovative companies: the Park gets the incubation function for new enterprises. After the star-up step it's important the Park continue to supply the necessary support, advice and financial help, also when the enterprises are localized out of the incubator and of the Science Park.

Produce innovative commercial services: through this activities the Park try to identify a sustainability in their activities selling services both for internal and external actors.

Create relations: the Park has to develop relations with all the local stakeholders: the government, private and public authorities, associations and foundations.

To sum up, the Park's goal it's the development of a localized system to support the growth of its actors with particularly attention to SMEs. The specific objectives will be reported to the features of the sector, to the enterprises' interests that work inside of the Park or in the local territory. Finally to define these objectives it's important to considerate the possible markets.

3. From the science Park environment to the cluster network

The globalization process and the growth of innovative sectors represent a new challenge for regional development policies also from a single R&D center point of view. The scarcity of resources to invest in territorial development and worldwide crisis that now in a periodic way are affecting territorial development policies oblige regional authorities to re-think their strategies for growth. Such elements affects heavilly the approach that an R&D centers could have vis a vis TT activities.

More and more is not possible inside an R&D centers or an University to “spread” simply resources without any real focused approach. In case of TT if the R&D centers are willing to build synergies with the local environment they have to identify local strengths and to concentrate on such strengths the growth of their TT activities at local level.

The basic idea is that R&D centers have to build a “portfolio” of complementary different industrial sectors activities that could overcome crisis balancing the “risk” and at the same time could be interesting at global level and/or basic for the local development. The approach that seems to be more efficient in such perspective is the creation of a local system and network, a cluster that could represent the basic tool to support the growth of a particular industrial sector and of the actors inside such sector.

But there is not a direct identification between clusters and industrial sectors. Clusters are something more: they are defined as: “Geographic concentrations of interconnected companies, specialized suppliers, services providers, firms in related industries, training institutions and support organizations linked around technologies or end product within a local area or region”. They are not a quantitative dimension but more a qualitative approach where the real secret is not simply to have a certain number of companies and R&D centers in a particular region but to have such actors working as a dynamic system. This is particularly true for innovative clusters i.e. clusters that are focused on high-tech sectors. The innovative cluster reality, that start for the above mentioned Michael Porter view from one side reminds the industrial district and technological district definitions, on the other side it differentiates from this by its geographical valence. In innovative clusters the territorial dimension (“concentration”), that is the identification of “where”, partially loses its importance. The innovative cluster is a really “flexible” concept that depends from the perception of the players proximity with one another. This perception in reality varies depending on territories and cultures and it is really affected by modern way to communicate. At the same time the dynamism inside an innovative cluster is not simply the value chain that links buyer and supplier but is something of more complex where actors are covering at the same time both roles and factors such as the exchange of knowledge, the sharing of shared resources, the propensity to the risk, the perception of the market, the recognition to be part of a cluster, etc are strategic for the growth. Innovative clusters starts from strong links between local actors and they need an high company creation dynamic in order to assure a territorial growth. Attraction of foreign investment is only a part of the “game”. The real secret is the growth of a critical mass of locally rooted companies that could survive working at global stage.

The concept of “smart specialisation” i.e. the strategy that aims to concentrate resources on the most promising areas of comparative advantage, e.g. on clusters, existing sectors and cross-sectoral activities, eco-innovation, high value-added markets or specific research areas is also a key concept to take in consideration. It

permits to overcome the idea that innovative clusters have to be based on a single technology. It permits to focus more on the application fields that in the technologies that are used to fulfill needs.

Innovative clusters and as a consequence networks inside a cluster, have to start from some pre-requisite that constitutes the basic environment from where they can develop:

- A relative relevant scientific base is the on territory presence of universities, research centers followed by a “relative critical mass” of researchers
- A dynamic and innovative entrepreneurial culture with a growing entrepreneurial base with spin-off and start-up
- Positive environmental conditions and the presence of infrastructures and international links
- The on territory availability of specialized service distributors and enterprises in correlated sector
- The on territory availability of qualified manpower
- The on territory availability of support networks and technology transfer
- The existence of public authority, international, national and regional politics and relative financial support structures

It is easy to outline that such prerequisite frequently could be identified also in science parks. As previously described Science Parks are “...an organization managed by specialized professionals, whose main aim is to increase the wealth of its community by promoting the culture of innovation and the competitiveness of its associated businesses and knowledge-based institutions.

To enable these goals to be met, a Science Park stimulates and manages the flow of knowledge and technology amongst universities, R&D institutions, companies and markets; it facilitates the creation and growth of innovation-based companies through incubation and spin-off processes; and provides other value-added services together with high quality space and facilities.”

They are focalized, case depending, in the development of different industries from different sectors ranging from agro-food to Information Technology, electronics, life sciences, aerospace, automotive etc. Usually, particularly at the beginning of the science Park history they were characterized by a general approach to the development of industries. In such perspective, Science and technology parks are in general hosting a mix of companies of different sectors. They are perceived more as a general tool for the development and the attraction of Foreign direct Investment (FDI) than as a specific tool for the development of a particular and specific industrial sectors. In such approach the support to the growth of innovative companies is of particular importance. The role of “Incubation facility”, more precisely the presence of a tailor-made institutional location that functions as an activator able to attract and develop the resources, the expertise and system networks. In such way the science

park is able to start the virtuous circle that begins from technological opportunities to entrepreneurial activities. Such situation has changed in the last 15 years. The growth of really innovative and high-tech sectors (life sciences, nanotechnology, energy, etc) characterized by elevated growth rate, high pervasiveness and the transfer potential of innovations to other sectors (“cross fertilization effect”) the increasing competition between territories and the globalization of the world economy together with the above mentioned need for each regions to concentrate investment and activities in few industrial sectors has been some of the reason why a new generation of science parks, particularly in more developed countries has been conceived. “Specialist science Park” are science parks that concentrate their activities in supporting the growth at territorial level of one single industrial sector. They specialize their activities, in term of technology transfer, incubation, consulting and settlement of companies in order to fulfill specific needs and to act as specialized organization. What is changing is not the definition of the science park but simply the sectorial field of action. It is easy to understand that the two policy trend, the creation of really competitive territorial clusters and the science park development has a lot of element in common:

- They are based on the proximity and concentrations
- They are not simply a “physical place” but in reality they are a system
- They growth through the growth of the actors involved
- They are, particularly for specialized science parks, focused on one industrial sector
- They have to support really innovative companies that have local roots in order to growth
- They are based on the creation of a community of local actors more than to the development of a simple network
- They have a global perspective

The two approaches in such perspective are not opposite but synergistic. Science Parks and organizations also R&D organizations acting such as a science parks, could act as “hot spot” from where it is possible to build links inside a specific territory but also towards other complementary and synergistic area of the region and country concerned and of the world depending if the long term strategy is more oriented to the “local market or the continental/world-wide market”.

Such strategy have to be based not only on technological knowledge but also, and more, on the capability to be market driven i.e to be able to transform/use technology to solve problems through innovative products and services. In such perspective the science park could be the real territorial system integrator and catalyzer. It became a real “cluster and network managing company” where all the “most specific” science park activities (creation of communities, support to young innovative companies, capability to build bridges between research and industry, project building, internationalization, etc) are scaled-up at territorial level to support the development

of a specific sector. In such perspective a market focus instead than a pure technological focus in developing such approach seems to be important. If we analyze some of the sectors that are classified such as high-tech (ICT, nanotechnology, Hydrogen, new materials, green energy, and Biotechnology particularly) it is clear that a general approach is a limit. It is necessary to focus on some innovative market area with the goal to deliver products and services. In such perspective Innovative clusters are in reality multi-technological/multi sectorial initiatives. The concept of converging technologies and smart specialisation i.e the use of different technologies to identify and develop a product and or a innovative services as a consequence a key point in the clusters strategy maximizing the impact of activities. This “multiplier” effect emphasizes the cooperation which is established between industrial enterprises of different sectors. The intensity of iterations research-research and research-enterprises and enterprises-enterprises reinforces the capacity of innovative clusters to attract further settlements. In such clusters the presence of a nucleus of excellent scientific competences is of central importance along with the presence a dynamic entrepreneurial scenario. From the financing point of view it will be necessary a model that involves directly private and public initiatives (PPP – Private Public Partnership) together in order to identify resources. But at the same time a PPP approach needs a governance system in order to maintain strategic focus and avoid opportunistic behaviors. Usually in such models public initiatives must assure a positive ecosystem for the growth of innovative private (or private with public involvement) initiatives. It is sure that to involve private actors it will be necessary to identify what could be of “interest” for such actors and which are the monitoring/management tool of the the system: probably financing linked directly to cluster existence but also added value services such as TT initiatives, export initiatives, quality labeling initiatives, training initiatives, etc. Territorial living labs and regional open innovation initiatives are also useful in order to build local innovative communities .

4. The creation of a local network: the logical and practical path

The creation of a territorial network could be considered one of the main ways to exploit and maximize the above mentioned approach. From an R&D center point of view the creation of such network permits the identification of synergies with the local companies and the possibility to focus and launch specific and targeted TT activities. Such results require a deep knowledge of the local territorial environment. A really useful starting point it the realization of a SWOT analysis that allows to identify strengths, weakness, threats and opportunities.

This analysis model is based on two principal concepts: the distinctive abilities and key factors of success at internal (inside the R&D organization) and external (in the territory) level. SWOT analisys is an useful way to improve its competitive position. Identify the strengths means understand which are the advantage over the others.

Weaknesses are the features that represent some issues for the organization, they have a disadvantage respect di others. Opportunities represents external elements to improve performance in the environment, finally the threats are external features that cause trouble for the organization's projects.

But to strengthen the competitiveness and exploit opportunities the internal/external SWOT analysis it isn't sufficient. All the elements have to be trasformed in more focused internal and external analisys. For a TT center, i.e. An R&D center that is willing to perform TT activities acting such as a science park some factors have to be taken in consideration:

- The geographic location
- The core activities of the research centre: in this step the organization have to study the key activities to understand what are its best skills. It's important because it allows to strenghtnes its position compared to the competitors. An internal mapping and a internal culture mapping is a required. It permits to split up activities identified by their sector: for example enviroment, chemical, pharma-chemical, pharma, consulting servises, agro-food and make a primary possible interconnection with the market sector.
- The organizational analysis i.e. The identification of "who is doing what" It permits to understand if it's sufficient or it's necessary to increase the staff number/skills in some sectors.
- The infrastructure into the centre: laboratories, machinery, conference room
- The analisys of already existing links with external
- The creation of a database that contains the works of the centre: the researches, the events and all the projects do by the centre. It's important to steadily update the database so the external actors can know each centre's activities.

Some tools could be useful:

- The creation of knowledge instruments and tool marketing to improve the positioning of the center and the capability to realize Business development activities
- The realization of external animation activities and creation of thematic workshops with companies, because it allows to exchange differents points of view and identify common solutions.
- The implementation of shared infrastucture and common services. it's important to reduce costs and increase the competitiveness.

The creation of thematic networks at local level with other R&D institutions and companies to increase contacts with other enterprises and partner.

2) In parallel with the internal mapping the analysis of the external environment has the goal to match what the center is doing with the external environment. The activity consists to identify those variables that can affect the success of development strategies at territorial level. A possible way to do this is a customized version of the PEST analysis, it considers the external variables as Political, Economic, Social and Technological:

Political: this variable considers how the government intervenes in the economy. For example tax policy, environmental law, restrictions. Above all with health matter governments have great influence because is one of the most important social topics. Understand as the government acts on the health sectors it's useful to the requests of funds for the research projects.

Economic: this factor includes number and typology of companies, industrial sectors, economic growth rates, etc.

Social: this variable include cultural aspects like population growth, health consciousness, age distribution. It's important to study these factors because they are linked with the life science sector and through this aspects you can understand the main needs of the society and work to satisfate them.

Technological: also this variable is linked to the life science sectors because includes aspects like R&D activities, incentives of technological change. The centre must have a good informations about innovation to be always in the lead.

Such approach could be practically implemented folowing simple steps:

- analyze the actors of interest, University, research centre, private and public authorities, foundations, companies. Through contacts inside the research centre with external employees, website, regional or state government. The results will be a complete data base of the universe concerned (Anagraphical data, contact points, description of activities, etc. The uses of keyword (e.g. EEN like keywords) could be useful.
- Starting from such analisys it will be necessary to segment the “market” identified using standard variables such as the industrial sector, the size or geographic location
- The segmentation will permit to cluster actors following the above mentioned variables and to identify a sample of companies and R&D center that will be targeted for further analisys. The involvement of local socio-economic actors such as the Chamber of Commerce could be useful.
- To visit the companies and R&D centers inserted in the sample in order to have “first hand” informations on needs and market/technological trends
- To mathe such results with internal assets in order to draw up a list with the possible interactions between research and industrial sector
- To match local results with national global trends

3) One time that the external analysis has been completed it will be necessary, starting from the reality of actors present at local level to start-up the local network. Such activity is crucial for the development of the local system. Some characteristics have to be respected:

- a) strategic approach: to avoid episodic activities and to follow a strategic focus (e.g. Development of relation of the R&D center with local actors, Support the growth of territory, etc)
- b) Coherence in time and commitment: it will be necessary to be coherent because only in rare cases activities will have results on the short terms
- c) identification of interfaces between the R&D center and companies: it will be necessary to “institutionalize” the activity to avoid egoistic and “fire and forget” activities. It will be necessary to identify “formal” entry points for the company that is willing to access the R&D center.
- d) identification of synergies: it will be necessary to work in complementarity with other organisations and not against other organizations.

The creation of the local network will start probably from the companies that already are in contact with the R&D center and from the companies that have been identified as part of the sample analysed during the external mapping. It will be necessary to reinforce the positioning of the R&D center at local level but also to strengthen the social links between the companies and the R&D center. In order to realize such action some tools could be useful:

- 1) kick off conference where all data collected will be presented and shared at global level
focused meetings with the most important and influential local stakeholders
- 2) creation of an advisory committee of the R&D center composed by local companies
- 3) launch of a programme of technical and managerial training events focused on the presentation of the R&D capabilities to the companies
- 4) to define standard technology transfer activities and to standardize as possible document (e.g. contracts, prices, etc)
- 5) Creation of specific technical working group where companies will be invited in coherence with the internal asset of the R&D center
- 6) Creation of a news/mailing system in order to communicate in a periodic way to the local companies. Already existing system could be used in complementarity
- 7) Identification of a periodic event (one time a year) in order to communicate to the local companies what the R&D center is realising and with which impact on local economy
- 8) Creation of common marketing tool: a brand for the network, a web, a public

- db of members, a brochure, etc
- 9) Creation of advantages for the local company on working with the R&D center: e.g. discount scheme, common services, training activities, etc
 - 10) Participation of the personnel of the R&D center to international event and formal reporting to the local companies
 - 11) Creation of an internal DB on contacts in order to have a “customer Relationship system” able to trace relations with network members
 - 12) Creation of Key performances indicators in order to assess the sustainability of all the activities

Annex 1 Cluster creation

Michael Porter defines a cluster as: “Geographic concentrations of interconnected companies, specialised suppliers, services providers, firms in related industries, training institutions and support organisations linked around technologies or end product within local area or region”²

A clusters encompass an array of collaborating services and providers that create a specialized infrastructure, which supports the cluster’s industry.

Life sciences clusters have an important role in the growth of the industry, because concentrate activities of various actors in a geographical area.

The geographical concentration of the biotech industry offers **many advantages**:

- Productivity advantages: geographical concentration of the biotech industry offers some advantages to increase the purchasing power for laboratory supplies, raw materials and services. Another is the use of shared infrastructure provided by biotech park or by the scientific centre it allows to reduce costs and find funds to help the start-up companies.
- Innovation advantages: the concentration academic institutes allows to create networking among professional and researchers and help to sharing ideas and information.
- New business establishment advantages: the idea of cluster is to develop incubators, technology transfer centres and professional networks, adapted infrastructure and government support.

The enterprises benefit from cluster because it creates collaboration and competition in the same time. There are **three dimensions** of a cluster development, they are the first step to achieve global competitive advantages:

- The dimension of framework conditions: cluster needs to develop a favourable framework inside to support the activities of cluster companies. The general framework conditions are for example specific infrastructure, labor force skills or institutes and regulatory issues (taxation).
- The dimension of cluster actors: cluster has to contain strong companies and strong interaction among different actors. The strength is the cooperation between companies and other stakeholders as universities and research

² Michael Porter Competitive Advantage of Nations ,1990

institutes.

- The dimension of cluster management organization: the main activity of cluster management is to support strong dynamics among companies and other actors of cluster.

Components of a successful life sciences cluster:

- Strong science base: is formed by academic institutions and universities that have the task to make research and in the same time develop a skilled workforce it's the base to develop the applied Science, new drugs and technologies. A lot of these research results are put on the market.
- Entrepreneurial culture: is a critical factors. It involves the ability of individual to take risk, discover new territories, build new business and transform idea in commercial services. Academic institutions have the chances to developing entrepreneurs, the scientists have access to numerous idea and technologies that can be taken to the market. Moreover the biotech cluster help the birth of many new companies.
- Strong base of companies: for a good biotech cluster it's important that it has a large and different base companies start-up and mature. A mix of these companies increase productivity and develop networks in the territory. In the biotech sector the R&D is the key activities, to support it the cluster has to provide a strong base of companies.
- Effective scientific and business networks: means the developing social networks among managers, scientists and financiers, they are useful to the exchange of ideas and information across various actors of the cluster. Network allows collaboration, resource sharing and commercialization.
- Ability to attract a skilled workforce: for a successful cluster you have to get companies that attract and motivate the best management and scientific staff from other country. To do this the cluster has to give opportunities for employment and career development.
- Effective financing mechanisms: they are the base for build a good cluster. Many example of financing mechanisms:
 - Start-up funding have high risk and they could provide by acquaintances (friend, family)
 - Grant funding: this type is provided in the form of grants government and agencies as National Institutes of Health, National Science Foundation.
 - Venture capital: they invest in the company after a sufficient proof of concept for its product or technology. It involves multiple investors and funds.

- Public offerings: investment by general public. This way requires formalities and services of investment banks.
 - Private investment in public equity: this route involves the selling of publicly traded common stock or preferred stock to private investors.
 - Partnership deals: this involves non-dilutive financing to fund specific projects of a company.
- Strong infrastructure and business support services: for the formation of successful clusters it's necessary to have a base of infrastructure as roads, airport, water, electricity, basic law and order. It also important to have specialist business service, as central laboratory services, patent agents, lawyers and recruitment and property advisors in the region. These services help to reduce the time factor and the costs.
 - Conducive regulatory and intellectual property environment: for biotech sector is necessary to have a strong intellectual property protection laws in the place to make sure that the innovators are protected and the sufficient time to benefit from commercializing the innovations.
 - Support policy environment: a supportive at a country, state, or regional level can create the ecosystem for the formation and growth of clusters. Macro economic policies as tax, government funding, incubators, regional economic development agencies, help the innovation in a territory.

Different types of cluster programs

1. Cluster focus on regional economic development: the aim is the promotion of regional growth through the development of a cluster that are internationally competitive. This program is made for regions that are geographically limited and need support for expansion strategy.
2. Cluster focus on the commercial exploitation of the R&D potential of country's economy: cluster program is focus on the establishment of clusters or centres of excellence that are the driven to reduce the gaps between the research and the business sectors. In this program the aim is also share of economic growth objectives, it put more emphasis on the development of the research sector with the commercialization of its R&D results.
3. Cluster focus on the development of national industries: the main objectives is the developing of business-driven cluster that represent national industries.

This program supports the regional system of innovation, another task is to promote national and international collaboration with other clusters

Step of a cluster's creation

To begin a study for a creation of a cluster it's necessary identify many steps.

- Economic situation: the first step provides the study of the economic environment of the territory where the cluster will birth and growth. To analyze the economic situation it's necessary divide the composition of the sector: % of industry sector, % of agriculture sector, % of services sector. This step is important to design the first assumptions of possible relations among science research and industry goods/services.
- Key factors: an innovation centre typically are the result of relationships among many factors. In this step it's necessary to identify these actors in the own territory and understand the possible way to start relations with them. Key factors are:
 - Governmental and Public Authorities: identify how are the relations with region, state, and all public authorities as health ministry, agriculture ministry, industry ministry. It's important to understand the social policy and the accessibilities to give funds to the research sector.
 - Firms: know how the industry sector is composed and understand which are the needs of the enterprises, then think how the science sector could help the industry sector with its study and research results. The most important thing is to understand the external needs.
 - Educational entities: define possible relations with universities, for example through stage, seminary, or PhD. These activity are the first step to start a work with the universities.
 - Research institutions: identify the best research centre and understand if they are able to work together in a cluster and exchange information and results.
 - Bank and Financial institutions: to support the costs of the research it's necessary the presence of credit institutions.
 - Intermediaries: over the bank there is another way to find funds to support research, it could be with private or public organizations or foundations.

Structure of the cluster:

- Legal form of the cluster organisation: identify the type of legal form most suitable with the strategic objectives of the organization, for example in the life science sector the common legal form is ‘no profit organization’.
- Nature of the cluster: chose if the cluster will be a driving forces or degree of specialization.
- Composition of the cluster membership: organize the membership of the cluster identifying which are committed members, advisers, interns.
- Utilization of regional growth potential: understand if the regional authorities could support the development of the cluster.
- International members of the cluster: it’s important to create a network with foreign partners to have the possibility of other financial support.
- Nature of cooperation among the cluster members: identify the best way to achieve the interconnection among different partner with different objectives. Good relations allow more successful and fast development.

Strategy of the cluster organization

Assignment of tasks of role definitions of the cluster management and cluster member: the first step is to chose a cluster manager who coordinates the main activities of the organization, then analyze the cluster member and divide them in based of their tasks.

Number of cluster members and human resource: identify the number of the staff necessary to the organization and divide them in full time employee for example, part time or only for specific projects.

Strategic planning and implementation process: to start a development strategy it’s necessary to make a plan with all the factors using to achieve the final objective. This plan has to considerate many features as activities within the cluster, the human resources, the infrastructures, the economic availability. All these factors lead to the development.

Geographical priorities of the cluster strategy: identify if the strategy has at the beginning only territorial objectives or it wants to apply to the international market.

Services offered by cluster organization to support the development

Collaborative technology development, technology transfer and R&D projects: through organization of working groups

Internal networking among cluster members: organize regular meeting, thematic events, workshops for cluster members

Development of human resources: participation of study courses together with external partners like universities; training courses for cluster members

Development of entrepreneurship: acquisition of financing for example with venture capital, banks or public funds

Networking with external partners: through information material, web site, publications; presentation of the cluster and its member on conferences or matchmaking events for example

Internationalization of the cluster: cooperation with export promotion agencies, presentation of cluster and its member on networking visits or through study tours

Annex 2 Technology transfer

To study the process of technology transfer it's necessary to make an analysis of the mode of acquisition of technology by business. The technology transfer approach has to considerate the size and the sector of the business organization.

The technology acquisition by companies it's characterized in these phases:

- Scan: identify the strengths, weakness, threats and opportunities through the study of internal and external environmental factors.
- Focus: the company collects some signals to define a strategic response that allows to select the best solutions and design competitive advantage.
- Resource: organization acquires the necessary knowledge and resources and introduce them in the corporate. This can be done with the purchase of a machine or knowledge and through internal R&D activities, it also possible mix these activities.
- Implementation: organization implements technological innovation within the business environment
- Learn: in the last phase the organization make an evaluation about the process to identify possible mistakes.

Internal R&D activities, processes of cumulative learning (learning by doing), replacement of staff or the introduction of new staff, acquisition with other businesses, trade relations with suppliers or customers are the procedures to the identification and acquisition of innovations by business organizations.

The are **three key moments**: the research phase, the phase of the trial and the phase of exploitation of results and technology transfer. In these phases it's possible to identify the areas of potential synergy.

The research phase

When you achieve the results it's the key moment of the development process of any innovation. Then there is the process of its verification and valorisation. To exploit the results in the industry it's necessary to deploy expertise and resources like:

- the ability to assess the innovativeness of the invention from a patent point of view
- skills to analyze the market interest and related valorisation paths (for example patent and its transfer through license, start-up creation)
- knowledge of sources of funding and expertise for their activation
- identification of potential partnerships for the development of the invention and construction of pilot and demonstration projects

Where bodies of interface or system integration exist, they facilitate the action so the mode of operation can be simplified:

- make a mapping of the knowledge areas, of projects in progress and of the results that identifies the key variables. This activity can be based on an initial mapping (with interviews or questionnaires) and a one-stop physical desk. At the same time create a mailing list that allows the dissemination of information and opportunities (for example technology requests, technology offers, partner searches etc).
- after you've identified the scientific result, it can be analyzed under a valorisation perspective. This activity will be made in close contact with the holders of the innovation and then the objective is to identify potential paths of commercial exploitation, marketing and patent strategy. It's important to understand all possible interactions among scientific results and the interests of the companies.
- In the third step it will be possible to identify a need for another scientific activity that could lead to a new analysis.
- It's necessary to build valorisation strategies that are a real plan to exploit the results. these strategies allow to create individual steps to the exploitations for example through patenting or licensing or start-up company.
- Finally it's necessary to design an action for patent protection.

The activities of this phase are protected by a secrecy agreement to maintain the adequate privacy.

The phase of the trial

In this step the outcome of the research is protected and there are identified more paths of development. There are problems of economic nature and regulatory in this

stage, but also the necessity of continuous innovation and capitalization.

The phase of exploitation of results and technology transfer

After identify the scientific result, the appropriate valorisation paths and a good decision on the exploitation of these paths it's necessary to put the strategy into the practice. The solution has to build around the research result and the exploitation plan. In this step it's necessary to create a value around the innovative result in order to package for its exploitation.

Make a value creation means make: explicit path for exploitation of scientific results and commitment, strong patent protection, good scientific know-how and identified development milestones, analysis of key factors linked to development (for example market, regulatory, risk. Public perception).

Annex 4 examples in implementing a local network

Amsterdam BioMed Cluster

www.amsterdambiomed.nl

In the Amsterdam area there are a large number of companies and knowledge institutes active in the life sciences. This offers opportunities of clustering, the aim of the Amsterdam BioMed Cluster is to build a community to exploit synergy between the life sciences organizations present in the Amsterdam region. The principal goal is to open up their regional knowledge and technology base to national and international and to parties interested in doing business with them.

The principal activities by the Amsterdam BioMed Cluster are:

- connect industry and knowledge, by bringing together entrepreneurs, scientists and related parties active in the life sciences;
- support and represent the life sciences sector in the Amsterdam Metropolitan Area;
- promote the Amsterdam Metropolitan Area (internationally) as preferred destination for life sciences activities.

The Amsterdam BioMed Cluster consists of two internationally universities with their academic medical centres, a number of independent scientific research institutes and successful and specialist biomedical and life science companies. An intensive interaction among medical centres, basic research institutes, spin-off companies and the industries allows to achieve the development on novel drugs, preventive tools and diagnostics.

The Amsterdam BioMed Cluster has created a strong foundation for patient-oriented clinical research. Extensive database of patient material offer excellent partnering

opportunities for the biotech and pharmaceutical industry.

Science Park Amsterdam is the home of a number of important knowledge-based institutions: Faculty of Science of the University of Amsterdam and internationally research institutes

BioValley, The Life Sciences Network

www.biovalley.com

France, Germany and Switzerland have created a network of science, industry, politics and finance. The success of BioValley stands for cross-border cooperation and a pooling of the strengths and resources of the three countries. These regions of high growth have profited from each other and stimulated each others' development, the result is a high rate of economic and employment growth. The infrastructure, networks and trust among the participating actors and institutions has been established, now is time to build the unique worldwide potential of a cross-border cluster through companies working together and cooperative research in the life sciences field. This development serves also to bring science and business together in the other centres of excellence, to lend sustainability to the economic dynamism of the region. The core element of the trilateral partnership is the cooperation in the fields of education, research and technology. The BioValley cluster allows:

- to remove the disadvantage of a national border location,
- strengthening of the whole area in national and international competition
- exploitation of specific innovation potential in the individual parts of the region
- promotion of start-up
- networking of participants

To achieve these goals the BioValley has designed a strong communication system that allows to maintain the interactions among all different actors. It has established a structure as "BioValley web site", "BioValley News", "BioValley e-Newsletter", "BioValley company report", "BioValley database" and "Trilateral research database".

The instruments and types of networking used by BioValley allow create interaction among the members but also general public, it's the useful instrument to develop a strong link of relations. The BioValley organizes meetings to many high schools, three weeks programme, one week for region, to meet members or professional public but

also general public that contribute the promotion of the biotechnology within the population. An important aspect is the involvement of general public with conference and lectures, is a good way for BioValley to develop their networking activities. Also creation of round table meeting, include company presentations, company visits and information events. They serve as information and communication platforms for all young and scientists and business people open to new venture.

Cluster de Biotecnología de la Comunidad de Madrid

www.madridbiocluster.es

The activity of the Biotechnology Cluster began in 2007, but it had an intense activity during the 2008-2010. The creation of cluster is the key element to improve the innovation sector and achieve the goals of the innovation plans. The aim of the Biotechnology Cluster of Madrid is:

- the promotion, internal and external, of Madrid as international centres of biotechnology
- design a coordination model and develop of measures to increase the biotechnology
- increase the enterprises competition in the biotechnology sectors
- coordinate all the development activities among the different actors
- promote many activities that can allow the development in Madrid of business sector linked the biotechnology sector.
- collaborate in other companies with complementary activities of the cluster, to exchanged information and research results.

The Cluster works for many projects for example the Biochem, its aim is to implement and develop an innovational European partnership for the Eco-innovation in the biotech sector. This project allows to overcome the barriers for the enterprises that produce technological goods. This happens because there isn't connection among enterprises and science sector. Another project is promoted by the Madrid network with the collaboration of the Biotechnology Cluster of Madrid. The goal of this project is to create a network among different European actors through a link of regional cluster that have development strategies. The main aim of the Biotechnology

Cluster of Madrid is to develop strategies to coordinate more actors, they can be regional, national or international.

Atlantpole

www.atlantpole.fr

Technopole is a global concept of economic development based on innovation, it's supported by a strong partnership among the local authorities, chambers of commerce and University. The creation of network is the key to develop technopoles strategies through activities of networking and incubation. The main mission of the Atlantpole are the following:

- Animation and ability of networking
- Engeneering and innovation
- International marketing
- Innovation projects with the collaboration of enterprises, researchers and students
- Develop innovative companies and new laboratories
- Create interaction among business sector and life science sector

Atlantic Biotherapies includes 45 companies dedocated to Life Sciences and health, it gathers nine-hundred researchers, two universities, two university hospitals, one veterany and Audencia, one of Europe's top ten business schools. The members of Atlantic Biotherapies share to bring more new biopharmaceuticals to the market with enhanced selectivity and efficacy with specific areas of excellence. (cell and gene therapy, immunology, etc). everu year Atlantic Biotherapies incorporates five new biotech companies, this allows a fast growing of the cluster. For Atlantic Biotherapies to take part of a cluster it's a better solution, because it helps to consolidate the sectorn and also have easy access to finance. The cluster creation allows to develop new areas of cooperation and to share information and results. The last goal for the Atlantic Biotherapies is to create a common area to exchanged results and point of view among all actors of the cluster.

Shanghai Juke Biotech Park

In China biotech development is slowed down by many obstacles as poor IP rights protection for drug innovation. This situation makes the international investors sceptical about China's health biotech industry and explains why the health biotech mainly relies on government support and funds.

In general Chinese biopharmaceutical companies selling biogeneric drugs but don't invest in innovative R&D. The Shanghai Juke Biotech Park supplies facilities and provides services, management training, technology training and funding application to 44 biotech start-ups.

China has relevant low cost in R&D, especially in animal testing and clinical trials, in fact many Western companies would like to move their R&D in China. Chinese biotech SMEs have to improve their technology operation to meet requests of international collaboration.

The develop of relations through the European cluster and Chinese partners has following advantage:

- Setting up Join Venture with Chinese laboratory
- Take advantage of the cost-efficiencies offered by the emerging biotech industries through out-sourcing of repetitive R&D
- Increase investment in automating labour-intensive biotech procedures in order to obtain cost and time-saving benefits
- Increase the attention given to effective collaboration between research institutions, biotech companies, pharmaceutical companies and the health-care systems of the home country in order to improve drug development efficiency

The Parc Cientific de Barcelona

www.pcb.ub.es

The Park Cientific de Barcelona is the location where universities, enterprises and research centres can meet together and can strengthen the innovation in the Life Sciences sector. The main goals of the Park are the following:

- Strengthen the excellent research with the support of an extends technological offer
- Develop the relation between universities and enterprises
- Promote the creation of new enterprises and institutions
- Promote the dialogue science-society and the science research

Within the Park there are 3 research institutions, 75 enterprises, an incubator for the companies, 70 group of research and great technological offer that can help the research. The laboratory building includes core services, scientific and technical platforms.

One of the strategic lines of the Park Cientific de Barcelona is its positioning like a reference instrument in knowledge transfer and promotion of entrepreneurship. To develop this strategy the PCB has three main lines of activities: consulting an environment supporting new collaboration formulae, especially public-private partnership; supporting the creation of new technology-based companies; strengthening the PCB as a Bioincubation environment in its region, compatible with different incubations step, from identification of the business idea to the post-incubation phase. The PCB also promotes patent protection of the research carried out in this institution and its transfer to the productive sector and faster the creation of technology-based academic spin-off enterprises.

For PCB the participation into a network of a clusters allows to create a strong position in the European reality. Take part to a network of cluster it's important to support development strategies, to promote the PCB transfer to other regions and also to have an easier access in the international field.

bioPmed Piemonte Innovation Cluster

www.biopmed.eu

bioPmed is a new innovation cluster dedicated to bio and medical technologies created with the intervention of Piemonte Region. bioPmed has 300 companies, 3 universities and different research centers, foundations and associations active in Life Sciences fields. bioPmed works to stimulate innovative activity by promoting intensive interactions, sharing of facilities and exchange of knowledge and expertise and by contributing to technology transfer, networking and information dissemination among the actors of the cluster.

The bioPmed cluster has the aim to coordinate the different actors during the innovative process and also it has the goal to supply infrastructures and facilities to support the needs of the technological enterprises.

The main objective of bioPmed is the development of a bio/med-tech cluster to support the growth of all of its actors with a particular attention for the enterprises. During these years bioPmed's activities are focused on start-up, development of an entrepreneurial system and interconnection, relation among research sector and the R&D activities and also to find solutions for the patent problems.

BioPmed is building networking activities with European partners to develop together projects on technology transfer and creating tools for enterprises and members of the cluster. These activities are necessary because internationalisation is the most important character in Life Sciences. The cluster needs to be connected in a network to increase know-how, knowledge, technologies and innovation. For these reasons bioPmed concentrates its activities to develop and maintain a strong network among all of its actors.

Bioindustry Park Silvano Fumero

www.bioindustrypark.it

Bioindustry Park Silvano Fumero is a science and technology park that promotes and develops research in biotechnologies and Life Sciences, hosting enterprises of the chemical, pharmaceutical, diagnostic, bioengineering and information science fields. The park offers research facilities, scientific and support services as technology transfer, patent support, tutoring of start-ups and spin-offs.

The mission of the Park consists in:

- Creating a link between University and Private research
- Assisting start-up, spin-off and growth of innovative companies
- Providing incentives for R&D and technology transfer activities by offering scientific services and know-how
- Creating of factors for the development of the territory

The Bioindustry Park thinks that it's necessary to encourage the relations among business and research sectors to translate scientific discoveries into innovations so everybody will profit from them. To achieve these goals BiPCa stimulates collective projects of Research and Development, translates the results into patents and innovations, supports the creation of new companies, supplies infrastructures and many services to reduce the costs of the companies.

The BiPCa's project is based on the involvement of private and public actors but in the same time it ensures their autonomy. BiPCa develops a governance system and also the involvement of all the actors through the creation of sharing structure and meeting. These actions are made because the Life Sciences sector requests a continuous exchange of information and research results.

There is a Cluster Manager that ensures the necessary support to the actors and to the public institutions, also creates initiatives to realize the interconnection among the different actors and finally allows a easier access to the relation with the UE for financing the projects.

