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1. WHAT IS KNOWLEDGE TRANSFER?

1.1. INTRODUCTION

Nowadays, the growth or sustainability of a company in the medium or long term highly depends on introducing new processes, new products or new business models in its activity and to do so, among others, it is necessary to innovate and accumulate knowledge.

Access to knowledge and technology can be done through internal resources, such as the R & D departments of companies, or through external sources such as universities, technology centres, etc. Due to this, the environment plays a crucial role, since the competitiveness of the countries depends on the organization that it has in terms of science, technology and innovation so that the technology and / or knowledge transfer takes place.

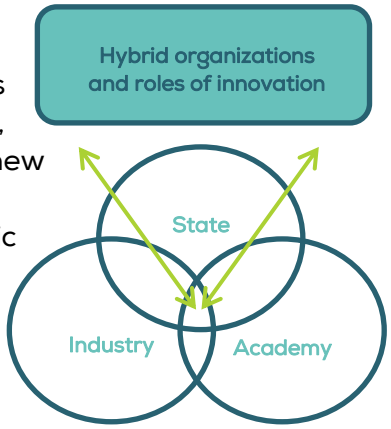
Traditionally, technology transfer was associated with the incorporation of foreign technology, but right now it has evolved towards a mentality change where not only they talk about technology transfer but also of knowledge transfer.

Likewise, the transfer of knowledge has evolved in two remarkable aspects:

i. The relationship between the different parties has changed from a unidirectional way to a bidirectional, where both the agent that transfers the knowledge and the receptor of it are involved and take part.
ii. The number of research sectors has been expanded, as well as the disciplines.

There are different models and theoretical approaches that show the importance of the transfer and the incorporation of knowledge in the innovative processes of companies relating them with the different agents of the process. It is worth mentioning among them, the Triple Helix model since it includes in a particular way the interactions between; University, business and government. The two main characteristics of the model are

- Situates the different agents of the process together; university, industry and government, highlighting the interrelations, emergence of new roles and functions.
- Relationship between science/business/public sector encourages the emergence of new hybrid organizations that facilitate and promote



innovation. Some examples of this type of organizations are technological centres, science parks or even incubators.

The evolution of knowledge transfer organizations has permitted to broaden the complexity of intermediation between parties, since now the triple helix includes new dimensions, resources and environmental challenges.

These new dimensions are beginning to generate a new helix to the aforementioned model. A new concept is arising, the fourth helix, which considers the importance of society in the process of knowledge transfer, becoming at the same time the main claimant for new technology.

1.1 OVERCOMING THE LINEAR MODEL OF KNOWLEDGE TRANSFER

The traditional model of knowledge transfer is based on the transfer from the University to the company. This model starts with the invention and discovery by the researcher and ends with the commercialization of a new product or technology in the market. Therefore, the following stages could be defined within the process:

First. The researcher's invention process is followed by the communication to the appropriate administrative unit in the university, generally the Office of Technology Transfer (TTO, also known as "Tech Transfer" or "TechXfer"), detailing the characteristics of the discovery or invention. The function of the Tech Transfer staff is to assess the grade of newness of the invention, as well as its economic potential. Firstly, the Tech Transfer must decide the convenience or not of making a patent application related to the invention.

Second. A particularly important role of the Tech Transfer is intermediation (broker), connecting academic inventors with entrepreneurs who are interested in commercially exploiting the invention. In this sense, the Tech's Transfer serve as educators or trainers of entrepreneurial skills for university researchers (contributing to the formation of academic entrepreneurs), as well as providers of information needed by potential investors to make the decision to finance the technological development of university inventions.

Third. Tech's Transfer must manage the negotiations between the parties. This involves handle the agreements related to the licensing of intellectual property rights.

When the state of the technology to be patented is not mature enough, it is difficult to find interested companies or people in acquiring licenses or finding investments that allow resources to be dedicated to develop commercialization. In these situations, the best or only option to carry out marketing is the establishment of a company by the academic inventor: the formation of a spin-off.

1.1.1. Traditional model: linear and unidirectional

The traditional model gives a simple and unrealistic approach to the knowledge and technology transfer process, since it obviates some of the stages and limits the possibilities of transfer. The two debilitating characteristics of this model are:

i. Linear and unidirectional approach
ii. Excessive emphasis on patents as the main vehicle for knowledge transfer

The simplicity of the model based on a simple transaction and the distortion of it has led to the evolution of the model and change from a transactional to a relational one.

1.1.2. From the transactional to the relational pattern

The existence of a relational pattern of knowledge transfer based on other types of collaborations between researchers and non-academic organizations has allowed us to evolve towards this new relational pattern that is characterized not only by the interaction between the agents but also by the bidirectionality of it.

Some of the channels or means used by this pattern of knowledge transfer are:

- R & D cooperation agreements
- R & D contracts
- Consulting
- Agreements on personnel mobility
- Co-supervision of PhD students, among others

It has been proven that these type of collaborations are considerably more frequent within academic organizations than those presented by the transactional system (patents, licenses or spin-offs). In addition, it increases the income in the area of transfer, and what is much more important, makes them more constant in time.

2. AGENTS IN THE TRANSFER OF KNOWLEDGE

2.1. UNIVERSITY AND KNOWLEDGE TRANSFER – THE TECH TRANSFER (TTO)

Academic organizations and universities in particular, are one of the most important agents in the Knowledge Transfer (KT) since it is in them where the main investigations are carried out. To carry out the main mechanisms of commercialization and technology transfer, universities use means such as the commercialization of license agreements, collaboration in research, research and consulting services and university or academic enterprise initiatives.

It should not be forgotten that KT includes elements of Knowledge Management (discovery, articulation, acquisition, communication, internalization, application and absorption of knowledge, among others) and therefore the existence of a relationship between university and industry must be considered in this context, where another agent appears: the company.

At the interface between universities and companies, four basic competences stand out, each of which corresponds to four key results of participation:

1. **Creation and Management of Research Projects**: It is related to the identification of the type of research projects, the collection of costs (and therefore the establishment of a price), the control of key negotiation phases and the follow-up of each contract
2. **Patent and entrepreneurship**: It is the capacity of a Tech Transfer to allow the transfer of intellectual property (IP) of public research teams to private companies and to facilitate business activity. This is related to the usual activities around the protection of IP, the patent process, the establishment of technology offers and the licensing.
3. **Knowledge sharing and support services for companies**: This competence is the ability to promote and develop knowledge-based support services for companies and share best practices between public and private research partners. For example, the "exchange of facilities" can help a company build prototypes.
4. **Limits that cover human resources**: The fourth competence is related to the capacity os establishing knowledge-based activities through the effective mobilization of people (human resources). This is related to the ability to create knowledge through outsourcing and socialization. A key concept in this is the "network as knowledge", which could be realized through the organization of joint conferences.

2.2. TECHNOLOGICAL CENTRES

The availability of knowledge-intensive services influences and largely defines the innovation capacity of a territory and is reflected in the results of its companies. Among the main providers of knowledge-intensive services are Technology Centres (TC).

TC's offer a wide variety of services focused on the technology and knowledge transfer and are key for the infrastructure of the territory innovation support. Time ago, they were helped by the public sector since one of its aims is to bring on the possibility of carrying out business strategies for innovation, and consequently, to improve its innovative results and competitiveness of companies.

There are many different definitions, depending on the country, so it is difficult to define a single model of Technology Centre in Europe. However, they could be defined as those non-profit entities, legally constituted, that are created with the purpose of contributing to the general benefit of society and improvement to the competitiveness of companies through the generation of technological knowledge, carrying out activities of R&D&I and developing its application. The two main attributes that characterize the TC are the technological strength (capabilities) and the attention they provide to companies (service), classified among them by the level of turnover dedicated to R&D.

In Spain, according to the directory of technological centres of the Ministry of Economy and Competitiveness, there are almost ninety technological centres. From all of them, 49 are currently part of FEDIT (Spanish Federation of Technology Centres), which brings together all technology centres of a higher size.

According to data from FEDIT, around 30,000 companies have used the services of a TC since 2005, most of which are medium-sized, although large and small companies, in this order, have also used them. It is remarkable that it is necessary that companies which are potential users have a minimum scale to interact with the TC's. This factor is reduced when the company has a certain technological level, is it based in industrial districts or belongs to a cluster. The geographical situation due to proximity or sectoral functionality positively influences the use of services offered by the TC's.

This result suggests that companies turn to TC's to complement their internal knowledge and highlights the difficulty of stimulating the use of advanced knowledge services in non-innovative companies.

On the other hand, the type of company that collaborates with universities tends to be of a higher level of technology, medium-large size and from high-tech

sectors.

Finally, it should be noted that the degree of satisfaction of the users of TC's is high, and may also assess the results not only from an economic point of view, but also from the technological impact or those related to intangible aspects.

2.3. SPIN-OFF

The concept of spin-off defines a company or organization born as an extension of another by the separation of a subsidiary division or a department of the company to become a company by itself, with independence and its own viability, in terms of legal, technical and commercial structure.

In general terms of the definition, spin-off refers to a person or group of people who leave the company where they are working to create a new company linked or supported in some way by the existing society, of which this person was a member.

The parent company can also be the potential market or the beneficiary of the supplementary services provided by the spin-off.

Each spin-off is different and it is difficult to classify them, however, different authors have tried to categorize and establish different models and typologies; according to their origin (academic and industrial), the technology used (technology-based or conventional), the strategy (reactive, proactive, «offensive»), the reasons (for restructuring, for safeguarding know-how), the impact on the strategy of the organization of origin (technical and competitive), etc.

Among all the classifications, the most relevant are those that refer to the origin and the impact on the strategy of the organization of origin.

Spin-off according to its origin: Two kinds of spin-off can be distinguished:

- Business or Industrial spin-off: Creation of a new company that comes from another previous organization (either public or private). Up to date, this type has been the most widespread, having the support of CEEIs-BICs (European Business and Innovation Centres-Business Innovation Centres).
- Academic spin-off: It begins its career in the heart of a university centres or research institutes. It is the most recent and is supported by the European Union through different programs with the aim of transferring the knowledge acquired in the university to the company. Precisely, this is the point of view of the Tech Transfer and its final product, the EBT or Technology-Based Companies.

Spin-off according to the impact on the strategy of the organization of origin. In this case we can also distinguish two types:

- Technical spin-off (or spin-off itself). It arises when researchers discover a new technology with a high economic potential but that is not relevant to the competitive strategy of the organization of origin. This category can include all academic spin-offs, since the company created does not modify or have an impact on the strategy of a university or a public research organization.
- Competitive spin-off (or spin-out). It includes all those cases that have the purpose of the independence any department or division of the company. This process is often a consequence of the rationalization of processes or out of an outsourcing plan for some activities, to subsequently focus on the key aspects of the production process, modifying, the company's value chain.

On the other hand, there are **several reasons that may explain the creation of a spin-off:**

- Retention of talent and not letting out valuable employees in new business projects.
- Setting up of new business niches and opportunities in the future of corporate activity.
- Strategic survival in crisis processes of the company.
- For taxes or commercial, application of labour agreements or labour regulations
- A specific financial dynamic that seeks to raise funds to develop a specific business unit

Finally, among the advantages of creating a spin-off, three of them stand out:

- Entrepreneurs will be able to continue developing the business area that was generated in the beginning until reaching the final product. In addition, they consider the possibility of hiring valuable research personnel and obtain economic returns from the process.
- The university will be able to boost its transfer work regarding the results of the research.
- The society will benefit from the qualified jobs of the spin-offs, the taxes they pay and the innovative products they develop.

2.4. START-UP

A start-up is defined as a small or medium-sized company of recent creation related to the technological world. It differs from other companies on the business idea, it is innovative and evolves in a phased manner until it becomes profitable.

Start-ups have some differentiating elements that explain their nature; such as the temporary character, innovative nature, reduced costs, external financing and a high risk.

Many of these emerging companies disappear after a short time or are sold before finding a stable business model. However, there are notable examples of start-ups that have prospered, becoming reference businesses such as Google, Facebook, etc.

The keys for moving forward a start-up are:

- Have an innovative technological component
- Have several specialized professionals in different sectors
- Target niche markets with high potential
- Get good financing both in quantity and time
- Have a great capacity for change
- Quickly adapt to market needs

Several timers, when the business prospers they are usually bought by other larger companies that end up investing and acting as a shuttle.

Once the start-up has obtained a repeatable and scalable business model it means the end of the start-up in itself, which happens to become the classic company as we know it.

3. TECHNOLOGICAL AND KNOWLEDGE TRANSFER CHANELS

3.1. LIVING LABS

A Living Lab is a concept used in research that could be defined as a real test bench in an experimental environment where users and producers can co-create innovations

These processes involve both public and private groups and their main

objective is the creation of new products, services and infrastructure appropriate to the real needs of the Company. The scenarios offered are the spaces where technological prototypes are developed and tested for the improvement of citizen welfare and which will have a real and proven effectiveness. Generally, all agents are involved in the transfer of technology; from universities and TC to companies (start-ups, spin-offs) through public funding entities.

The European Commission characterizes the Living-Labs as Public-Private-People Partnerships (PPPP) for open innovation driven by users. The Living-Lab are based on four main activities:

- Co-creation: co-design of users and producers.
- Exploration: discovery of emerging uses, behaviours and market opportunities.
- Experimentation: the implementation of "live" scenarios within user communities.
- Evaluation: of concepts, products and services according to criteria; ergonomic-partner, cognitive-partner and economic-partner

3.2. CLUSTERES

Michael Porter, a world-renowned economist and professor at Harvard, defines a "cluster" as a concentration of interconnected enterprises and institutions in a particular field for competition. In addition, he states that clusters have the potential to affect competition in five ways:

- By the increase in the productivity of the group companies
- By promoting innovation in the field
- By stimulating new companies in the field
- By reducing opportunistic behaviour
- By increasing the pressure of coordination between companies

Some of the fields where you see different clusters are the automotive, information technologies, tourism, smart grids, etc.

As there are different organizations in these groupings, the knowledge transfer channel for universities and TC is favoured. In fact, there are not only sectoral clusters but also based on different types of knowledge:

- Technical-clusters: groups oriented to high technology, well adapted to the economy knowledge, and usually have as nucleus renowned universities and TC.

- Clusters based on historical "know-how": these groups are based on more traditional activities that maintain their "know-how" advantage over the years, and in the case of some of them, throughout the years. centuries. They are often specific industries

3.3. CREACIÓN DE SPIN-OFF

The creation of spin-offs, which come either from academic institutions, TCs or companies, is considered as one of the main mechanisms to carry out the technology and knowledge transfer. In a quick way, you can start to commercialize the technology created in the organizations from which they derive making the transfer in a natural way and in a short space of time

3.4. PATENTS

According to the Spanish Ministry of Energy Tourism and Digital Agenda, a Patent is a title that recognizes the right to exclusively exploit the patented invention, preventing others from manufacturing, selling or using it without the owner's consent.

Thanks to patents, the plagiarism of a technology is avoided, but it must be taken into account that once the invention is patented, it is made available to the public for general knowledge.

It is important to highlight that patents are rights acquired in specific territories, generally in countries or regions where an application must be submitted, complying with current regulations stipulated by each of the regions or countries. The duration of the rights is variable, but it can generally be considered to be 20 years from the date of application.

Not everything is patentable since there are certain limitations. Here are some of the things that cannot be patented:

- The theoretical or scientific principles.
- Discoveries that consist in making known or revealing something that already existed in nature, even if previously it was unknown to man.
- The schemes, plans, rules and methods to perform mental acts, games or business and mathematical methods.
- The forms of presentation of information.
- Esthetical creations and artistic or literary works.

On many occasions, especially in academic and TC's, there is a case in which resources are not available to exploit it, which is why licenses usually appear

3.5. LICENCIAS

Licenses as a technology and knowledge transfer channel are defined as authorizations that assign the right to use or exploit a good to a person or company. In general, these are intellectual or non-tangible goods, such as patents, trademarks, designs or even technology transfer agreements

The technology or knowledge transfer through licensing is usually done under a legal agreement, which sets up both the rights and obligations of each of the parties, the transferor and the receiver, as well as the other agreed conditions such as duration, fees to pay etc.

In general, licenses stipulate as a minimum the following rights and obligations for different parties:

- Receiver obligations: To pay the fees stipulated in the agreement and not to disclose the business secret.
- Receiver rights: To receive the knowledge or technology.
- Transferor obligations: To transmit the knowledge or technology and answer for the damages.
- Transferor rights: To receive the agreed fees and to respect the commercial secret.

3.6. SUBCONTRACTING SERVICES

The lack of innovation departments or development of technologies within companies should not be a reason why knowledge is not developed.

The subcontracting of services to TC's or academic organizations through private service contracts is a channel of Knowledge and Technology Transfer as valid as any other. In most cases it is an option that considerably reduces the expenses of the subcontracting organization and obtains faster transfer results since it reveals the bidirectionality of the method discussed above.

3.7. COLABORATIVE PUBLIC PROGRAMS (H2020)

European research projects produce many excellent results, whether these are a finished product ready to be sold or as knowledge to be transfered. But how many results of academic research in technologies become industrial practices?

In this context, Horizon 2020 integrates for the first time all phases, from the generation of knowledge to activities closest to the market: basic research, technology development, demonstration projects, manufacturing pilot lines, social innovation, technology transfer, testing of concept, standardization, support for pre-commercial public purchases, risk capital and guarantee system.

H2020 can be a very useful financial tool that facilitates research mainly to academic centres and research centres, since it requires the exploitation of results, thus promoting the technology or knowledge transfer.

3.8. COLABORATIVE PRIVATE PROJECTS

In general, in any collaborative public program, it is mandatory to carry out a dissemination of the results obtained from the project, as well as the exploitation of them.

When facing to low TRL ideas or projects close to the market, where the innovative character is high and there is no interest in publicizing the lines of research, it may be useful to carry out private collaborations with technology centres or academic organizations that have the knowledge or the necessary "expertise" for the development of the project.

This option is usually highly cost since there is no public aid available and it is necessary to do it by self-financing or through the search for private investment, facing the problems that this supposed.

Generally, this type of projects is carried out by large companies that have large investment items for the development of technology and knowledge or by companies with a lot of financial solvency.

3.9. MOBILIZATION HUMAN RESOURCES:

Innovation and technological development is an intensive activity in human

resources; therefore, the level of knowledge in people determines the quantity and quality of innovation.

Human resources is a key factor for economic growth, both for a country and for an organization. Favouring the movement of talent greatly helps the realization of technology and knowledge transfer.

Among the possibilities of mobilizing human capital for the promotion of technology and knowledge transfer, the following models stand out:

- University-Business Chairs
- Exchanges program
- Fraunhofer model
- Business-Industrial doctorate with a collaborative nature

4. KNOWLEDGE TRANSFER IN SUDOE REGION

4.1. ESTATE OF SUDOE REGION – SPAIN, FRANCE AND PORTUGAL

SUDOE region is currently at a critical moment in terms of knowledge transfer since, to a large extent, the decisions made in the next few years in the science and technology system could make it one of the driving forces of economic and social development. For this, there are currently important pros:

- A solid and diversified base of generation of scientific and technological knowledge. In certain areas, even an international leadership position has been achieved.
- There are K&T transfer structures consolidated in the institutions dedicated to research.
- Examples of management models of K&T transfer have already proved their validity in the region.
- There are K&T transfer professionals highly competent and motivated in numerous institutions.
- Industrial sectors based on technology, where highly competitive companies stand out globally.
- Examples of companies with innovative vocation, even in sectors considered as «traditional».
- The industry's willingness to explore new ways of collaboration, such as "open innovation".
- Involvement of the public administration in supporting the K&T transfer, with recent initiatives in the legislative and financial fields.
- An incipient venture capital sector specialized in investing in early phases of technological projects, in addition to the activity of private investors (business angels) interested in R & D & I.
- In general, a growing awareness of the agents involved; The importance of K&T transfer has already been included into most speeches, debates and future plans.

Despite all of them, it is important to also address the following needs.

4.1.1. Strategic aspects

Transfer structures must evolve and adapt the needs of each of the organizations. Currently, it is necessary to define models and strategies that are above all flexible. To do so, it is important to focus on the following points:

I. Detect early transfer opportunities → generate fluid communication between researchers and innovation managers.
II. Promote incipient projects → importance of obtaining economic resources.
III. Define action plans that allow enhancing the value of the project in order to bring it closer to the market.
IV. Find which transfer model is the most appropriate → not always the patent model is the best option.

Globally in the companies, K&T transfer objectives should have greater influence and importance in the strategic plans of organizations, in such a way, it should be integrated as one of the engines of economic development, integrating the whole K&T transfer throughout the organization.

4.1.2. Indicators: results and impact

In order to be able to quantify the transfer in the short and long term, it is necessary to define objectives. These must be measurable, realistic and significant in terms of socioeconomic impact.

It is important that they are realistic and should not fall into the error of measuring only the number of patents, as it has been done in recent years. Patents are not the only way to carry out K&T transfer and to avoid falsifying these data it would be convenient to define additional indicators such as number of licenses, economic report of patents and licenses, number of spin offs created, economic amount reported in public programs, etc.

4.1.3. Human Resources and training

In the same way that the mobility of human capital results is an important channel for promoting K&T transfer T, maintaining talent and achieving indispensable results within the strategies should be carefully taken in consideration. It is important for all the SUDOE region (France, Spain and Portugal). It is necessary to improve stability, as well as working conditions, for both, technology managers and for scientists and technologists.

The K&T transfer activities must be carried out by professionals who have the necessary training, experience and professional skills. It is worth remarking the importance of a mixed trajectory industry-academy on an international scale. In the field of institutions, some current circumstances of the public function make it difficult to make a good selection of permanent staff. Thus, for example, it is not possible to select by competencies neither give incentives based on performance nor terminate

the relationship due to low performance.

It is necessary to emphasize the importance of the recognition of technical merits, of transfer and innovation, not only to organizations, academic or technological centers, but also to the personnel dedicated to the management of K&T transfer and to the researchers who develop it. The researcher is the basic agent for the generation and development of knowledge and this recognition would lead to greater integration in future transfers.

In order to encourage the participation of the researcher in the K&T transfer, in addition to the tangible returns, also intangible returns should stand out:

a) the improvement of skills, which will improve their research and teaching quality, and the expansion of contacts and opportunities
b) reputational revenues
c) the reinforcement of the legitimacy of its role before society.

4.1.4. Education, conscious and culture of transfer

We must work on raising awareness about the importance of innovation and entrepreneurship in the education system. In general, scientists and researchers lack the necessary academic education regarding K&T transfer.

It is not only a training that has to be acquired in academic organizations as in universities, but it is also necessary to transmit a culture of transfer within technology centers and companies. This culture involves both K&T transfer managers and the researchers themselves in a way that internalizes the importance of seeking an application to the results obtained from technology and knowledge.

4.1.5. Coordination and collaboration

It is essential nowadays to promote the coordination and collaboration between the different agents of the system in order to achieve a successful transfer. The distribution of roles should be more efficient and rational: who does what and when should be done, in response to the needs of the different phases of the transfer process. In particular, the coordinated action of universities, research centers, technology centres and science parks is identified as a challenge and an opportunity.

In the relationship between the worlds of research and industry, it is still necessary to reinforce mutual understanding and trust, in order to establish links of collaboration and exchange between both spheres. Both parties should be

realistically aware of the value they bring and the rules that prevail in each area. For example, the constraints and legal and economic limitations to which public organizations are subject and the servitude of companies to the market; It is common for there to have a great distance between the laboratory and the market.

Therefore, the intervention of private dynamic agents that support the most incipient technological projects, is necessary, in order to contribute to their maturation, and assume the leadership of coordination in research collaborations and K&T transfer, reducing the associated risks in early phases.

4.1.6. Legal and Financial Aspects

Laws have not been modified in recent years and should be updated in order to improve and facilitate K&T transfer channels. Therefore, there is a wide margin for improvement regarding the legislative and financial aspects that would benefit the K&T transfer, in the countries of the SUDOE region.

Public institutions should acquire a more important role in K&T transfer, as nowadays there are certain laws or regulations that penalize it. Some examples of these laws or regulations are:

- General Law of State Budgets
- Contract Law of the Public Sector
- Law of Incompatibilities of the personnel at the service of the Public Administrations
- Staff hiring rules
- Sustainable Economy Law
- Law on Science, Technology and Innovation

In the financial aspect, the main problem faced by technology-based companies is not creating it, but they have to deal with a multitude of obstacles in order to grow. The difficult access for finance considerably limits its growth.

5. USE CASES

5.1. SUDOE REGION COUNTRIES

5.1.1. Universidad Politécnica de Navarra (UPNa)

5.1.1.1. The origin and activity of the research service

The Research Service of the UPNa was created in 2007 under the Office of the Research Vice-Rectorsip and consolidated the union of two management areas that until 2004 had remained separated both administratively and geographically: Calls and the Tech Transfer (TTO)

Specifically, the Tech Transfer of the Public University of Navarra, TTO Navarra, was created in 1991. It emerged as a mechanism for the generation of knowledge in accordance with the needs of the environment and facilitate its transfer.

However, analysing the functions entrusted to these offices at the beginning, their activity was centred around the University itself, with only administrative tasks and little oriented to enhance the transfer activity.

In recent years the Tech Transfer in general have evolved considerably and as a result of the adaptation, their current functions are:

- Identify R&D results that may be transferable to the business sector.
- Prepare and disseminate the scientific-technical offer of the University with the transferable results and with its R&D and the accumulated knowledge capacities.
- Protect and manage the intellectual and industrial property of the University.
- Collaborate and participate in the negotiation of R&D contracts, technological support, consulting, licensing and patents, etc.
- Inform the research community of the University about regional, national or European Union R&D programs, energizing and supporting it in the preparation of proposals.
- Collaborate in the search of partners in the business and scientific field.
- Encourage and mediate in the researcher-company relationship.

- Facilitate and promote the exchange of personnel between the University and companies.
- Guide researchers work lines, based on the research and development needs of the industrial sectors.

In the case of the UPNa, the most used operational instruments in university-business relations have been the R&D contract. On the other hand, the least used have been the license of patents and the creation of companies.

Due to the little activity related to marketing and the development of market-oriented strategies on the technologies and knowledge generated in the university, the main agent in the transfer has been the research group. The use of groups as a transfer agent helps to prevail in the environment a partial vision focused on the area of knowledge on which the group works with a greater ignorance about the capabilities of the University, as well as about the services it offers.

Although it is not part of the Research Service, it exists a centre in UPNa that also serves to encourage and facilitate the relationship between research groups and companies. This is the R&D Centre for Electronics and Communications Jerónimo de Ayanz. This centre was born as a result of the motivation and experience of various groups that maintain regular collaborations with the productive fabric. The Centre acts as a channel and adapter between society and the university environment, adjusting the speeds of both and applying the rules of the game. It is born with a non-profit commitment to create and transfer knowledge in the terms of time and costs previously determined. One of the distinctive elements of the Centre is the offer of a physical space in which researchers or technicians of companies and University can work together and in conditions of confidentiality in R&D&I projects.

In addition, it is convenient to refer to another instrument that the UPNa has; the Scientific Culture Unit. It was created under the aid of the Spanish Foundation for Science and Technology (FECYT), to promote and facilitate the transfer activity. Its objectives are communication and dissemination of research and development activities that are generated at the University. The fulfillment of these objectives, and in accordance with the statements made by both the companies and the researchers themselves about the ignorance on the part of society of the activities carried out at UPNa, will serve to enhance the activity of knowledge transfer. The Scientific Culture Unit has an Expert Guide made up by the staff of the University which intends to be a meeting point between the researchers and the media, a bridge that allows bettering the contact between journalists and specialists of the universities from different areas of scientific, technological and humanistic of the Public University of Navarra.

5.1.1.2. Integration of the service as an interface between producers and recipients of knowledge

The main mission of the Transfer Section of the Research Service is to act as an interface between producers and receivers of knowledge. The UPNa defines the following guidelines in order to achieve an efficient transfer

a) Technological and environmental monitoring
b) Scientific communication and dissemination plan
c) Professionalization of the service

5.1.1.3. Management of transfer mechanims

The UPNa manages the technology and knowledge transfer through four channels: contracts, patents and licenses, spin-offs and collaborative research.

a) Contracts

The contracted research is a usual activity within the administrative activities of the Transfer Section.

One of the problems detected was that most of the contracts, around 95% according to the own technicians, were presented by the researcher responsible of the project. Few contracts come from the clients themselves. The fact that the researchers themselves submit a draft contract makes it difficult for the office technicians to advise. Although there are contract models available for researchers on the Research Service website, there are numerous contracts that arrive in a very advanced state of articulation. The objective of the transfer organizations in this aspect is to centralize these contracts and establish channels for efficient management and organization.

b) Protection of results: patents and licenses

Although patents are the paradigm of "Technological Transfer", it is a complex activity that implies an important economic investment, knowledge of the technological market, negotiation capacities and handling of legal aspects. In this way, the agents that operate in the Innovation system producing knowledge and technology such as universities, must develop policies in this matter and follow procedures for an adequate management of them.

Currently, the UPNa has a procedure for the management of Industrial and Intellectual Property Rights developed from the experience accumulated in the

subject over the years. While the Tech Transfer is responsible for the management of the proposals and to inform the UPNa Commission of Inquiry, it is to the latter (according to the Statutes of the University) to make the decision of initiating and continue in its case the process of patenting.

c) Creations of spin-offs

The creation of technology-based companies involves directly assessing a scientific-technical knowledge, whether it is or not previously patented. One aspect to take into account is the existence of different types of companies and the participation of the University in these

The impulse of the university to the university spin-off is not limited to the identification of business projects, but it is accompanied by measures that facilitate the success of the projects promoted

The Research Service, through the Transfer Tech, manages a University Business Incubator that provides support for the constitution of companies, as well as those already established, throughout its first years of existence. The Management of the Incubator destined to the Business Ideas in the project phase corresponds to the Transfer Tech, while the management of the Incubator destined to the spin-offs is produced in collaboration with the Business and Innovation Centre of Navarra (CEIN in Spanish) that brings the business focus and knowledge in management to transform research into a product or market service.

In addition, within the framework of the II Technological Plan of Navarra, an active support is established for the implementation of new actions for the promotion of Technologically Based Innovation Companies, following the experiences of other member states of the European Union.

The commitment to the creation of technology-based innovation companies in the last two technological plans and the creation of the Technologically Based Innovation Companies Network, implies the adaptation to the Research Service program in its way of managing the knowledge transfer, as well as in the provision of mechanisms to carry it out.

In this aspect, it is necessary to sensitize the researchers of the importance of the existence of an environment in which there are technologically innovative companies. Without them, it is difficult to find ways to exploit patents, as well as quality and competitive projects that allow research groups to differentiate themselves.

d) Collaborative Reserch

Collaborative research is another mechanism for the transfer of knowledge.

It can be generated through public announcements such as the CENIT, EUROINNOVA projects or the European Union Framework Programs or without going to these aids.

In cooperative projects, at least one public R&D&I centre or a university participates in cooperation with a technological centre or a company or a business association or group. The objective of these calls is to favour the efficient transfer of the results of the research carried out in the research organizations to the companies. This is one of the mechanisms that the University has to enhance since it means more funding for the transfer activity and contributes to the creation of innovation and development networks.

5.1.2. University system in Occitania.

Occitania region has a technology transfer program that develops different services.

5.1.2.1. Solutions to major challenges

The University system in Occitania offers support throughout the cycle of technology transfer and extends best practices through all members of its institutions.

For example, SATT are private technology transfer companies working very close to publically funded research centers in order to enhance the value of their results towards industry. They take part in all phases of technology transfer; detection of invention needs and market analysis, intellectual property strategy, proof of concept, support to the creation of start-ups and negotiation of licenses. There are two in Occitania: "Toulouse Tech Transfert" (TTT) in Toulouse and "Axlr" in Montpellier.

Also mentionable are the incubators offering safe and cozy environments and working areas with essential tools and infrastructure for the success and growth of new businesses. They often house spin-offs from university laboratories allowing them to strengthen their business model and study the technical viability of their project.

Toulouse University is also leading a France-Spain-Andorre transregional POCTEFA project aiming to boost innovation and competitiveness of companies named aCCeSS : a Crossborder CoopEration for Smart Specialisation. They are

doing so by linking technology transfer organisms to enhance collaborative R&D projects.

5.1.2.2. Innovation Center

The University system in Occitania supports innovation through innovation centers as well.

We count 8 "CRITT" or "Regional Center of Innovation and Technology Transfer" in Occitania, one of whom deals with the issues of Industrial Process for Environmental Technologies. These institutes were created from 1990 to bring together scientific and industrial actors in a given sector. They provide scientific expertise to SMEs that can't afford R&D center and make the link between public laboratories and industry.

There is also one "IRT" or "Research and Technology Institute" in Toulouse which role is to associate public and private partners to lead world-class research activities using the resources of related technological platforms. This collaborative environment allows to develop disruptive technologies of which maturity is in line with industry requirements.

5.1.2.3. Student Entrepreneurship

Students in Occitania can improve their business skills through professional guidance and entrepreneurship training in various universities thanks to management and entrepreneurship Masters. It is complete business programs that offer to the selected students a variety of courses, tutoring with professors of diverse disciplines and training in company that has as a result the entrepreneurship Business.

Students are encouraged to start an entrepreneurship project during their studies through the student-entrepreneur status proposed in France. They are then supervised by a Student Cluster (PEPITE) and the Business Procedure Center of Trade and Industry (CCI) and are offered a formation and a special support from a company director. In Toulouse, they can also be accompanied by the "Catalyseur" which aim is to be the missing link between students, laboratories and companies. It is a living place dedicated to innovation and entrepreneurship composed of a co-working area, a fablab, a showroom and an area conducive to friendly exchanges.

5.1.3. Oporto University

5.1.3.1. Technology Transfer

The University of Oporto is aware that creating an innovative product from the results of I & D, is not as "simple" as it may seem. It implies talent, creativity, vision, work and risk, but also a series of procedures that are fundamental to protect and externally value innovations with the university's own hallmark. Therefore, the University provides different services and programs whose main objective is to help transform the ideas that originate in schools and research centers in products that can reach the market and be marketed.

With the support of the Department of Innovation of the University of Oporto, any researcher, teacher, official or student (current or old) can enjoy a personalized follow up in all the steps that compose the chain of transfer of Knowledge. These include the communication of an invention, the protection of rights over an idea or technology (through a national or international patent), the identification of business opportunities, the establishment of contacts with the industry and, finally, the marketing and negotiation of this technology.

The transfer of technology is also an essential component of the entrepreneurial ecosystem of the University of Oporto. Of the technologies generated in the university has resulted the creation of spin-offs with high innovative potential. At this level, the University promotes several activities of support to the entrepreneurship especially directed to its researchers. This is the case of the BIP - Business Ignition Programme, a program intended for those who intend to develop a business based on technologies developed in the academic environment.

All these principles are at the base of the intellectual property Regulations of the University of Oporto (RPIUP), created in 2005. Through this tool, it seeks to provide its inventors with direct access to the benefits resulting from the valorisation of knowledge, thus enhancing the visibility and notoriety of the institution to industry, companies and Society in general.

5.1.3.2. Spin-off Creation

Within the framework of the strategy developed in the last decade to promote entrepreneurship within the community, the University of Oporto has structures to support its researchers and entrepreneurs who intend to form companies from Research and development activities of excellence carried out in the university.

Sustained in activities aimed at the protection of intellectual property and the institution of exchange systems and support for the transfer of knowledge from the University to society. This policy is particularly focused on the creation of spin-off companies, which are considered fundamental for the quality of services in the teaching, research and innovation systems at regional, national and international

levels.

To identify, validate and stimulate the creation of spin-off companies, the University of Oporto has a regulation that establishes the types of spin-off that can take place in the university, associating legal effects to the act of recognition of the companies and regulating the relations between companies, spin-off and the University. This recognition applies to teachers and researchers in schools and research centers, but also to non-teaching workers, students and former students, as well as former workers, teachers and researchers who can apply to Department of Innovation recognition of your company through the seal of the University of Oporto Spin-off.

With this seal, companies enjoy an ecosystem of entrepreneurial spirit and innovation, consisting of research units, incubators and innovation support services, which accompany them in the main phases of their growth and development, "opening lessons" to competitions, in definitive, approaching through the networks of contact of the university itself, to mature and established companies in the market, as well as to business opportunities and national and international financing.

The researchers of the University of Oporto can still resort to the services offered by the Park of science and Technology of the University itself (UPTEC) and by other incubators where the university has participation (NET-SA, LET-IN | INESC TEC, Inova. Gaia, the port Hub, etc.), in areas as diverse as training, support in business assembly, incubation infrastructure, networking and consultancy, among others.

5.1.3.3. Support for Entrepreneurship

The University of Oporto has been betting over the last decade for the creation of competencies, infrastructures and services capable of boosting the entrepreneurial potential that exists in the community. Among the offices of support to entrepreneurship and innovation, through actions of training and teaching related to entrepreneurship, competitions, workshops and conferences, there are many initiatives that have been materialized by all the poles of the University.

There are several entrepreneurs who found their place in the science and Technology Park of the University of Oporto (UPTEC), space destined to the incubation of innovating companies (start-ups), through a set of structures and specialized services, developed to meet the typical needs of the start of business activity.

The university, it also develops the potential of researchers seeking value through the application of their projects on tradable products or the creation of competitive spin-offs. of the various units and organizations that carry out this

mission, highlights the work carried out by the Department of Innovation, a body that offers different services in support of the transfer of technology and the economic and social valorisation of the Knowledge generated in the university.

5.2. EUROPE

5.2.1. Steinbeis case

Steinbeis has become synonymous with successful transfer of tangible knowledge and technology. Managed by entrepreneurs, Steinbeis Centers build firm and solid bridges between science, academia, commerce and industry, always focused on how everyone involved in the transfer will truly benefit.

Steinbeis network is a unique model of success: Steinbeis network of companies oriented to transfer is expanding within Germany and internationally to help all parties to exchange and use knowledge more efficiently and effectively. The professional experts of science, academic organizations, the market and industry, merge technology and management skills, thinking globally and acting locally, with impact and precision. With a decentralized structure, the Steinbeis network provides knowledge and experience in a wide range of topics.

The Steinbeis service portfolio covers:

- Consulting
- Research and development
- Training and professional development
- Evaluation and reports.

The network partners with clients of all sizes, from unique owners to large corporations. The objective is to help the greatest number of companies to access innovative technologies and methods and to access the technical knowledge available through the network, thus discovering solutions that meet their needs and achieve a successful transfer.

5.2.1.1. Structure and concept

The non-profit society "Steinbeis Foundation for Economic Development (StW)" acts as an umbrella organization on the Steinbeis network. The founding guiding principles of the foundation are established by a series of advisors and an independent committee. These are composed of representatives of commerce and industry, science and academia and the world of politics

The foundation promotes knowledge and technology transfer with a wide

variety of instruments. These include Steinbeis-Edition, the editorial arm of Steinbeis, which issues specialized written publications and edited by experts; the Ferdinand Steinbeis Institute, which promotes transfer by coordinating activities in the context of digital transformation and technological convergence; symposia on current technology and management issues where current developments are presented. To deliver a tangible transfer, the Foundation operates through individual Steinbeis companies.

The responsibility for all business activities related to knowledge and technology transfer, as well as Steinbeis' own core framework, rests in a Steinbeis subsidiary called Steinbeis GmbH & Co. KG für Technologietransfer (StC). It is StC who has the formal responsibility to take the reins of the Steinbeis network, accessing the knowledge and skills of more than 1,000 independently managed Steinbeis companies (transfer centers, research and innovation centers, consulting centers and institutes of transfer at the Steinbeis University in Berlin).

Several organizations work in partnership with the Steinbeis Network, including franchises (with the aim of entering foreign markets), start-ups and other companies in which Steinbeis has a stake to promote strategic knowledge and technology transfer.

Maximize what decentralizes, minimize what it centralizes: a creed in which firmly believe in Steinbeis. In fact, the interaction between these two opposing principles creates a fundamental strength of the Steinbeis Transfer Network. The Steinbeis organization is decentralized. The lowest level unit within the organization is Steinbeis Enterprise, each of which is directed by its manager as a company within the company. These companies take various forms: Transfer Center, Consulting Center, Research or Innovation Center, Transfer Institute or GmbH (German company with limited liability). At the same time, a common central framework defines its structure.

The Steinbeis transfer network links businesses of all sizes with the contacts they are looking for: experts trained to provide broad support to face the challenges in research and development, consulting and training and employee development.

Flexible and without bureaucracy burdens, Steinbeis companies follow the rhythm of the requirements of each client, taking advantage of the full scope of the experience found in the transfer network. The result: customers see that their projects are managed in a reliable and quickly way.

All the companies in the network are financed through customer projects. As a result, directors and employees adopt the role of 'transfer entrepreneurs', taking responsibility for their actions. The customer-centric approach is one of the key

elements of the corporate culture: each transfer provides the client with a specific benefit, often with decisive competitive advantages.

5.2.1.2. Service Portfolio

The service portfolio on which Steinbeis has based its success is:

a) Consulting: Steinbeis' extensive network of experts makes them a key contact for large corporations and small and medium-sized companies alike. It allows them to obtain all the benefits of the service portfolio, from brief consultations to extensive business consulting services and projects for the challenges at each stage of the value chain.
b) Research and Development: Innovations ensure companies an advantage in global competition. The Steinbeis Network not only implements research and development projects: they put their clients first, putting new knowledge and experience within range, in other words, a genuine economic asset.
c) Training and professional development: for employees in the corporate sector as well as for sole proprietors, lifelong learning is now crucial to remain competitive. Demonstrating solid professional skills goes hand in hand with keeping abreast of current developments by successfully implementing what has been learned.
d) Evaluation and reports: the experts in the Steinbeis network have the necessary skills and experience to evaluate the commercial potential and analyse the viability of business ideas and the chances of success of business plans. Detailed reports from experts provide guidance and guide decision-making processes while describing possible scenarios of solutions and suggestions. As a result, clients evaluate opportunities more accurately, minimize risks and address current and future challenges with greater confidence.

5.2.2. Fraunhofer Model

5.2.2.1. Fraunhofer's incomes

Fraunhofer is a German research organization with international recognition as a model of partnership with private companies. The main characteristics of the success mechanism carried out by Fraunhofer are presented below.

a) Transfer through the circulation of human capital:

Within Fraunhofer there is a technical transfer system based on the circulation of human resources. Specifically, Fraunhofer hires talented young researchers for a fixed period. After those researchers have gained experience and built personal connections, Fraunhofer sends them to the industry. After moving on

to the industry, these same researchers commission R&D to Fraunhofer, thus becoming Fraunhofer clients. This circular model is the common basic mechanism in the Fraunhofer research institutes

The researchers remain in Fraunhofer between five and seven years on average. During their first and second years, they are entrusted with project parts or individual topics of larger projects, and as a result they gain experience as researchers with the achievement of each objective. In their third year, they are entrusted with small projects and are expected to manage delivery times, communicate with customers and calculate benefits and losses. Finally, they are placed in supervisory positions as leaders of one or two main projects, where they experience a practical understanding of management. In this way, researchers are required to improve not only knowledge but also experience as managers who can quickly capture industrial trends.

Therefore, there is a circular system in which researchers who leave Fraunhofer to join private companies become R&D supervisors who then carry out research projects with Fraunhofer. In the words of Fraunhofer, it is about "technical transfer achieved with the human brain".

b) Research Autonomy

Another characteristic aspect of Fraunhofer is the autonomy of its research institutes and the strong authority that institute directors possess. At least nominally, all 67 of their research institutes focus on different research topics. Of course, the peripheral overlap of the fields creates some competition among the institutes, however, such competition is really welcome rather than discouraged.

The directors of the Fraunhofer research institutes have great self-reliance in the areas of operation of the institute, personnel matters and the selection of research topics.

It should be noted that in Fraunhofer's philosophy, because of being an applied research organization, they must always understand market trends and respond to its changes by carrying out research activities at the present, but monitoring the future demand.

c) Fraunhofer model based on the private contract:

Fraunhofer has an institutional financing framework linked to the results in which the subsidies for the next year increase in relation to the research income by the contract of private companies. In general terms, this scheme, known as the Fraunhofer model, has been used without modifications since it was approved by the

German Cabinet in 1973. The key point is that, instead of simply relying on proportion, institutional funding increases according to larger amounts of research by contract, the scheme encourages institutes to actively accept contractual research by private companies based on compliance with their missions as public research organizations, specifically through the implementation of competitive research and the application of funds for projects. The subsidies for operating expenses are composed of four elements.

- Research funds of 600,000 euros that are distributed uniformly to all research institutes
- Research funds equivalent to 12% of the full research budget of the previous year. The amount varies according to the size of the research institute.
- The amount corresponding to the revenue from contractual research of private companies is calculated as 10% when the revenue from contractual research of the previous year falls below 25% of the research budget, 40% when it is between 25% and 55%, and 10% again when it exceeds 55%.
- 15% of the amount of competitive financing accepted by the EU.

Of these points, the third is an exclusive rule of Fraunhofer. The basis of this calculation is the following: when the income from contractual research falls below 25%, it is considered that the research being carried out by the institute does not have enough demand in the market. On the other hand, when these revenues exceed 55%, it is considered that the institute is excessively partial to corporate R & D and not sufficiently involved in an investigation that is consistent with its status as a public research institute.

5.3. USE CASES OUT OF EUROPE

5.3.1. The Engineering Research Center Program, USA

5.3.1.1. Objective and overview of the programme

The Engineering Research Center (ERCs), sponsored by the National Science Foundation (NSF), is a group of interdisciplinary centers located in universities throughout the United States, each in close collaboration with the industry. Each ERC provides an environment in which academia and industry can collaborate to achieve strategic advances in complex systems and level technologies in systems that have the potential to generate new industries or radically transform product lines, processing technologies or methodologies. delivery of services in current industries. The activity within the ERC is at the interface between the culture of science based on discovery and the culture of engineering based on innovation.

The centers provide the intellectual base for the industry to collaborate with professors and students in the resolution of long-range generic challenges, producing the necessary knowledge base for constant advances in technology and its rapid transition to the market.

ERC industry teachers, students and partners integrate discovery and learning in an interdisciplinary environment that reflects the complexities and realities of real-world technology. The ERC exposes prospective students (graduates and non-graduates) to industrial viewpoints to develop proficiency in engineering practice and produce engineering graduates with the depth and breadth of education necessary for success in technological innovation and for leadership effective interdisciplinary teams throughout their careers. It is expected that ERC innovations in research and education will have an impact on curricula at all levels, from pre-university to permanent learning, and that they will be disseminated among their academic and industry partners and beyond.

The National Science Foundation (NSF) states that the goal of the ERC program is "to create a culture of innovation in research and engineering education that links scientific discovery with technological innovation through 'transformational engineering systems research' and 'education'". The "transformational" world means the ability to change something or have transformability. Therefore, another way to establish the objective of the ERC program is "to create new engineering systems and train people to direct them in order to transform existing mechanisms".

The ERC program is considered a model case among the strategies to support the establishment of university research bases in the United States. Many universities are oriented to research in the USA. They establish Engineering Research Centers (ERCs) that are outside of their usual educational and research organizations, usually formed by faculties and departments. The ERCs serve as places where disparate specialty researchers come together to carry out interdisciplinary activities that go beyond the existing academic fields. In many cases, industrial and social needs cannot be resolved by focusing on a single academic field, and, therefore, university CKDs play an important role in industry-academia collaboration.

For "transformational engineering systems" and "methods for building transformational engineering systems", the ERC program receives proposals from researchers and analyses them. Then, for those you select, it provides support that initially lasts ten years. The focus of the program is characteristic since it mainly considers:

- Integrated promotion of education and research: the knowledge gained through the program should be incorporated into teaching materials and curricula, and strategies to develop human resources to lead the next generation should be translated into explicit knowledge.

- Search for interdisciplinarity in several ways: "Transformational engineering systems" are based on the execution of research that unites different fields and, therefore, the members of different actors must participate in its construction. For example, collaboration with other universities (and the participation of at least three instructors and three students from each university) is essential and the participation of private companies is desired. In addition, if the various interested parties cooperate substantially or not, it will be confirmed through annual visits to the site. The objective is to achieve interdisciplinarity not only of the fields but also of the participants.

The program is achieving very good results that are reflected through the various impact surveys conducted, the results of the ERC's independence from the NSF's aid, the educational development of university graduates, as well as the high percentage of students who ends up working in the industry.

6. IMPROVEMENT GUIDES

6.1. GENERAL GUIDES FOR IMPROVEMENT

After the presentation of the situation of the K&T transfer and challenges, in order to improve the effectiveness, small concrete actions will be presented below as a guide for improvement

As it has been experimenting lately, the K&T transfer is a long and expensive process whose returns and impact are most of the time visible in the long term. However, it is possible to propose a long-term action plan with small short-term strategies that allow the impact to be evaluated in a shorter time than expected and to achieve the objectives set.

6.1.1. Strategic field

Some of the strategies of action could be the following:

- **Prioritization and exploitation of the system's strengths and opportunities**

In this sense, it is proposed to focus resources on strategic sectors due to their real capacity and/or potential of increasing the competitiveness of the SUDOE region. For example, in leading or emerging companies with high growth potential.

In addition, a commitment to models that have proven their effectiveness in the SUDOE environment is also necessary. The public system cannot continue to support the current multiplicity of campuses, parks, centres, foundations, etc., with equivalent or overlapping functions

- **Multidimensionality and multidirectionality**

The K&T transfer must be an activity in which all sectors and agents of the system play, moving in all directions without remaining stuck in the linear model between academic institutions and industry.

The multidirectionality must be reflected in the functions and the work plan of the Tech Transfer, which implies being attentive to the needs of the industry.

- **Internacionalization**

K&T transfer should not be approached from a local perspective, but should be internationalized at all levels.

6.1.2. Structural, organizational and management aspects

In the structural, organizational and management areas, they stand out:

- **Redefinition of the management model of K&T transfer structures**

The management model requires a restructuring and a new definition of the roles of each agent and their competences and responsibilities, in order to achieve fundamentally the following objectives:

- Avoid redundancies in the process
- Cover the process chain completely.

There is not a unique management model and it is necessary that each organization adapts and looks for the most appropriate structure, always bearing in mind that the K&T transfer is responsibility of all the agents: management, researchers, managers and Tech Transfer.

When defining the structure and management models it is also important to take into account aspects such as:

- Roles and responsibilities
- Size of the different agents
- Definition of the management type to be carried out
- Statement of objectives (long and short term)

- **Coordination and integration of efforts and resources**

In order to arrive to a model that not only is effective but it is also efficient, it is necessary that both resources and efforts are coordinated. The more local the activity, the more important this aspect is. Some of the measures to be carried out are:

- Pooling services that require critical mass for its viability.
- Proceed the work of agents with the same or similar functions.
- Specialization according to the strengths and capabilities of each organization.

It is important not to forget promoting the network of agents that are dedicated to the early identification of K&T transfer opportunities.

Finally, the development of integrative models in which private and non-profit dynamic agents take over and limit the risk of the earliest phases must be addressed,

enabling the projects to progress to the level of maturity necessary to capture the interest of capital and the industry.

- **Improvement in the management of processes and resources**

  In order to refine and improve processes and resources, we propose:

  - Rationalization of processes, eliminating unnecessary redundancies and improving efficiency.
  - Unification of procedures of funding agencies.
  - Reduce the workload in financial aspects such as audits.
  - Redefinition of those responsible of administrative tasks.
  - Improved documentation and traceability of management.

- **Indicators**

The definition of some quantitative and qualitative identifiers, allowing the measurement of the impact and improvement of the K&T transfer activity in the different relevant areas over time, such as economic activity, impact, culture change, quality improvement of life, etc.

To complement this, it will be necessary to define another number of intermediate indicators that allow the activity to be assessed and help guide the progress in the right direction. Some possibilities to carry out this monitoring can be: the number of patents, number of researchers dedicated to innovation and K&T transfer, number of contracts with companies, etc.

6.1.3. Management of human resources and their training

In human resources management and training, some of the following initiatives could be carried out:

- **Professional development of TCyT technicians.**

Find specific programs for researchers in order to professionalize and improve the stability of technology transfer teams. Contribute to the system with those agents capable of contributing to the complementary functions of researchers, such as business development, business management, marketing, etc.

The proposed actions are: support programs for the hiring of highly qualified and experienced professionals to K&T transfer teams, inclusion of a variable part in the remuneration of the K&T transfer professional, subcontracting of some K&T transfer services or specific training programs for professionals of the K&T transfer.

- **Recognition of the role of knowledge and technology generators**

Recognition of the merits of K&T transfer in the professional development of scientific researchers and technologists.

6.1.4. Awareness and creation of a culture of technology transfer

- **Training on K&T transfer**

It is important to address the specific training of personnel dedicated to K&T transfer to all agents regardless of their roles and responsibilities within the K&T transfer process.

It should be noted that this training is essential to do it both in academic centers and in the field of business and industry, always focusing training from the point of view of each of the organizations.

Including this training in business schools would be another remarkable initiative with a great impact.

- **The «transfer of people»**

Promote the mobility of human capital through different actions:

  - Doctorates and end of degree assignment in the field of industry and working in them.
  - Postgraduate and PhD student mobility programs, as well as exchange of academy-company personnel.
  - Use and enhancement of resources available in the system, such as university-business networks.

- **Social awareness towards K&T transfer**

Awareness campaign of public and private authorities on the relevance of the K&T transfer for the development of the country, as well as campaigns to promote the culture of transfer in organizations where knowledge is generated.

This type of campaigns must also be exposed to the public in general, in order to value the impact of science and technology, improving their quality of life.

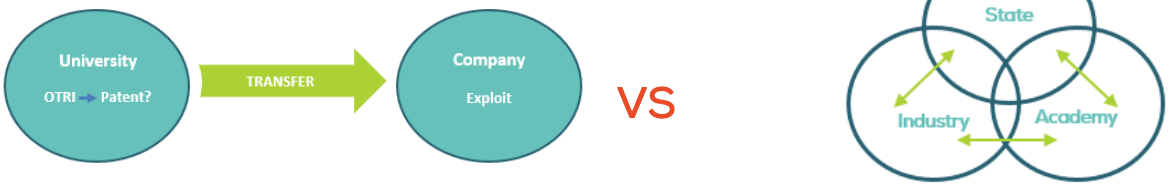
As it was mentioned previously in the three helix model, the society is taking part of the process more and more and the social awareness is considered a key factor to enhance the technology transfer.

6.1.5. legal and financial environment

In the legal and financial environment, it is necessary to update the different laws and regulations discussed in previous sections, as well as to facilitate access to financing to carry out K&T transfer activities. In addition, mechanisms and incentives must be sought for organizations, such as tax incentives or research grants.

7. CONCLUSIONS

To summarize, it is important to know that the K&T transfer is the process by which innovation carried out in research within an institution is transferred to society and whose model has evolved from a linear model transference (linear and unidirectional approach and an excessive emphasis of patents as the main knowledge transfer vehicle) to a triple helix model (multidirectional approach and use of different knowledge transfer vehicle)



On the one hand, among all the agents involved in the K&T transfer it is necessary to remark:

1. Universities: carry out the creation and management of research projects, patent and undertake, in addition they share knowledge and support services for companies and mobilize human resources.
2. Technology Centres: are non-profit entities, legally constituted, that are created with the aim of contributing to the general benefit of society, improving the competitiveness of companies through the generation of technological knowledge, carrying out R & D activities and developing its application.
3. Spin-Offs: person or group of people leaving the company where they are working to create a new company linked or supported in some way by the existing company, of which this person was a member.
4. Start-Ups: Small or medium-sized company of recent creation related to the technological world. It differs from other companies in that the business idea is innovative and evolves in a phased manner until it becomes profitable.

On the other hand, it is important to highlight the different channels of K&T transfer; Living labs, Mixed clusters, Creation of spin-off, Patents, Licenses, Contracts of services, Collaborative public projects (H2020), Private collaborative projects, Mobilization of human capital, etc ...

Generally speaking, there is a room for improvement in K&T transfer, for all the agents involved in the different models. From different points of views, it is recommended:

- Strategy:
  - Prioritize and take advantage of the system's strengths and opportunities
  - Take advantage of multidimensionality and multidirectionality
  - Internacionalice
- Structural, organizational and management:
  - Redefinition of the K&T transfer structure management model
  - Coordination and integration of efforts and resources
  - Improvement in the management of processes and resources
  - Obtain metrics (KPI's)
  - Professional development of K&T transfer technicians.
- Scope human resources and their training:
  - Professional development of K&T transfer technicians
  - Recognition of the role of knowledge and technology generators.
- Scope awareness and creation of a culture:
  - Training in K&T transfer
  - The «transfer of people»
  - Social awareness towards K&T transfer

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