Strengthening Partnerships Between Universities and SMEs Within the Open Innovation Framework

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Abstract. Since about twenty years, the theme of the innovation marks the public's policies of the European Union. In this context, on one hand, universities are incited to value the result of their research; on other hand, SMEs are encouraged to strengthen their capacity to innovate. The common sense might suggest just that these two types of organizations just have to work together remove a mutual benefit from it. Unfortunately, relationships between academic and socio-economic world are struggling to establish themselves and remain largely focused on large companies. Studies led on collaborations universities-SMEs or on technology transfer from University towards SMEs draw up balance sheets more than very reserved. This state of fact continues in spite of the various structures of intermediation set up by the public authorities since more than a dozen years. It is therefore urgent to consider new forms of organization. In this context, this article presents an original structuring of the valuation of the research in of a university in order to answer the question.

Keywords: Open innovation · Organizational change · University and SMEs

1 Introduction

Since twenty years, public policies of European countries are strongly involved on the theme of innovation as a vector of the economic development. In this field, becoming particularly aware of the economic importance of SMEs and their ability to create and develop jobs, Governments decided to promote innovation in SMEs.

In order to act in this field two axes of stimulation were set up. First, universities have been encouraged to disseminate and enhance the results of their research [1]. Second, SMEs were encouraged to strengthen their capacity of innovation to better face the technical and economic changes and to contribute to the creation of new jobs [2]. In this beneficial framework, common sense would have wanted that universities and SMEs are moving closer to work together. Each entity would have its role in the economic chain. Universities would spread their knowledge and would transfer their technologies towards SMEs which would incorporate them into their new products commercially meaningful. This virtuous partnership to spread to the civil society the innovations, to participate in their own economic development and thereby feeds the needs of the citizen.

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Thus the joint efforts of both sides would be beneficial to the development of the economic development and in the employment in the region where they are located [3]. This essential notion would so allow to reveal universities as strong actors of the regional economic development.

In reality, in France, studies show that less than 10% of innovative SMEs used regularly to external information sources [4]. From both SMEs and universities, several reasons explain this situation. SMEs have opposing characteristics. On positive side, they are predisposed to innovation because their size allows them to have flexibility in their organization, a good reactivity as well as a great proximity to their customers. But on negative side, they are penalized by the lack of human and financial resources. Add to these elements, heads of the company, yet at the origin of new ideas, are too often involved in short term. That strongly impacts their power of innovation [5–7]. They have difficulty to grasp the necessary changes to adapt them to the new key success factors. SMEs lean essentially on their internal design skills. These are not enough differentiating, and includes very rarely skills outcome of research [8]. The low absorption capacity of the new knowledge of SMEs further complicates this aspect. Focused on their technological business [4], SMEs are struggling to evolve their basic skills. Aware of these shortcomings, managers of SMEs complain that there is no system of support simpler innovation for them [9] and does not turn of themselves towards the universities.

Universities are deeply rooted in their historical missions: teaching and research. The United States aware of the decline in their economic competitiveness voted in 1980 the Bayh-Dole act that deeply changed American public research. Universities were encouraged to commercialize the technologies developed from their research results and to hold patents. Technology transfer offices were then created for this purpose [10]. Gradually an economy of science settled down in the service of the economic development of the country [11]. In the 1990s, Europe has decided to follow the same direction and to give the universities a third mission: the valorization and dissemination of research results. Because of these changes, universities were encouraged to take part in the development of the capacities of innovation of the SMEs. However fearing that the marketing becomes the goal of the academic research [1], oppositions have emerged. Policy choices had difficulty in being set up because of the culture shock between the functioning of researchers and business leaders. Indeed the objectives of researchers are in connection with their intellectual interest and recognition of their scientific community. They are more attracted by high-tech projects than by the real needs of SMEs, especially when the latter are of low-technology level. Recognition of academics is based on the scientific notoriety while the recognition of the head of SMEs confronts in the economic results. This cultural gap has not favored the emergence of fruitful exchanges.

So, generally, SMEs prefer to innovate in house so going without the differentiating impact that research could bring to him. Even if overall SMEs innovate, they are very far from to integrate innovation at the heart of their strategy. Truly innovative SMEs represent only a small part of all SMEs. So, the role of each of both entities remains regrettably separated. The zone of co-creation, yet essential to the intersection of interests, and crucial for the cross-fertilization, remains empty. It raises a real problem for

the development of the territories even though the University could fully contribute to their development.

In order to promote the innovation in SMEs and ensure a rapprochement with universities, multiple initiatives to bring the SMEs and the universities closer were launched in the years 1980 to 1990, and then in the 2000s. The national and regional public policies have created various structures of intermediation between the academic and the economic worlds. Without exhaustibility, we can quote the technological platforms, the incubators, and technology parks first. In a second time, in France, came the poles of competitiveness and the thematic research institutes and the regional poles of innovation. The balance sheets of its experiences [5, 12–14], realized decade after implementations are very reserved. The main criticism concerns the fact that the structures settled on the territories have not really contributed to the expected economic development. Similarly the more qualitative benefits of these structures - learning networking, mutual confidence between stakeholders within a territory, intensity of informal trade - have not sufficiently valued. They are always very difficult to quantify.

In this framework, this paper presents the initiative of a French University (the Université de Nantes) that decided to directly answer the problem. It has implemented its own structure of interfacing with the socioeconomic world which is both totally in adequacy with the needs of SMEs and in line with the expectations of researchers. In the spirit of entrepreneurial University [10], the University of Nantes created, inside a private subsidiary company, a new profession, that of "technology maker" or "maker of innovation" at the confluence of science and the economic development of companies and of its territory.

2 The University Group a New Concept

Universities and particularly large multidisciplinary universities with their numerous laboratories and teaching departments represent a great potential of knowledge and know-how very important for a territory. However this great wealth is also hard to read by all of the socio-economic world. In order to actually serve the economic development and allow companies and especially SMEs to better understand what they can offer, the universities must organize themselves clearly. It is necessary that the universities clearly present their technology offerings and services that implement them to be able to work effectively with the companies. The details and internal structuring of universities do not interest companies and have to stay in background. Only, reputation and scientific radiation of the University are enough to attract the interest of companies. Universities must therefore only present the answers they offer as do all economic providers to companies, because only the technical efficiency interested the companies. The University of Nantes do that around the concept of the university group.

2.1 Global Context

The academic researcher work for a long time with the companies. However in most cases this is collaborations through collaborative research with major companies. These

actions are often conducted in a totally independent manner by different researchers without clear organization within the University. This creates a fuzzy on what is actually carried out. This led the company to think that partnerships with the University can be done only within the strict framework of the research. That's why, academics do not appear as real economic allies to companies and notably SMEs who do not search knowledge and promising innovative solutions. Unlike large companies seeking science in collaboration, SMEs search only mature technologies and quick answers to their market.

Of course the historical profession of the University is the creation of new knowledge and collaborative research work is a voice to allow the transfer of research results. Now, in this context, regularly, universities share IP with companies and thus ensure financial returns. But the universities should not settle only for those activities which are within this framework mainly for large companies which in France represent only 5–6% of the socio-economic world. In keeping with their mission of valorisation, it must be able to support the needs of all of the companies. In this context, it must be able to implement the structure necessary to make sure that all companies can find the solutions they need.

There is a specific scale to set the level of technological maturity of a technology. It is the TRL scale (acronym for Technology Readiness Level) with 9 levels. This scale is now also used to estimate the levels where is an innovation vis-à-vis the market. A project on level ranging from TRL 1 to TRL 3 corresponds to a research activity. Levels from the TRL 4–6 match to the level of high R&D. Finally, levels of TRL 7 to 9 corresponds to technological levels. The TRL 9 indicates a technology is ready to be launched on the market. The products are ready to be marketed.

With this scale we can also define the needs of different types of companies. Thus, a large company will come to work with a laboratory on levels that can be of level 2 or 3. That is to say in the upstream phase of creation of knowledge. These companies typically own in-house service that have the capacities to understand the research results and to conduct R&D activities. Of course they have all the downstream engineering services to transform the results of R&D into products (TRL 6 to 7). The smallest but very innovative companies usually have an R&D department and therefore have in-house services to work with a laboratory at the R&D level (usually on TRL 5 or 6). And to complete the innovative classic SMEs own only an internal engineering service working from the level of TRL 7. The rest of the SMEs are generally equipped with a technological service intervening on the last levels 8 and 9, to adapt their products.

According to this description, it is clear that if a university wants to be able to work with all the companies, it must be able to carry out its missions on all the levels of the scale. Obviously, through its laboratories, universities master TRL 1 to 3 perfectly and for a multidisciplinary university in many scientific fields. By extrapolation, and even if this is not their professional priority, during a short period, researchers can also work on TRL levels 4 to 6, notably in the collaborative framework of open innovation. It is therefore clear that the challenge for universities is to be able to acquire a complementary structure that will ensure, alongside researchers, levels TRL 7 to 9 and to manage permanently the activities on TRL 4 to 6. The University of Nantes set up such organization within the framework of its concept of university group. Thanks to that, it can now work with all companies whatever their needs. Its activities with companies can go

from the research to the realization of technological solutions relying on all its potential of knowledge. The university is now becoming a fully actor in regional economic development. The following sections describe the global organization and the specific structure that was set up.

2.2 The Approach of the University of Nantes and Global Structuration

The University of Nantes is a large multidisciplinary university covering the major disciplinary fields of science and technology, health, humanities and social sciences, and law economics management. Thanks to this wealth of knowledge and following public incentives previously mentioned, the University should have become one of the major players in the regional economy. However, about ten years ago, the University of Nantes became aware of the very low impact which it had on the regional economy and in particular the SMEs that surrounded it and which represent more than 92% of the companies in the territory. Although the relations between the university and the major groups were still to be strengthened, its relations with SMEs were almost entirely to be created.

On the strength of this observation, to be able to set up a real dynamic of relations with all companies, the University of Nantes decided to deploy a global strategy. For that, it decided to work on two complementary axes in order to set up an activity to support all the companies in its territory, regardless of their size, large or small.

The first point of the strategy was to define clearly from its areas of competence the generic economic offers that it could provide to companies and to centralize the general communication of its offers on a single highly visible point. On the innovation aspect based on the research results, the second point of the strategy focused on the creation of an interface structure with the socio-economic world. This one, which is responsible for providing simultaneous support for researchers and companies in their relations, is the real heart of the exchange and of the round-trip process between academics and companies. This structure is presented in more detail in Sect. 3. It should be noted as we shall see it, in the diagram of Fig. 2, the same approach was initiated on the training aspect for company.

To introduce the presentation of the interface dedicated to the innovation, the following part presents the economical generic offer and the general organization of the university with its three interfaces. Section 3 is devoted to the interfacing structure dedicated to the support of innovation and the profession of technological maker.

To meet the needs of the companies, the university has simplified its language and proposed three generic offers. These are defined in terms of action which the client companies have to implement in order to develop their economic performance. These offers leaning on research and teaching jobs of the universities are described in an “action vocabulary” and are focalized on the needs of the companies. These three generic offers are: INNOVATE to ensure your differentiation on your markets in face of your competitors; UPDATE SKILLS of your companies by training your employees in new technologies; RECRUIT graduates from university to develop human resources. To carry this global business message and be in permanent connection with companies, the

University of Nantes set up a specific service called “space for companies”. Figure 1 below shows the overall offer of the university in simplified form.

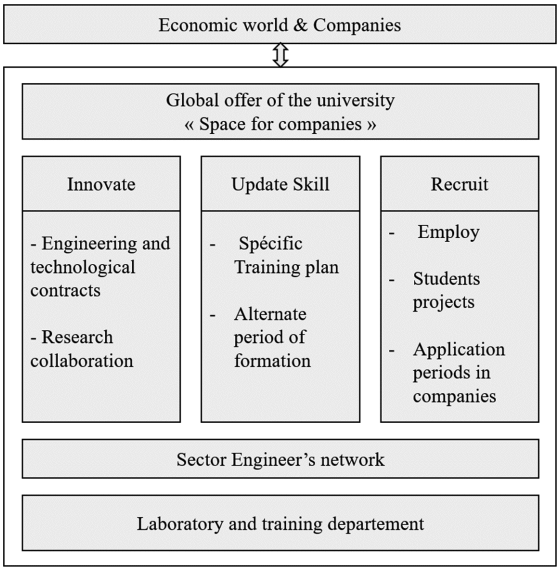

Fig. 1. Organisation of the offers of Université de Nantes to the companies.

On this diagram we find the “space for companies”, the three specialized structured each responsible for the realization of a one of three offers, as well as laboratories and teaching departments. Meanwhile the diagram also shows a network of sector engineers between the laboratories and the interfacing structures. These last connected to the “space for companies”, have the role of constantly animating and monitoring everything developed by the teacher-researchers within the establishment. It allows to keep a constant watch on the activity of the university in order to feed the permanent creation of new technological offers developed by the interfacing structures.

Each interface is able to answer directly to the companies and act directly in many case. But the “space for companies” is able to answer widely to the companies and could help the SMES to formulate clearly the request. In summary, it is a key to enter in the university for the lost companies. With this organization the university group answer to the economic world in each level. Private or internal status of the interfaces is chosen to be the most effective in their work. However, regardless of the status of the interface, the functioning of its activities requires a private economic model in order to make sustainable activity.

The diagram in Fig. 2 below shows the functional and synergistic organization of all the different structures at the university group. Around the classical structures of the laboratories and training departments we find the three specialized interfacing structures. Some of the structure are in private form, but the university still owns them. Others are internal services of the university.

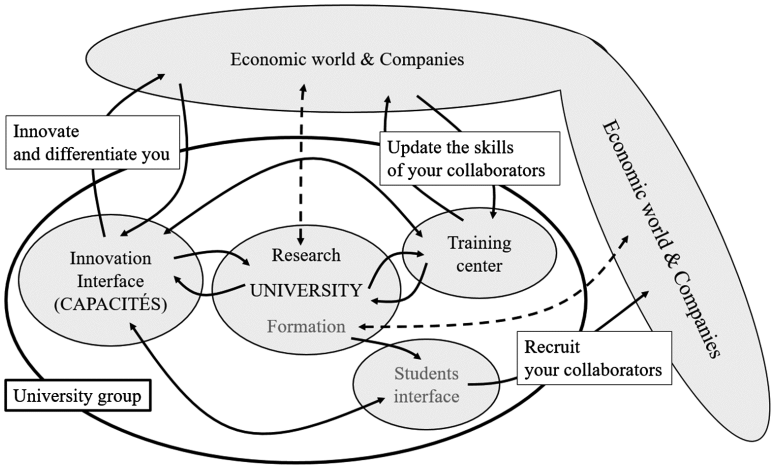

Fig. 2. This scheme represents the concept of the university group with the three incentives.

The concept of the university group thus corresponds to the set of all internal and external structures. They all share the same image with companies. As indicated by the various arrows, all the structures work closely together in order to ensure a high reactivity and to ensure simultaneous response on all aspects if necessary.

This work of permanent exchange also makes it possible to make transverse innovations. The university answer to the companies thanks to the all part of the system but quite particularly thanks to his private interface CAPACITÉS, which is the most original feature of the system. That why, in the last part we make a specific focus on this interface dedicated at the innovation.

3 The Interface for "Technological Maker": CAPACITÉS

Thus the interfacing structure dedicated to the innovation is CAPACITÉS set by the university in 2005. This is the subsidiary company of the university. The private status of the subsidiary is a major asset in the relationship that maintenance with its private clients. Thus fully integrated into the university group, it is also fully integrated into the economic world. To further increase its visibility, in 2015, the university opened the capital of CAPACITÉS to the Chamber of Commerce and Industry of Nantes. The shares are now held by the university at 93% (which thus keeps the whole control of its subsidiary company) and by the Chamber of Commerce and Industry of Nantes at 7%. CAPACITÉS presents a turnover of 5 M€ and account about 65 employees. It has for object to realize the activities of transformation into generically technology the results of the research of the university. And from these it has to create an offer of services to help companies integrate these technologies into their products or processes. The employees of CAPACITÉS work directly in the laboratories in rented offices. So, in one hand, through this proximity they work closely with researchers to develop sources of innovation through internal R&D. On the other hand, as partners of companies, they are

constantly listening to them and especially SMEs. From this permanent economic watch, they are able to understand the needs and therefore to work in anticipation to find solutions from sources of innovation that they master. If the use of existing knowledge and know-how does not provide suitable answers, then they can seize associate researchers to remove the technological or scientific locks. In this case, the staff of CAPACITÉS help the company to define and to write the expected specifications. Similarly, when researchers deliver scientific results, they accompany their clients in the implementation of the results and in their integration. To carry out its missions CAPACITÉS is organized in "team of skills". Each one is composed of engineers and technicians who works within the laboratories (half of them are PhD). Their role is to develop the sources of innovation and to put in place the activities necessary to enable the client companies to use them. Each "team of skills" has its specific domain in relation with the scientific domain of the associated researchers. To carry out their missions engineers remains permanently link with them. To ensure a strong and symbiotic link with the laboratory teams, each team is supervised by a researcher. Latter may be involved alone in the laboratory or be accompanied by other researchers associated with the project. But whatever the situation, the teams are integrated into the laboratory valorization policy. Internally a team is managed by an engineer who assumes the roles of business manager and project engineer at the same time. Each team has it proper business model to assume under joint responsibility of leading researcher and engineer the economic profitability of the activities of team.

The schema of the following Fig. 3 presents the forward-return cycle between the business world and the world of research that the staff of the cells has to insure.

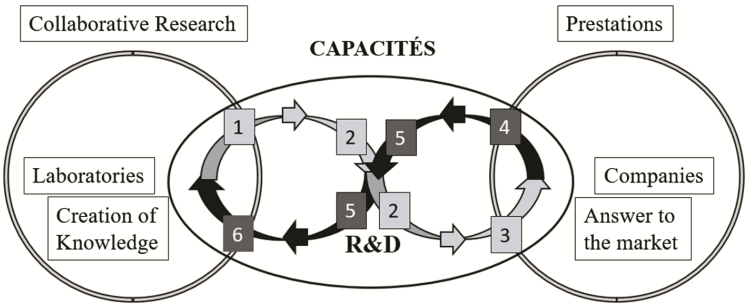

Fig. 3. Organisation of the relation between the Université de Nantes and the companies.

This permanent cycle allows alternatively to feed a world while recharging at the same time before returning to feed the other world there also to be recharge. In this cycle: the first part goes from the world of research to the business world (step 1 to 3); the second from the world of business to the laboratories (step 4 to 6).

The various actions carried out at each stage of the first part are: step 1 (know-how sharing between the laboratory and the associated team); step 2 (Internal process of R&D. Engineers use of the know-how to turn knowledge into potential solutions (generically technology). In this step the stall of the team of skill create value and sometimes transform it into patents); step 3 (the engineers provide innovative answers to companies

using solutions from the previous step). The actions carried out at each stage of the second part are: step 4 (watch services on the future needs through exchanges with the company, listen and analysis of needs in order to anticipate); step 5 (Internal process of D&R. In its step it is the opposite action of R&D. In this action the engineers dismount the needs in order to analyze the needs and to look for new needs of science); step 6 (the engineers provide the laboratory with new technological or scientific locks and question the laboratory).

The Fig. 4 below describes how the relationships between the teams of skills, laboratories and companies are organized.

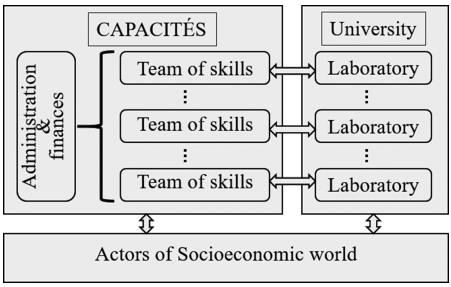

Fig. 4. General organisation.

The development of a team of skills is another way to cultivate and ensure the increased use of research innovations, especially by SMEs. It is also a complementary form offered to researchers who wish to be involved in the development of research while remaining fully active in research. In the past, the only solutions were the creation of start-ups. With this solution all parties are winners: all the companies including SMEs, university and researchers as well as economic territory. The university is very often vertically organized in silos. Every scientific skill remains in its laboratory. Indeed, even though transdisciplinary research projects are developing, science is still very disciplinary. However, the needs of the companies are obviously global. CAPACITÉS with all its teams works as much as possible in a completely transversal way to associate all the sources of innovation that it has in the teams. Indeed, turned towards the permanent development of new solution the engineers of different teams organize themselves as they wish to answer their customers.

4 Discussion and Conclusion

The universities must become real actors in the economic development of their territory and irrigate companies with their sources of innovation. To do this, the universities must develop a new profession as technological maker and accompanying companies. In [7], Haussmann describes how limitation that have the companies forms barriers to turn their knowledge of the market into products or services. The combination of the new skills of the university with its traditional research skills and market skills of companies is a response to its limitations and especially for SMEs.

The choice of the university to create its subsidiary and the team of skills approach respond well to future challenges of territorial economic development and the aspirations of researchers. The creation of start-up to valorize the results of the research, introduced for nearly 20 years, as the way to stimulate the development of innovation, has left aside many people and has not kept its economic promises. With hindsight, a large number of start-ups disappeared rapidly or remained at very precarious stages of development. The creation of a start-up must lead to a quick development of the business and when the initial investment is very important. Of course, in this context, creations are necessary, but many project of start-ups, at least at the beginning, often find themselves faced with the same problems as SMEs, even though they have a high absorptive capacity. Like SMEs, they can benefit from the support of the subsidiary. Thus everyone finds himself there: the companies by constantly differentiating themselves from their competitors; the academics being continuously involved in the valorization of their works but remaining fully involved in their research. So, implementation of a team of skills within the subsidiary of the university is an interesting solution. It allows a researcher to associate his activities of research to a team of valuation. Settle all activities beside those the other teams, within the same company, allows to strengthen the economic weight of each unit by aggregating it to the others. It does not create many fragile societies, but a stronger company given a better visibility to the university.

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