Processes and actors in technology transfer and commercialisation

The relevance of innovation for economic growth and competitiveness has resulted in increasing attention to the processes through which ideas and knowledge are transferred from public research organizations to the marketplace. The pace and effectiveness of such processes has a substantial impact on the contribution of the respective public investments to economic development, and calls for awareness regarding its attributes and the actors involved.

How does the process of technology transfer and commercialisation unravel?

Technology transfer and commercialisation do not evolve naturally and linearly from research and the discovery of scientific solutions. Often, unfavorable economic conditions and inadequate supply of complementary services form obstacles for commercialisation. On other occasions serendipity and chance become keys to success for these multi-actor and multi-stage processes. Commercialisation processes are executed via both, formal and informal channels and mechanisms including:

- R&D collaboration of universities and PRIs with firms: In general terms, R&D collaboration presumes a stable link between universities and PRIs, on the one hand, and private firms, on the other, with an objective to develop or improve a specific innovative product, process or service, or a range of those.
- IP licensing and sales by universities and PRIs: contractual mechanisms that require and incorporate the monetary value of exploitable scientific discoveries and that clarify ownership and exploitation rights. They constitute the formal channels of technology transfer and commercialisation; their institutionalization is a key requirement for unlocking the potential of new scientific discoveries, while they become a clear incentive mechanism for knowledge production.
- Spin-off firm creation by universities and PRIs: a spin-off firm refers to new business created around a technology as opposed to licensing a technology; their creation is a core processes supporting technology transfer and commercialisation. Spin-off firms are a natural vehicle for bringing new products and services to the market since they combine both research and entrepreneurial skills.
- Consulting and extension services by universities and PRIs: universities and public research institutes do not only actively participate in direct research and development activities but also often share their soft innovation skills through a set of mechanisms including advice, consultancy and extension services. These mechanisms are usually realized through formal or informal links between the scientific community, business and/or government and may be a result of either contractual relations or informal contacts.
- Placements and sponsorships: schemes to assist strengthening the science industry links by means of direct involvement or financial support. Sharing human and financial resources assists in the fusion of ideas and objectives and ensures the commercial relevance of conducted research.

Which are the Key Actors participating in the technology transfer and commercialisation process?

The technology transfer process is executed by the active participation and support of various actors [1] whose main role is adding value to the process and acting as a core node of the supporting system. Key participants in technology transfer and commercialisation include:

- Scientists and engineers: are the main sources of knowledge generation and sustain the continuous supply of new concepts and ideas that can become commercially relevant. Scientists may also be initiators of industrial partnerships and intellectual property transfer. Other contributions to the technology transfer process include their active role in the development of prototypes, their direct involvement in spin-off creation and their indirect support to the process through the provision of knowledge services (e.g. project evaluation, consulting).

- Universities: in addition to their education and research activities, during the last few decades, universities have been placing increasing emphasis on the exploitation of newly produced knowledge in markets and the wider society. Such orientation has turned universities into the key host of core institutions, such as, technology transfer offices, technology incubators and extension service providers that specialize in technology transfer and commercialisation activities.

- Public research institutes (PRIs): contribute to various stages of the technology transfer process due to the diversity of activities they undertake. More specifically, PRIs increase the stock of scientific knowledge by carrying out basic research, supporting firms' innovation efforts through technological development and the provision of advice, consulting and extension services and, more recently, active participation in the transfer of new knowledge to the market by engaging in spin-off activity and patenting and licensing in knowledge markets.

- Private research institutes: the contribution of these entities resembles the one of PRIs in terms of knowledge production, research infrastructure and the provision of supporting services. Private research institutes add to the stock of knowledge potentially available for commercialisation, while their financial dependence on private funds may result in different (to the public one) research orientation and increased competition at the commercialisation stage. A private or quasi-public research organization may be a Contract Research Organization (CRO) solving problems or developing products for corporate clients who have decided to outsource selected R&D or do not have the necessary in-house capacity.

- Technology Transfer Offices (TTOs): are those organizations or parts of an organization, which help universities and PRIs to identify, protect, exploit and defend their intellectual property assets into ways that facilitate their further development and commercialisation. Direct benefits to universities and PRIs include income from licensing or creation of spin-off firms, however most TTOs only break-even; indirect benefits of forming working relationships with industry partners for example may produce greater impact.

- Incubators, accelerators: Business incubators and accelerators provide guidance and other business development services to startups and young companies at different stages of the business life cycle. Business incubators catalyze the process of starting and growing companies by providing the expertise, funding, networks and tools entrepreneurs need. Accelerators provide intensive but short term mentoring and small scale funding.

- Science or technology parks (STPs): enable collaboration between firms and research institutions and facilitate the emergence of spin-off and start-up companies by nurturing the benefits of geographic proximity and providing the necessary infrastructure. Additionally, STPs host business incubators programs and provide support services to start-ups.

- Extension service providers: auxiliary actors that can exist independently or form part of other organizations (i.e. universities or PRIs) and assist other agents to improve their

capabilities and identify critical issues needed to produce innovative products, processes, or services. Their role is confined in the provision of services without further involvement in the transfer of specific technologies or research results directly to the market.

- Intermediaries: brokers engaging in information arbitrage, making connections to markets when seeking technologies to absorb and adapt for local needs or markets to commercialise new products or services. Linking networks of entrepreneurs generating new ideas is another level of brokerage. Typically the less developed the country the more intermediaries can add significant value. Considering the diversity of innovation systems the positioning, activity combination and population of these actors may vary across contexts. Different institutional setups allow for various forms of organizational arrangements; this means that the technology transfer and commercialisation process can follow paths that are tailored to a specific institutional context.

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[1] https://www.innovationpolicyplatform.org/sites/default/files/styles/panopoly_image_original/public/technology-transfer-commercializing-and-innovation_532203fdd99b5_w1500_0_0.jpg?itok=6tqJdVjv