European Commission

Technology Transfer
From Research to Impact

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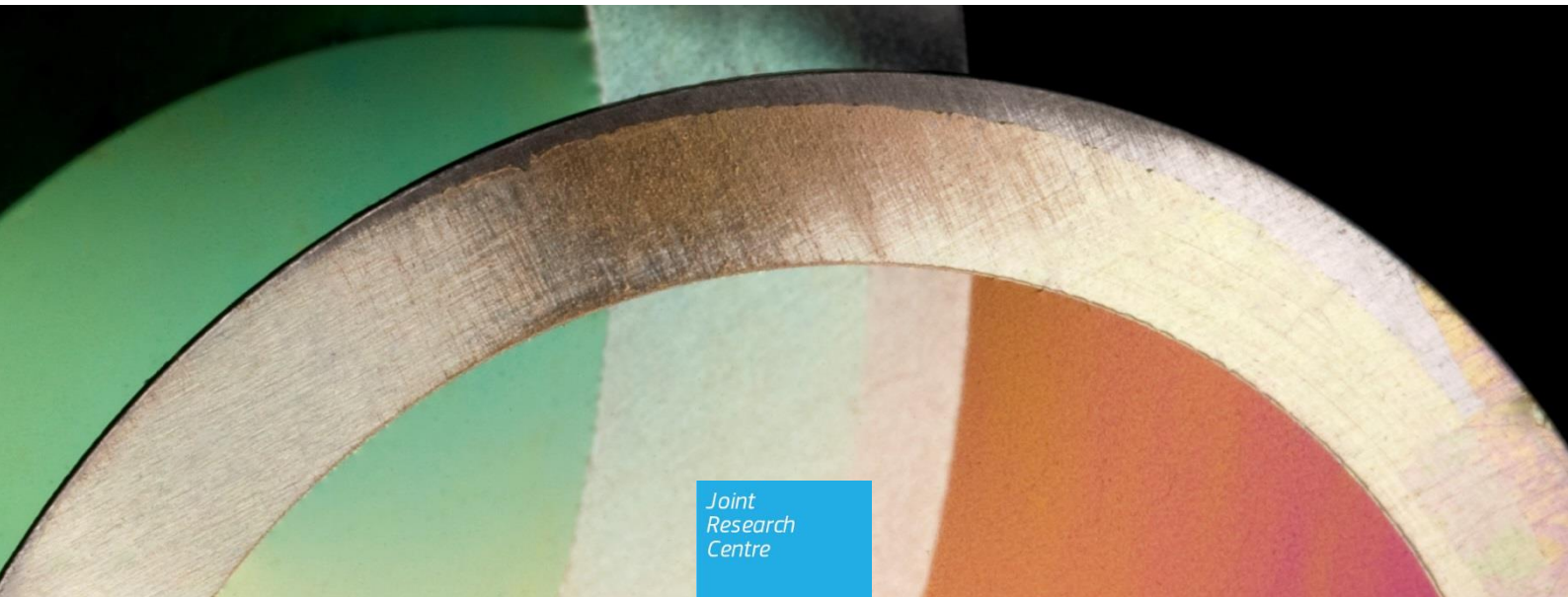

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Technology Transfer – From Research to Impact[1]

Introduction

This note seeks to provide a cursory overview of the technology transfer field including its delineation, historical background, organisation, development, and associated policy.

The term *knowledge transfer* is frequently used in the context of, or indeed instead of, *technology transfer,* but there are several reasons for seeing them as separate, although interrelated, concepts. In organisational theory, *knowledge transfer* refers to the flow of virtually all knowledge in an organisation and the attempts to create, capture and manage that knowledge. In turn *technology transfer* specifically refers to the conveying of results stemming from publicly funded scientific and technological research to the market place and to wider society, along with associated skills and procedures, and is as such an intrinsic part of the technological innovation process. Technology transfer therefore is a decidedly specific subset of *knowledge transfer*, with proprietary and particular means of functioning and progressing.

JRC activities are strictly concerned with the process of support to conveying research results to the market place and to society as a whole, and thus the international trade aspect is outside the institutional scope. In international trade *technology transfer* indicates the action of transferring a technology from one geographical area to another – mainly from capital intensive countries to those of low intensity and without R&D activities – and issues that emerge alongside such transfer.

Figure 1. *Fundamental steps of the technology transfer process.*

Policy context

There is common agreement that the EU's excellence in the realm of scientific research does not translate into a corresponding high level of performance in terms of innovation. The perceived failure of European countries to turn scientific advances into marketable innovations is often termed the 'European paradox'. This situation would, thus, be a clear cut depiction of a market failure in urgent need of addressing, as innovation is increasingly becoming a necessary precondition for competitiveness and growth.

Informal interaction between academic researchers and private enterprise contributing to the creation and deployment of new technologies existed prior to the development and implementation of governmental policies for this purpose. There is paucity in evidence of such earlier historical processes, as the general notion was that academia, along the lines of its independent nature and traditional role, should remain separated from the commercial sphere. From the beginning of the 20th century, however, attitudes in the US were changing and academic researchers started patenting.[2, 3] Academic patenting then intensified along with the massive growth in federal funding, and prior to the enactment of the Bayh-Dole Act in 1980 the US government had accrued a total of around 28000

[1] This note draws on results from past and ongoing activities and associated accumulated experience of JRCs Intellectual Property and Technology Transfer Unit (I.4). *Link to Unit I.4 web landing page*.

[2] Weiner, C. 1987. Patenting and Academic Research: Historical Case Studies. *Science, Technology, & Human Values,* Vol.12(1), 50-62.

[3] Cottrell, F. 1912. The Research Corporation, an Experiment in Public Administration of Patent Rights. *The Journal of Industrial and Engineering Chemistry*. December Issue, 864-67.

patents. Of these inventions less than 5% had ever been licenced out,[4] and this situation, along with the severe economic downturn in the 1970s, triggered a debate on whether the federal government was the most suitable owner of IP – mainly patents – arising from federally funded research projects. With the conclusion that this was not the case, the Act was introduced, thus enabling ownership of the IP created by universities, small businesses or non-profit organisations.

The Bayh-Dole Act has inspired the development and implementing of similar TT policies across the industrialised world, including in a number of EU member states[5] and in Japan.[6, 7] The Act's obligation to commercialise the IP associated with the legislation has indirectly led to the establishing of technology transfer offices (TTOs) at universities and Public Research Organisations, and indirectly also to an international community of practitioners.

The main relevant policy subareas in relation to technology transfer in the EU institutional context comprise capacity building, financial instruments and innovation ecosystem design, areas which are lined out in continuation.

Technology transfer capacity

Efficient technology transfer capacity entails skills relating to a range of divergent areas of experience. For the purpose and context of this paper, *technology transfer* alludes to the practise of conveying research results to the market place and to broader society, and is as such an intrinsic part of the technological innovation process. This progression is convoluted and multi-facetted, and, moreover, depends upon enmeshed, identifiable but not always readily quantifiable non-scientific and non-technological factors and forces. In consequence, good or high quality research results is not the sole prerequisite for successful technology transfer; general awareness and willingness both at the level of organisations and individuals, as well as skills and capacity related to specific aspects, such as, e.g., access to risk finance, management of intellectual property (IP), the deployment of different kinds of incentives, and so forth, are also necessary components.

Financial instruments

One of the main challenges of technology transfer is its financing. From the viewpoint of traditional risk finance, the technology transfer segment is very early stage, and its associated potential investment targets are considered to be very high risk, unwieldy management wise, and as having a much more extensive investment horizon in comparison to those further downstream. The *Valley of Death* (see figure below) alludes to the situation in which a technology no longer qualifies for conventional public research funding because of its advanced development stage, but is perceived as too uncertain for private equity or industry uptake.

Savvy public sector intervention is required to counter this market failure – that is, to bridge the Valley of Death – and the development of adequate policy relies on profound understanding of the intricacies of technology transfer. One financing approach of proven efficacy for early stage technologies is the so-called *Proof of Concept* (PoC) model. Proof

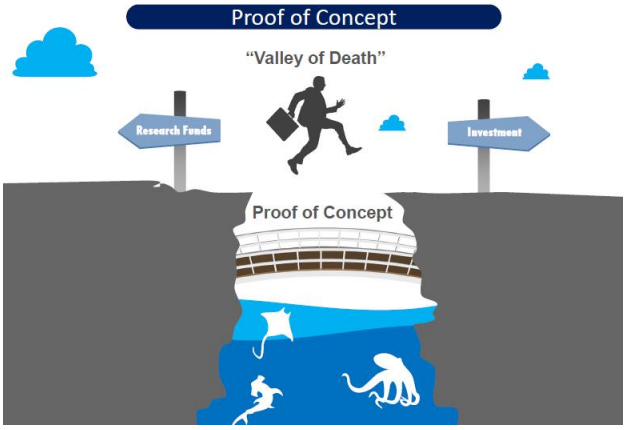
[4] U.S. Government Accounting Office (GAO) Report to Congressional Committees. May 7, 1978. "Technology Transfer, Administration of the Bayh-Dole Act by Research Universities." www.gao.gov/special.pubs/d04261sp.pdf

[5] Siepmann, T. 2004. The global exportation of the U.S. Bayh-Dole Act. *University of Dayton Law Review* 30.

[6] Takenaka, T. 2005. Technology licensing and University Research in Japan. *International Journal of Intellectual Property*, 27-36.

[7] The university and the technical revolution in Japan: A model for developing countries? https://link.springer.com/article/10.1007/BF02259974

of Concept refers to the technological development stage of a product at which its projected performance is verified, signifying that the funding provided is intended to lead to a functioning prototype. The PoC concept is intimately linked to the *Technology Readiness Level* notion (TRL). The TRL scale was originally developed by NASA to evaluate the maturity of space technologies being developed, and was subsequently adopted by a wide range of organisations in the US and worldwide. In EU policy[8] it is universally applied across many fields of technology.



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Innovation ecosystem design

Innovation ecosystem design denotes the development of optimal policy for innovative regions, science and technology parks, and incubators and accelerators for enhanced technology transfer in the service of regional economic development. Research infrastructures and testbeds are essential parts of such ecosystems, and the main challenge is to increase their accessibility particularly for researchers and SMEs.

Being an integral part of the innovation ecosystem, the management of a technology transfer office requires several skills and competencies, ranging from the evaluation of inventions, running a proof of concept programme, defining an IP strategy and managing the IP portfolio, supporting spinoffs and start-ups, licensing to industrial partners, and so forth.

Role and activities of the JRC

The JRC Strategy 2030 stresses the importance of understanding innovation, the characteristics of successful innovation eco-systems, as well as the protection, exploitation and trading of intellectual property rights. The JRC has longstanding expertise in relation to both operational and policy support aspects of technology transfer, along with a tight knit network of associated relevant stakeholders and actors both within and outside the European Commission. The recently established Competence Centre for Technology Transfer will assist the fulfilment of an essential need for policy support that is to a great extent currently lacking.

[8] Mihaly, H. 2017. From NASA to EU: the evolution of the TRL scale in Public Sector Innovation. *The Innovation Journal*. 22: 1–23.

Concluding remarks

The EU needs to strengthen its innovation capacity, and hence there is a need for public sector intervention to create adequate policy and instruments in support of technology transfer. The main relevant policy subareas are technology transfer capacity building, financial instruments and innovation ecosystem design.

Successful technology transfer requires capacity related to specific aspects, such as, e.g., access to risk finance, management of intellectual property, implementation of various kinds of incentives, and so forth, are necessary components.

Financing is one of the main technology transfer challenges, and one model that has proven efficient to help traverse the Valley of Death is the so called Proof of Concept instrument, which aims at bringing a product to the prototype stage.

Innovation ecosystem design denotes the development of optimal policy for innovative regions, science and technology parks, and incubators and accelerators for enhanced technology transfer, which in turn leads to increased regional economic development.

Intellectual property rights are core technology transfer assets and their importance command the knowledgeable development of a suitable IP strategy and associated IP portfolio management.

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