FORECAST NEW STREAMS OF TECHNOLOGIES IN MEDTECH: the importance of GPTs

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General Purpose technologies (GPTs) are regarded as crucial for the growth of an economic system, technological progress and social welfare. In addition, it is also an important dimension with regard to firm's innovation strategies. In fact the analysis of the technological sources can provide useful information on the new stream of technologies that will influence a specific sector. However, the effort of the scholars so far has been centered mainly on the identification of GPTs (Youtie, Iacopetta, & Graham, 2008),(Bresnahan & Trajtenberg, 1995). With this paper we want to put a new light on this concept, starting from a new point of view: the 'user sectors'. In the specific case of this paper, we are going to analyze the orthopedic sector in Switzerland.

To be identified as GPT, a technology must hold three characteristics: pervasiveness, innovation spawning effect and scope for improvement (Helpman & Trajtenberg, 1994). The attribute of pervasiveness implies that GPTs have broad applicability, horizontal propagation and therefore economic wide impact. The innovation spawning effect captures the impact of the evolution and innovation of users sectors on the growth of the 'source' GPT. The mutual growth of the GPT together with the users sectors creates some complementarities, which could increase R&D for both and that is the scope for improvement.

In the specificities of our case, the orthopedics sector, we see crucial complementarities between GPTs inventions (Mechanical engineering and then ICTs) and the development of medical devices applications.

Subsequently, we see how the production of knowledge on the user side (orthopedics) – that is the development of new applications – is central to ensure the effective diffusion of the technology.

This process is called "co-invention of application" to stress the creative (R&D) aspect of it.

The successive inventions of a GPT extend the frontier of invention possibilities for the whole economy, while applications developments change the production function of particular sectors (orthopedics).

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The economic structure outlined by the presence of GPTs and user sectors creates externalities between the two technologies.

A first type of externality is simply that the basic inventions generate new opportunities for developing application in particular sectors (orthopedics)

The second type of externality is that the more extensive and earlier co-invention and adoption occur in a user sector, the higher is the incentive for producers (basic inventors) to invest, race and compete for the business created by the application

The third type of externality is within user sectors and deals with the falling of co-invention costs: early user's experience lowers later cost of co-invention/adoption.

In the case of ICTs as a GPT, the externality structure has been particularly strong and powerful in activities where some specific circumstances created a very favorable environment for the co-invention of applications, which in turn generated virtuous feedback loops in the system.

For some other activities (such as services), the whole dynamic did not work so well. This has been the case particularly in Europe.

The aim of our paper is to forsake the very famous questions: is 'x' technology a GPT? How does the GPT influence the economic system in all its aspects?

Conversely we focus on a different aspect: we look at a very dynamic and powerful 'user technology', (specifically orthopedics medical devices), that are clearing using two or three GPTs to evolve, to explain the dynamic of the sector and to try to forecast what the new GPTs for this sector will be.

Methodology and Data

We use patent data. The source is Patstat, version December 2014. We take all the patents applications with at least a Swiss inventor or a Swiss applicant from 1985 to 2012, applied at the EPO or PCT or Swiss patent office. Looking at the count of patent and their time series distribution, we have clearly identified that MedTech is the most active sector in Switzerland. In order to understand the characteristics of the sector, we have interviewed different people, working in the medical device sector. They confirm that MedTech in general strongly needs knowledge from other sectors to evolve and innovate. Nevertheless, they warned us about the big differences along the sector itself. They suggested to focus only on one subsector, specifically the 'orthopedics' one because it is the most prolific and dynamic subsector of MedTech in Switzerland. We have conducted a search on the WIPO online tool, to identify the IPCs related to the orthopedics sector. The total number of Swiss orthopedics patents is around 9857. We develop the analysis of the sector and the forecast, based on the citations, on the other technologies present together with the orthopedics IPC into the patent classification and on the time lag of the technologies cited.

Moreover, we contribute to the existing literature on GPTs, trying to overcome one of the problems related to the methodology. Hall & Trajtenberg, (2004) raise the problem that patent classes by

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themselves do not provide sufficient substantiation of breath and pervasiveness of a candidate GPT. In many of the papers related to GPTs, when patent data were used, the technologies were divided are 5 categories (Hall & Trajtenberg, 2004): computers and communications, drugs and medical, electrical and electronics, chemical, mechanical, others (Moser & Tom, 2004).

Hall & Trajtenberg, (2004) underline the issue that the measure suffers from the fact that the patent office treat technologies that are closely related, but not in the same class in the same way that they treat very distant technologies. This inevitably led to an overestimation in some cases and underestimation in others.

They also suggested that 'making use of the subclasses to refine the class measures would be a formidable task, because subclasses are spawned within the three digit class 'ad libidum' and may descend either from the main class or from another subclass.'

In order to overcome this problem, we propose a new categorization based on the technology distance measure of 'relatedness' proposed by Teece et al. (1994).

Expected results

Given the good performance of the orthopedic sector, we would expect to see the typical S-curves related to the life trajectory of a technological change, moving over time.

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