ROBOTICS INNOVATION IN JAPAN

Introduction and Main Drivers of the Successful Field of Japanese Robotics

The field of Robotics is defined as the engineering of machines that can autonomously or semi-autonomously perform physical tasks on behalf of humans, typically either highly repetitive motions or actions performed in an environment too dangerous to afford risking human lives. Nowadays, in Japan the field has greatly advanced with the exploitation of those defined as "new technologies", with the implementation of new kinds of sensors and data to increase programming capabilities of robots. As other innovation sectors in the Japanese market, in the Robotics branch it is possible to recognize the following patterns:

- the institutional regime can be labelled as intrapreneurial, because of its high degree of stability and presence of large established firms[1];
- the availability of cumulative knowledge stocks, as a result of the continuous solving of tasks with information and knowledge gained from previously solved one (*allowing the building of new knowledge upon current knowledge*).

Hence, while start-ups still possess an important role in new industry sectors, as these new technological opportunities can be exploited by new firms as well, their contribute to the cause is still weak. On the other hand, cumulative knowledge alone is not enough; much importance has to be placed on the ability of firms to integrate across technologies and sectors, and then take advantage of that. Similarly, in an intrapreneurial regime as the Japanese one, key factors to the emergence of new industries are the characteristic *developmental State catch-up economy* and the phenomenon of *Path Activation,* which has been pursued by relying on diversification strategies, internal collaborations within firms, and by the major role played by established large firms and their groups; all factors that allowed to overcome lock-in effects in the field of Robotics.
An interesting phenomenon that should be analysed, to understand the success of this sector in Japan, is the perception of robots themselves as well as the different approach Western countries apply to the thematic. European and American societies tend to show signs of what is called *techno-paranoia* and a general sceptic aptitude towards new technologies, which have been limiting their own interest in the field, on the contrary Japan has always displayed the perception of a symbiotic relationship between people and robots as natural, with the robots representing an extension to humans in their work contexts. Moreover, being Shintoism – Japan's traditional religion – an animist one, robots are believed to possess a spirit like all other living and non-living entities, and building harmonious relationships with them is an important value for Japanese people. Hence, given the mutual reinforcement between religion and the Japanese popular culture, ethical concerns are less likely to arise here than in Europe, whether it concerns the reliability of machines for social interaction or the employment of industrial robots in working facilities, as a replacement to human workers.
This phenomenon can partly explain Japanese people's continuous embracing of new technologies into their domestic life and working society, however government support and contribution played a major role for innovation in Robotics. To prevent the loss of world-leader position in the field, the Ministry of Economy, Trade, and Industry (METI), in year 2001, issued a report by the Japan Robotic Industry Association, addressing the need for a new *Robotic Technology strategy*, in order to expand the field from simply developing industrial robots to include new automated systems. More specifically, calling for more efforts in those identified as priority research areas, for instance nano-handling technology, Kansi interfaces[2], robot vision, mobile technology, and advanced manipulation.

[1] Firms referred to as "new" are those established withing the last ten years (Casper et al., 1999; Ernst and Young, 1998).
[2] According to Innovation Nation (Holroyd, C. & Coates, K. 2007, in "Robotics in Japan"), "technology for interpreting human behavior, simulation systems and virtual reality."