

THE CONCEPTUAL ROLE OF CYBER SYSTEMS IN VIRTUAL R&D

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ABSTRACT

These days Corporate Research and Development (R&D) and innovation activities have become increasingly integrated in global production and innovation networks. While the internationalization of corporate R&D and innovation is not new, its speed and extent have increased in recent years in response to increased global competition, technological change, and the availability and costs of skills. Unlike the past that firms are believed that keeping their information and knowledge back-door can be their success secret, Nowadays by progress of science and technology, Open innovation appears which help to share information and knowledge causes sharing profits at the same of risks. For this reason, the old structure of R&D cannot quickly synchronize with new technology and require the most modern strategy. Hence, in this paper we have decided to demonstrate changing in the structure of R&D and mature to Virtual R&D by using cyber systems that integrates with physical systems and can be ready as tools for empower virtual R&D. In fact, Cyber systems such as social network play a significant role in enterprises with cost and permanent labor reduction, progress acceleration and easy access to experts and resources.

Key words: Virtual R&D, Cyber systems, Cyber-physical systems, Open innovation

INTRODUCTION

In the last decades, with rapid progress of science and technology it has been become harder to keep information secret and inbound; it can be shared easily and quickly by different tools of cyber systems. In this area that is going toward more and more boundless information space, open innovation appears.

For many practitioners, the concept of open innovation gave a new language to speak about the nature of R&D and helping to shift the dominant of R&D away from the internal discovery toward external engagement. In fact, the old structure of R&D 'do-it yourself' mentality in technology and R&D is outdated and new structure of R&D require the powerful tools such as cyber systems. This can be used to mature R&D system to virtual R&D.

R&D of small and medium enterprises has an important role in production and development of products and that's the reason why most of these enterprises have an R&D department, so it's very important to pay attention to the new methods of technology management.

Actually it is the technology progress which makes enterprises avoid of using close information system. Koschatzky (2001, p. 6) found that "firms which do not cooperate and which do not exchange knowledge reduce their knowledge base on a long-term basis and lose the ability to enter into exchange relations with other firms and organizations". So we must find appropriate tools to employ open innovation for heart of a company's competition and R&D Department. Methodology of this paper is based on authors study in this field. At first we describe open innovation, cyber systems as a tool of open innovation employment for virtual R&D, physical systems and concept of virtual R&D and its advantages.

OPEN INNOVATION

The advantages of cooperation are increasing in open innovation era. As the focus shifted from purely internal R&D activities, the academic community started emphasizing that the firms should be open to outside innovation (e.g., Rigby and Zook, 2002; Christensen et al., 2005). In fact open Innovation is the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation (Chesbrough, 2006: p. 1). Developments in internet technology and social networking technologies will allow companies to interact with numerous sources and predict. One important source of innovation will be companies from other industries, because we know that most innovation is based on a recombination of existing knowledge, concepts, and technology and in this field cyber systems can help to access easily to outsource.

Established solutions from other industries will enrich corporate product development whereas reducing the related risks through reducing uncertainty. The corporate in R&D and innovation functions will be more open to external leverages (Enkel.E, Gassman.O, Chesbrough.H, 2009).

Firms are trying to develop their technology by using open innovation and need the system that help them for connecting with everyone and everything such as experts, specialist and resources and etc around the world more easier than ago.

CYBER SYSTEMS

Since the present age is the age of communication and information, one of the most important concepts is cyber systems that facilitate communication around the world. Today due to growing technology cyber systems has affected R&D. However R&D had used cyber systems but it has not mentioned as one of the major tools of R&D, so cyber systems can be introduced as the important and powerful tool that change structure of R&D and support open innovation.

As you see in figure1, Cyber systems has been used in 70s and grew rapidly in 90s and impact all facets of human life. This is due to increase of cyber systems and communication systems utilization. A cyber system is any combination of facilities, equipment, personnel, procedure and communication integrated to provide cyber services.

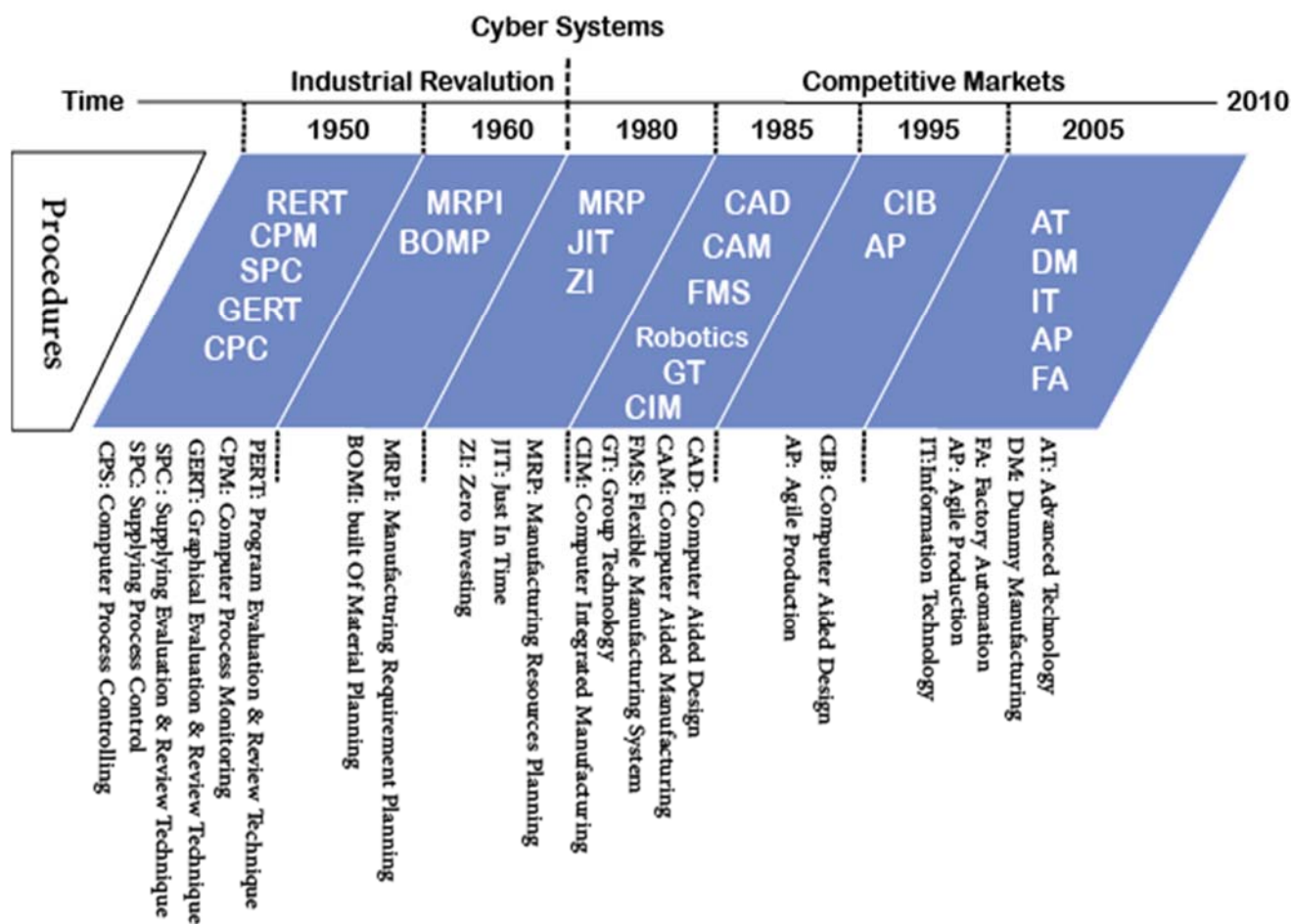


Figure 1: Growth of cyber systems

Firms can use cyber systems in various forms such as Web, Electronic services, Social Network, Search Engine and other kinds for growing faster. Here we are going to introduce some kind of cyber systems that can change our structure of R&D by their advantages.

Table (1): Cyber systems

Name	Usage	Time
Email	For fast communication between people	1971
Web	For reading and writing via computer connected to the internet	1980
E pay	For online payment	1995 by E Bay
Google	To obtain information about anything	1998
E learning	For learning in cyberspace	1999
LinkedIn	To demonstrate people knowledge and specialty	2003

Social network such as LinkedIn also plays a major role in cyber systems and has become so popular that it might one day replace physical networking. LinkedIn have a large network of experts and can

help R&D department of all companies. We think LinkedIn can sell gold, Why? Because it can sell brain of people (means knowledge of people) especially for SMEs and change their R&D to Virtual R&D and this is a great feature that any social network have. There are many advantages for cyber systems such as mentioned in below: 1- easy access communication to specialist and resources. 2- Many of Scientific and Technical Information are available in the easiest and cheapest way by web and other available structures. 3- All meetings, conferences and training courses can be held in cyber systems.

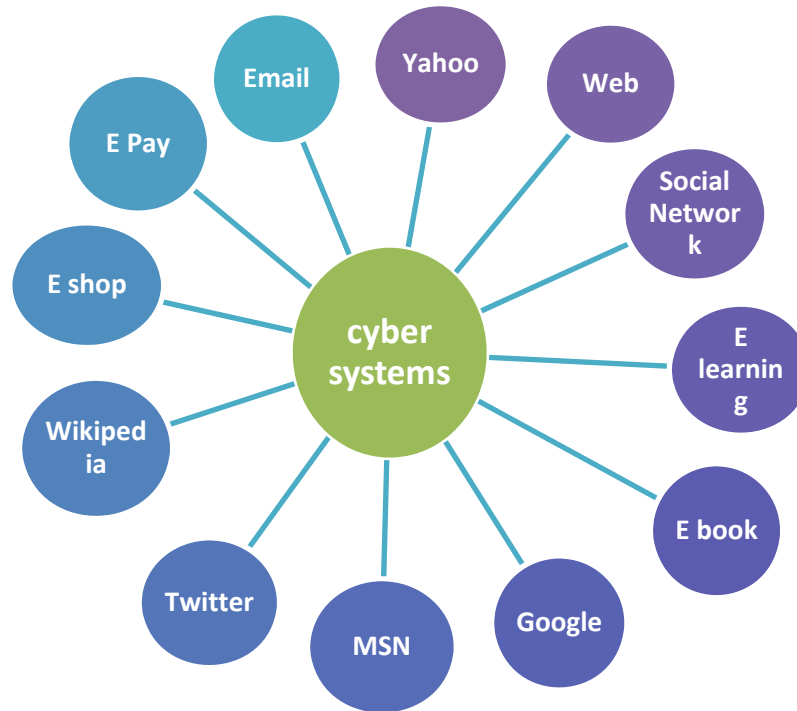


Figure (2) : Cyber systems

CYBER-PHYSICAL SYSTEMS

Like human that has soul and body, world has physical and virtual dimension that integrate together and create cyber-physical systems. According to stages of industrial revolution (figure 2), cyber-physical systems represent the coming fourth industrial revolution on the way to an internet of things, data and services which combines with physical world. In fact the systems are networked making the data globally available. Cyber-physical systems make it possible for software applications to directly interact with events in the physical world.

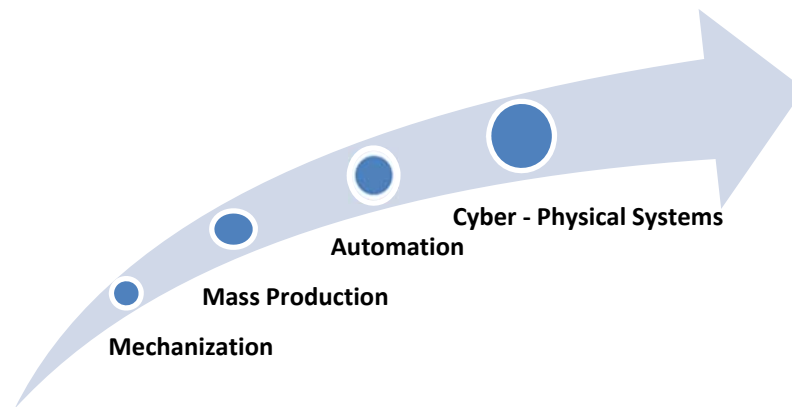


Figure (3) : Stages of the Industrial Revolution

Cyber-physical systems provide the basic for the creation of an Internet of Things which combines with the Internet of Services to make new structure of R&D possible. They are “enabling technologies” which make multiple innovative applications and processes a reality as the boundaries between the real and virtual worlds disappear. As such, Cyber-physical systems will transform how we interact with the physical world just like the Internet transformed how we interact with one another. Also cyber-physical represent the next stage on the road to the creation of smart cities through the creation of an Internet of Things, Data and Services.

There are currently 26 partners from 9 countries working together in the Cyber-Physical Systems Action Line, among them are: The Budapest University of Technology and Economics, DFKI, Ericsson, FBK, Fortiss, Royal Institute of Technology KTH, SICS, Siemens, Technical University of Berlin, Technical University of Munich, TNO, University of Bologna, University of Trento and VTT.

VIRTUAL R&D

With enhancing the entrance of technology in market and competing of market, the essential strategy of preservation and perfection of firms is paying attention to R&D and use most modern technology such as professional social network, search engine, websites and many applications. This huge virtual space services can changing R&D to virtual R&D. Virtual R&D will be a new way for SMEs that focusing on new product, sciences, technology, new product development (NDP) and open innovation by utilizing cyber systems.

The R&D need to use cyberspace advantages for growing faster and The problems of tradition structures of R&D and advantages of cyber systems caused we introduce cyber systems as tools of new structure of R&D that means Virtual R&D as represented in figure (4).

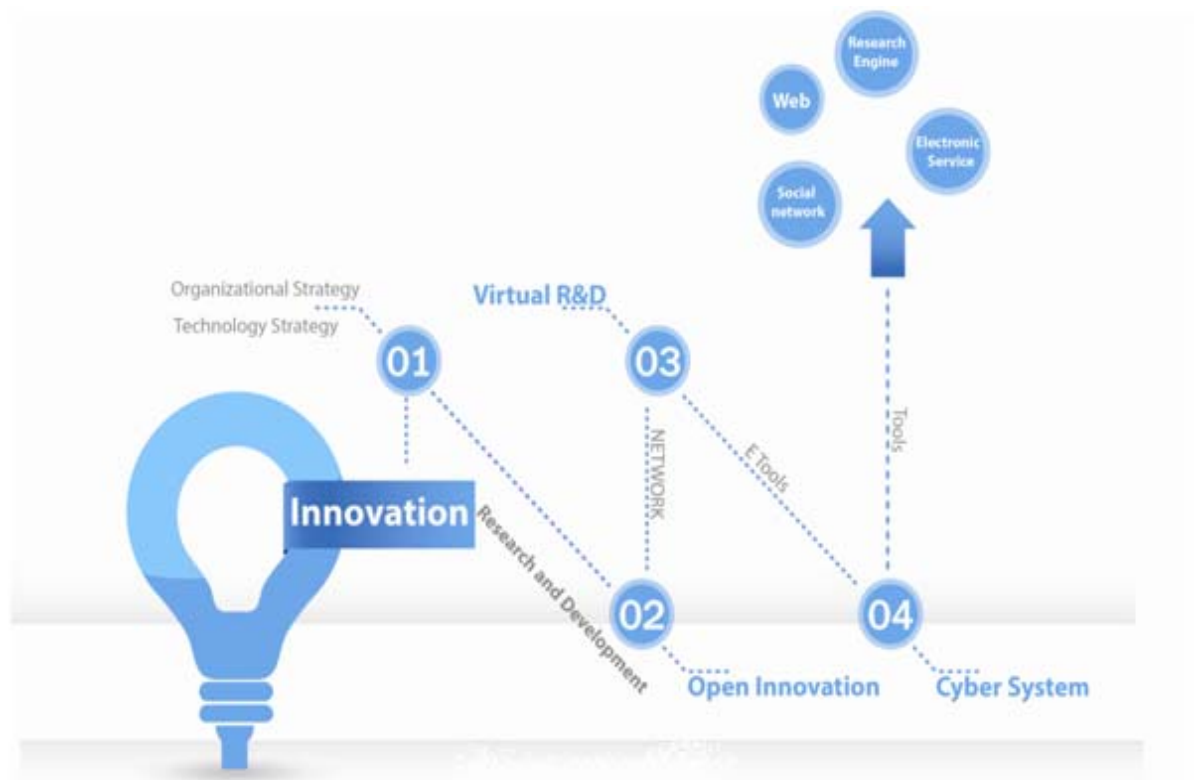


Figure (4) : Virtual R&D

Endo Pharmaceuticals is one company which has already expanded into virtual R&D, implementing its new capabilities in early and late stages of the drug development process, in an attempt to combine strong quality and oversight with international expertise. The executive vice president for research and development at Endo Pharmaceuticals, explained “Their virtual R&D team now includes in-house experts in the United States and partners in India with specific capabilities who work together toward research goals. Endo has biochemists and other scientists working in our U.S. location, but we use research labs in India and have up to 80 people working there full time under contract, plus dozens more providing support services in their labs. This model saves us development time as well as significant capital costs – it would cost almost four times as much to operate an equivalent R&D program entirely in the US.”

Commenting on the advantages of the company's current system, he added: “Not only does this increase our chances of achieving commercialization of new drug treatments, it gives us the option of shutting down programs that are not able to advance to the next level, and quickly shifting resources to accelerating the programs that are demonstrating the most promising results.”

CONCEPTUAL MODEL PROPOSAL

Today's business reality is not based on pure open innovation but on companies that invest simultaneously in closed as well as open innovation activities. Too much openness can negatively impact companies' long-term innovation success, because it could lead to loss of control and core competences. Moreover, a closed innovation approach does not serve the increasing demands of shorter innovation cycles and reduced time to market. The future lies in an appropriate balance of

the open innovation approach, where the company or the institution uses every available tool to create successful products and services faster than their competitor and at the same time fosters the building of core competencies and protects their intellectual property (Enkel.E, Gassman.O, Chesbrough.H, 2009).

Here we propose a model (figure.5) which shows that innovation happens in the intersection point of organizational strategy and Technology strategy.

Organization Strategy determines how open or close information of organization must be to avoid disadvantages of open systems such as loss of control and core competences and disadvantages of close system such as not serving the increasing demands of shorter innovation cycles and reduced time to market. Technology Strategy determines which technologies must be used in the organization for sharing inside information and using outside information.

As we know, the competitive environment needs to have innovation at the top of organization pyramid. Since technology has progressed, firms could not rely on their knowledge and need to utilize technology and knowledge of outsource. For this reason, open innovation appears. For using open innovation our R&D require a system that help to access experts and resources easily and due to growing technology in the world, cyber systems is the best tools to help firms and R&D department. Actually thorough cyber systems, firms can contact with outsource faster. One important outsource of innovation can be professors and doctorate or master students from universities or an easier way from social networks such as LinkedIn which has various members include individuals, universities and companies who has described their experiences and abilities completely. A company can link other companies and universities and individuals with different knowledge and ability who are interested in cooperation.

Obtaining innovation needs to have share of information which happens by utilizing cyber space such as social networks to augment its R&D to virtual R&D. The crossing point of these two strategies which has the most overlapping causes the appropriate innovation for the organization.

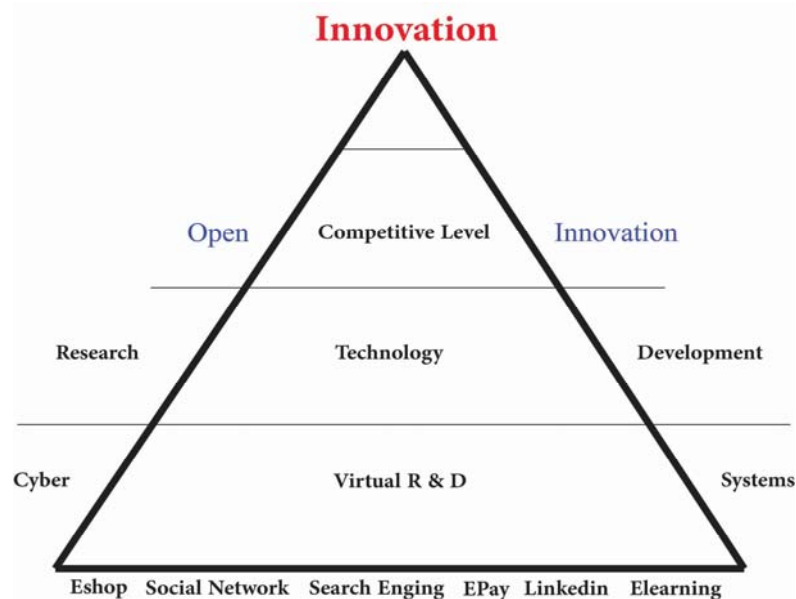


Figure (5): Conceptual model

CONCLUSION

This paper has provided a model to introduce cyber systems as a strong tools for R&D and change it to virtual R&D and helping firms to cooperate easily with outsource. We think virtual R&D is actuator motor of open innovation and taking advantages of using this method can be cause of: 1)Permanent labour reduction. 2)Creating low cost. 3)Easy to use tools for R&D Management. 4)Speeding up R&D progress. Also virtual R&D has the potential to improve success rates, because it enables the enterprise response to the market changes more quickly, which is a critical attitude for companies and enterprises to live on and succeed in rapid progress of technology environment.

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