Linear models of innovation are poorly suited to today's business environment

What is innovation?

Innovation is not creation or invention. Innovation is not a simple concept of create or invent a new product either. It is innovation that is to build a new successful product or a theory which will be accepted by people in the market. And linear models of innovation are a description of innovation process. It is a unidirectional, incremental process from basic science, applied science, design or engineering, manufacturing to marketing. To linear models, knowledge flow is very simple in the process of innovation.

The origin of innovation is science, the basic science. It will increase the production of innovation when increasing the investment to science. Actually, technology-push model and need-pull model are all involved in linear models of innovation. However, with the development of society and the improvement of science, it needs to be deliberated that whether linear models of innovation are suited to the business environment in modern society. This article will be attempted to demonstrate understandings of innovation and critically thinking of linear models.

Linear models of innovation and other models of innovation When people came to the world and knew how to trade in exchanging things, they were getting to know what the market is. So with the development of society, innovation theories came out for the business environment. Linear models are a description of innovation process. There are two main models. One is for ‘ technology push’ which means that technology pushes the development of products and the acceptance of users. People do research and development first and scientists make discoveries from those surveys.

Then technologists develop new product thoughts with those discoveries, which will be given to manufacturers to check and make into products. Finally, users will know the products from salesmen or see in the market. People who believe in this ‘ technology push’ theory will think of the more research and development they do, the more successful product they produce. The other one is for ‘ demand pull’ which means that demand pull the process of new products coming into market. Marketers collect ideals of new products.

And then they do research and development for the products’ design. Next the new products will be produced and come to customers’ life. In the period 1950s-Mid-1960s the industrial innovation process was generally perceived as a linear progression from scientific discovery, through technological development in firms, to the marketplace (Rothwell, 1994). That is ‘ technology push’ model. And In the period mid 1960s- early 1970s emerges the second-generation Innovation model, referred to as the “ market pull” model of innovation.

According to this simple sequential model, the market was the source of new ideas for directing R&D, which had a reactive role in the process. That is ‘ demand pull’ model. People got this theory because of their limited vision at that time. They thought the cause and origin of the innovation are sciences. So they considered that the more investment in science, the more new innovative product would be produced. Obviously, scientific research is one of the reasons for innovation. In the twentieth century, many large corporations, like Philips, Ford, Western Electric and ICI, put lots of money on research laboratory.

They built a steady stream of innovations which fed rapidly growing markets for automobiles, consumer electrical products, and industrial chemicals, with the help of science and technology and organized research and development effort. Another key factor is demand. It is easy to be understood. Consumers' needs make companies change. Companies need to meet consumers' needs so that their product can be sold and they can get profit. People follow the brand and watch advertisements. Branding and advertising play an important role in this model. And there is a bandwagon effect, which means innovation has been accepted by customers' needs.

For example, in 2007, Hyundai wanted to reintroduce ' Santa Fe' to the US market. The headline for their development program was ' touch the market ' and they visited an ice rink and an Olympic medalist to help them gain an insight into the ideas of grace and speed in order to meet their customers' needs. To linear models, they ignored the multiple links and feedback loops between the stages of the innovation process. Every stage has linked with other stages. When doing manufacturing, it can influence research and development and then when the products come into market, it may get feedback to be remanufactured.

It is not a unidirectional process but a multidirectional process. And also, linear models was not aware of the interchange between research and development managers, research and development funding sources, regulatory agencies, entrepreneurs, marketing experts, etc. They forgot the networks of innovators as well. Doing successful innovation needs the cooperation of companies, science laboratories and government agencies.

Schmookler(1966) demonstrated that push and pull…like a pair of scissors.

People can not divide them into two different parts. They should be put together to contribute to the innovation.

For instance, Sony’s Walkman cassette player came into marketing in 1980. Is it technology–push or market-pull? At that time, there was no identified need. But people complained about the weight of system. And headphones were the biggest technical challenge in the project and most innovative component. However it became popular soon as a personal device. One of the reasons is that people had potential needs because they disliked the weight system. And another reason is that Walkman gave people more private space when they wanted to listen to radio or music in public places.

So Sony gave people a new product and people made it become popular. It is a mixture reason of both technology-push and market-pull. There are multiple links between the stages of the innovation process. “ Innovation is a coupling process and the coupling first takes place in the minds of imaginative people“(Freeman and Soete, 1997). We can not do innovation just as only one process. It needs to contain the push and the pull. The push is sometimes significant, like the invention of laser and nuclear energy. It will not be faced by potential customers or the scientists.

The pull is significant as well, for example the Whitney’s cotton gin and the synthetic rubber. However, potential customers of the scientists may face the product directly There are many other models of innovation, like the chain-linked model, continuous innovation and open innovation. To Kline, there is another model called the chain-linked model. In this model, process will start in an empty market while new knowledge is no necessary for the

innovation. When we come to a problem during our innovation process, we get help first from science we have known and remembered knowledge.

But when we failed to get knowledge from our brain, we will need other demand or knowledge. The chain-linked model is a “ top-level model” and contains much more details and variety inherent in the innovations processes. And there are more important feedback from organizations and the world to fill in the gaps of innovation processes. To Rothwell(1994), he has a ‘ five generations of innovation’ model. The key features of first and second generation is simple linear models: technology push and demand pull. The third generation is simultaneous coupling model.

The features is research found interaction and feedback loops, innovation a corporate task, top management commitment and ‘ patient’ money. Those features are all depended on the background at that time. People were finding low-cost or cost control strategies because of the reduced demand and high inflation. And the fourth generation is between 1980s and early 1990s. People focused on core business or core technologies and the notion of ‘ global strategy’ emerged. And also a new model called ‘ parallel’ model came out, which complete suppliers in NPD process and integrate in-house. Japanese created the time-based strategies.

The fifth one is ‘ fast innovation’. People are focusing on networking. And there are organizational or systems integration and flatter or flexible structures. ICTs play a key role in NPD and networking. And there comes continuous innovation. Open innovation is a term promoted by Henry Chesbrough in 2003. Open innovation is a platform for companies to use

external and internal ideas or to improve their technology system. Open innovation can supply reduced cost of conduction research and development and it has potential to improve the product. It gives accurate research of marketing and customer targeting.

Open innovation has five models: product platforming, idea competitions, customer immersion, collaborative product design and development and innovation networks. Open innovation must rely on the modern network and open source. And open source is a natural way of innovation in the software industry and that it is an exemplary and very effective form of open innovation.

Conclusion

Linear model of innovation ignore the openness of process of innovation, the multiple links and feedback loops between the stages of the innovation process. So it is replaced gradually by the more comprehensive models of innovation. In the modern society, because of the development of science and technology, people are more likely to know ‘ innovation’ better. And linear models of innovation are poorly suited to today’s business environment, especially in this information era. First of all, the development of information and communication technology and the formation of knowledge network let people share and spread knowledge and information more easily. Then, the environment of knowledge network do utmost to eliminate the information asymmetry. People can search information they need at any time. So the open innovation may be more suitable to today’s business environment.