

Boosting Companies' Potential for Technological Innovation

Yassine Ben SALAH*, Mercy Anna NUAMAH** and Motoi WADA**

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Several Japanese companies have succeeded in making continuous innovation through improving their management. This paper describes some of the components that are essential, or influential upon innovation processes and examine how successful companies have assigned their resources to modify the companies' structure suitable for accomplishing innovation. It tries to propose a model for making stakeholders head toward the next innovation stage. Constituents of innovation can intervene at different levels of organizations in terms of location, internal structure and hierarchy, personnel management, external networks/links, and business processes for maximum performance. The omnipresence of innovative mindsets at all different levels will boost the company's potentiality for gaining competitiveness against other companies in the same field of business.

Key words: innovation, cluster, hierarchy, management, technology transfer, lean thinking

1. Introduction

In this open and connected present world, it is coming to be more difficult for a company to attract customers towards its own businesses field. Therefore, each company is trying to innovate and to add some originality to its products and services so that they become special and unique in the business market. Innovation strategies differ from one organization to another. They depend on many criteria such as the size of the company, the geographical location, the internal structure and hierarchy, personnel management, the way business networks/links are built, and the way how they conduct their day- to-day business.

This report reviews the management strategies adopted by different companies over the years to achieve continuous innovations for particular products to retain their valuable customers. It summarizes the components that affect innovation activities based upon some case studies. It then tries to establish a possible model to explain how innovation can be achieved from proper goal

settings, process managements, and community organization.

2. Innovation Cluster

Making innovation has crucial connection to a specific location. One good example is the Japanese company. Sony has over 95% of its research and development (R&D) activities done in southern Tokyo region. Its most famous products were created there.¹⁾ Geographic concentration of R&D activities can be critical. The "Industrial clusters" theory explains that innovation is more likely to occur if people, firms and other regional and institutional stakeholders are clustered in close proximity to each other, which is the case for Silicon Valley in the United States of America²⁾. There are several reasons for upholding such a theory. First of all, competition and collaboration occurs more often between nearby located firms,^{3,4)} Knowledge is more spread and better shared,⁵⁾ therefore the learning process becomes more interactive. Second, industrial clusters

* Graduate School of Science and Engineering on student exchange from Ecole Centrale Paris, France.

**Graduate School of Science and Engineering, Doshisha University, Kyotanabe, Kyoto 610-0321
Tel: +81-774-65-6351, Fax: +81-774-65-6891, E-mail: mwada@mail.doshisha.ac.jp

create a Social Network climate where communication and information exchange enhance reliability and cultivate trust between people. Finally, interaction among specific people can be created by managers' strategy. Innovation is known to be triggered as the result of the dynamic interaction between both codified and tacit knowledge. Codified knowledge is transmitted easily once the companies' decision is made, while tacit knowledge is best shared by people with similar culture, norms, routines⁶⁾. Therefore, companies prefer to have their key players in innovation in close proximity, so that information and tacit knowledge could be transferred easily. It may be argued that in the era of telecommunication distance may not be a determining factor. Even at present, however, face to face communication makes it easier to determine details in drawings and sketches for innovation in technology.

3. Innovation and Hierarchy

Enterprises have different structures and organizations. In fact, the management strategies differ from large scale corporations to small and medium size enterprises. Furthermore, the innovative process should depend not only on the company size and its nationality, but also on the internal hierarchy within the company.

Chemical industries are growing very fast all over the world. However, the Japanese firms for example have a completely different internal structure from the American firms. There arises one question which structure could more efficient in boosting innovation and creativity. Investigations show that the distinguishing features are defined by the relationship between the R&D and the marketing departments, and how their roles and responsibilities are attributed.

John Norton *et al.* point out that there are basically three key differences that distinguish Japanese chemical industries from American ones. First, the Japanese firms spend a higher fraction of their sales on R&D and have a relatively narrow definition of "marketing" and its role in

new product development. To the Japanese R&D department, the marketing department serves simply as an information resource. Secondly, in the Japanese firms, R&D and marketing have an asymmetric relationship in new product development. In fact, R&D has a dominant role. Finally, the American firms have a greater range of size and a greater potential for conflict between functions⁷⁾. In other words, the integration of each department in the other's activities is different between Japan and the U.S. In fact, while American managers emphasize marketing's involvement in generating and screening ideas and R&D's involvement in analyzing customers' needs, Japanese managers emphasize R&D's involvement in setting new product goals and priorities and designing information transfer and communication strategies⁷⁾. Therefore, roles and responsibilities are attributed differently to marketing and R&D departments.

In Japan, top down decision is common that marketing division accepts a role subordinate to that of R&D section in new product development, since they believe product success depends on the quality rather than the sales promotion. Nevertheless, roles are actually assigned more by consensus than by conflict. Such a structure makes development process and innovation make faster. On the other hand, there is a more balanced power structure in the U.S. where the two departments share equal responsibilities. Consequently, conflicts occur between managers of the departments and the development process often delays from the schedule due to the need for approval from both departments at each step. However, this strategy reduces possible risks owing to the mutual cooperation and coordination between R&D and marketing sections⁷⁾.

4. Personnel Management

Each innovative process needs human resources (HR) to transform the concept into reality. Thus, the employees have to be well qualified so that the perfection of a final product or a services will be as high as possible.

Therefore, personnel management is very crucial to innovative companies. Here we see the evolution of the Japanese HR management system, which is considered classified as the world's top level.

Japanese personnel management system has kept changing to increase the employees' efficiency and to maintain a high level of competitiveness against the international competition. Recently, many consulting groups are offering progressive methods to develop personnel's skills and abilities. At this stage of Japanese companies recovering from overstaff or over employment, consultants suggest companies' managers to boost the productivity of their current workforces before recruiting new personnel.

In traditional Japanese corporate society, employees used to do their jobs with just a few words from their boss. They were not used to express their opinions or share the ideas with others. All they were asked to do was to be obedient and execute the managers' instructions⁸⁾. A corporate CEO, confirms this situation when he explained his experience as a student in Germany.

In Japan, research students do work hard and follow the professor's instructions without having much freedom. They obey the professor and help him write the reports without complaining. They are like "servants" and they are taught to consider the laboratory's success more important than theirs. On the contrary, in Germany and Europe students enjoy more freedom to work on what they like in general. They are more relaxed. Besides, they are paid for their time unlike in Japan where research students pay for the opportunity to learn under a professor.

In other words, research in Europe is focused more on the student's interest with direction from the professor and therefore student's motivation is rewarded. Whereas in Japan the focus is on the professor's directed goal with student's input.

Nowadays, in the corporate world, consultants believe that by changing employees' attitude companies can increase their productivity and boost their innovative potential without recruiting additional people. Therefore, personnel need to gain dynamism and to become more self-reliant, more autonomous, more spontaneous, more risk-taking and more open-minded⁸⁾.

Consulting firms are now developing many personnel management programs. One famous program is the "360 Degree Feedback" which allows the bosses, through interviews, to identify their employees' weaknesses and strengths. The interviews emphasize some key skills such as analytic abilities, interpersonal relations, communication, leadership and self-control. They try to link skill development of individual employee to the corporation's goals. Besides, they let all the personnel, from ordinary employees to senior managers, feel as a part of a whole team which can reinforce the unity of the workforces⁸⁾.

Japanese companies keep changing their HR management to compete against foreign companies, as the internal economic/market structure is altered by European and American methods. Japanese companies' demands for management consulting have been increasing⁸⁾. On the other hand, some companies prefer to establish their own methods for personnel management rather than following guidance from consulting companies. Some of them still take the life-time employment system, which permits to invest in training employees while gives opportunities to work in other kind of job fields depending upon necessities of the company. Some, in addition, employ the merit-pay system.

In this highly competitive world HR management requires some scheme more than merit-pay system to keep motivations toward their jobs for both valuable workers and maintaining workers. Goals and job description have to be clearly specified and workers have to feel as a part of an important team. Poor communication between workers and managers is the

single most prevalent reason workers leave their jobs⁹⁾. Customers' needs have to be considered in innovation if maintaining old customers is important for the success of new inventions. In a sense, achieving an ideal mix of western contemporary approaches and unique Japanese personnel and organizational strategies will be necessary for a modern progressive innovation oriented companies and will make them able to face competition on a global scale. It should be the best possible methodology for a Japanese company to create a breakthrough innovation.

5. Business Networks and Technology Transfer

Business networks are essential to share information and knowledge. They make collaboration between firms possible and boost innovation. Japanese firms, like Sony for example, are achieving widespread success in innovation-intensive industrial sectors such as Electronics, Machinery, and Computers. Besides, they have a high international presence and a specific corporate culture and organization. They have stable networks of business relationships which are called "Keiretsu" meaning company groups. These groups guaranty strong collaboration and loyal partnership among group companies.

On the other hand, links between firms and universities are as important as links among industry firms themselves. In fact they permit technology transfer from the educational sphere to the industrial sphere and vice versa. The Japanese innovation system has been reformed since the 1990s and universities have been expected to develop closer relations with industry and to contribute to society¹⁰⁾. Therefore, many organizations came into being in order to put in place some collaborative agreements, such as internships between firms and universities. Since then, many debates and discussions have been made on the personnel issues involved in managing and implementing that collaboration. The addressed issues were related to the

age profile, the contract's duration, the necessary skills and the need for training¹⁰⁾.

Many organizations like technology licensing offices, venture support laboratories and other outreach offices can shape university interaction with industry and guarantee technology transfer between the two of them. Therefore, those organizations' personnel should be well qualified and have many backgrounds in business, science and law. In addition, they need to be able to communicate and to coordinate and link the two partners together in order to find mutual agreements. Financial resources and other supports for the nurturing and development of technologies are indispensable. Furthermore, training in an academic institution and on-the-job training which was usually done by Japanese companies can have positive effects on their productivity. In fact, lack of experience and expertise is observed in technology transfer offices not only in Japan but also in the UK where great efforts are made towards expanding the range of training courses available¹⁰⁾. There exists a fear, nevertheless, that it may result in a waste of time due to rotation of student generation. As students graduate from the universities, the opportunities for knowledge accumulation can be lost.

In order to get more information about those issues, a questionnaire survey was sent to nearly 400 employees in technology transfer and other outreach offices in Japan in 2007¹⁰⁾. Only 57% of the people who has had the questionnaire responded. When the personnel were asked to express their future vision of their work, the most recurrent ideas were:

1. The sustainability of the university-industry links is threatened by the seniority of the current staff. Consequently, it becomes urgent to recruit more young people.
2. There is a need to introduce longer contracts such as 5-year contracts because short-term contracts limit the ability of institutions to accumulate skills.

3. There should be more international links and networks, so the Japanese technology transfer offices can develop relations with firms and universities overseas.

Other comments include the necessity of fundamental knowledge on technologies for people working at technology transfer and other outreach offices, and proper evaluation of the personnel and the offices. The report concluded that companies need to make more efforts to enrich their professional networks and to strengthen their links with universities in order to increase their innovative potentiality.

6. Innovation Processes

Innovation can function differently depending on the company and its strategies. Three examples illustrate how the innovative process can be achieved. First, we learn what makes the Sony Vaio 505 computer so successful. Second, we will explain the Open Innovation process and how it can lead to Globalization. Finally, we will point out an alternative way of thinking, or “lean thinking”, and we will address its links with renewable energy.

6.1. *Sony Vaio 505*

The Vaio 505 success is due to the innovative process that took place in Japan. According to Yasuyuki Motoyama *et al.*, that made Sony one of the world’s major players in the computer industry¹¹⁾. The Vaio 505 was conceived and developed in the Tokyo R&D center. At the beginning, six team members started the project. They reviewed the market feasibility and tried to find some originality for the Sony product. At that time, the most common idea was “the bigger the memory size, the better the PC,” so they wanted to find out another way to reconsider the value of computers. With many brainstorming meetings focused on design and aesthetics, a smaller and lighter laptop with colors different from the common ones was made. A breakthrough innovation of portable and good-looking computer concept was

invented. Challenges in this breakthrough innovation were overcome with the team’s mindset of “learning by doing” and “learning only after making mistakes”. Face-to-face communication played also a very important role. It was the most efficient way to exchange ideas confirming the value of industrial clusters.

6.2. *Open Innovation and globalization*

The Open Innovation process consists basically in sharing information and collaborating with others in order to have a better output. Today, Procter & Gamble is a world class innovator and is said to be a leader in using Open Innovation¹¹⁾. But the company experienced some failures in the past. In fact, P&G innovation capability has been evolving since the late 1990s. At the beginning, the company invested a lot of money on R&D. They used to have one of the largest R&D budget in the world, however it did not improve their performance. Although they had developed a huge collection of patents, fewer than 10% of them were used in actual products. In addition, they were allocating supplementary resources for innovation, but they were not getting a very good return from it. At that point, P&G decided to change its strategy and thought that a step backwards might help. Thus, they reduced their R&D budget and started collaborating with their partners. It led them to get more experiments and to initiate the Connect & Develop Program which was designed to use Open Innovation. That approach made them learn how to use their resources more effectively. Once they consolidated their learning, they reinvested money into innovation and improved their idea selection process. Consequently, their innovation competence took another jump forward¹¹⁾.

Open Innovation is in that sense the first step towards Globalization. In fact, it seems to be strategically inevitable for multinational corporations to further internationalize their activities, especially their R&D activities, in order to collaborate with overseas local scientific institutions and to broaden their virtual markets. This tendency for internationalization becomes obvious

with the increasing number of overseas labs, the increasing number of nationalities among the employees and the increasing number of patents and scientific papers made by overseas R&D units¹⁴).

6.3. *Lean thinking and renewable energy*

There is a conventional way of thinking in which something becomes better only if you spend more money on it. In other words, if you need to make a product cheaper you have to take something away from it implying reduction in quality. This does not make any sense from the point of view of the lean thinking which tends to innovate with more output with less input. It is a system in which waste of all kinds is eliminated in a relentless and continuous drive in order to create more value¹²). An example of lean thinking way of starting a project includes setting clear goals and specifications and following an integrated and well thought-out approach, rather than starting it by calculating the sum of money. That will not only save time and cost but it will also improve the quality of the finished product. Moreover, waste can be minimized by addressing pinch points and aligning of all the processes.

Many companies in the world believed in the motto "do more for less". The Ford mass assembly manufacturing line lay at the heart of lean thinking. It enabled quality and quantity of production to be increased while the cost to consumer was cut. Besides, the supermarket Piggly Wiggly was reordering goods only when purchases had been made. Managers were aware that less stock meant less cost. Furthermore, Toyota, which has been learning particularly from Ford, has today one of the most lean production systems in the world. The company sets a continuous process in which all instances of waste can be identified and their elimination can be planned by using concept of the three Japanese "Mu" prefixes: Muda, Muri and Mura. Any new innovation idea is tested with the three "Mu" to find out if the project is not Muda- a waste, Muri- impossible or Mura- unstable in any process to waste corporate resources.

One additional example is Hilltop Yamamoto Seiko, a 60-year old Japanese company which specializes in manufacturing small and medium sized aluminum pieces used both in industrial and domestic machineries because it is cheaper, lighter, easier to cut and more commonly used for prototypes. The company has its own innovative production system which makes it possible to save time and give five more times the value than what the competitors do. This production system consists of 4 high-performing machines that are called "5-axes machines". These machines have a high productivity which lasts for more than 10 years.

Lean thinking has been evolving and being lean could mean going green today. In the past, natural resources were abundant. Businesses did not worry about wasting them and it was cheaper to throw them away than to use them again. Nowadays, everyone is starting to recognize that these resources are in fact limited. Their costs are consequently getting higher. Here is where the lean approach comes in to cut out waste and inefficiency, reduce the carbon emission, save scarce natural resources and redesign the manufacturing process so that the society becomes more sustainable.

If we want to safeguard our planet's natural resources, governments should tax more on reckless usage, people should consume less and economies should grow more slowly. However it is absolutely not easy to reverse hundreds of years of material progress, and even if we try to hold back consumption that will hit the poor far much harder than the rich. One possible solution is to push people to consume sustainably. This means to let the society prefer "green" products which use fewer natural resources and less polluting. Therefore, every link of the supply chain needs to be reinvestigated to minimize waste or resources.

One big effort is made by Tesco which aims at launching a zero-carbon business. They try to generate renewable energy to replace carbon emission energy. That needs a set of various practical steps. For example, the store is relocating its depots to bring them closer to

the shops they service. In addition, the company's transportation vehicles are redesigned to make them more fuel-saving. Moreover, new stores are designed to be as easy to dismantle and reuse as they are to assemble. Furthermore, Tesco is saving energy and cutting carbon by developing a combined heat and power plant which uses waste vegetable oil. The company is also selecting for sales various products that have the lowest carbon footprint. For example, Tesco is ordering cucumbers from Spain where they are produced without heating rather from the UK where they produce in greenhouses.

Once companies take decisions to think lean, it is necessary to convince consumers to do so and to follow the change. Therefore, green products need to be affordable and to be as easy to use as any others products. Besides, people need to be informed about goods that are harmful for them and for the environment. Sometimes, they should also be rewarded for thinking lean so that it becomes a global mindset. In essence, going green is nearly equivalent to thinking lean, which is an innovative way of thinking. In some cases, however, risks come out from green industry like the case of energy policy. So it is urgent to address them.

Historically, the economic viability of renewable energy has been determined by the prices of crude oil and natural gas¹³⁾. Thus costs of renewable energy need to be reduced so that they become competitive with gasoline. In some cases this goal is not far away from being reached. For example, electricity production from biomass is almost cost-competitive. Namely, all the green energy resources are not at the same level of competitiveness. Therefore, policies should depend on the technology's probability distribution of cost breakthroughs¹³⁾.

A randomly selected sample group of experts was interviewed in order to make a portfolio analysis of renewable energy to make an estimation of probability distributions for future technology cost reductions. The results reveal a significant impact on cost reductions of batteries, fuel cells, solar cells and biofuels due to the

hypothetical funding increases. This analysis will minimize the risk for a specified level of expected returns, taking into account both the expected reductions in cost and the variance of the expectation of cost reductions, thus providing an objective benchmark for efficient allocation of resources across renewable energy technologies¹³⁾.

7. Conclusion

Innovation is a complex process which goes beyond making up a new idea about a product or a service. It requires much more than that. Today it becomes harder for companies to gain a competitive advantage and to stand out from similar industries. They have to innovate in many ways. Innovation must intervene on many levels in order to guarantee an efficient return. Companies should reconsider their locations, their structures and their internal organizations. In addition, they need to create more efficient methods to manage their human resources so that they obtain a better productivity. Good business networks should enrich their links with universities and other institutions from overseas. They should conduct their industrial processes in order to make their business flourish quicker in an innovative way.

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References

- 1) Y. Motoyama, "Innovation and Location: A Case Study of Sony's Vaio Laptop", *The Industrial Geographer*, **8**, 1-25, (2011).
- 2) A.B. Jaffe, M. Trajtenberg and R. Henderson, "Geographic Location of Knowledge Spillovers as Evidenced by Patent Citations", *Quarterly Journal of Economics*, **108**, 577-598 (1993).

- 3) C. Antonelli, "The Business Governance of Localized Knowledge: An information Economics Approach for the Economics of Knowledge", *Industry and Innovation*, **13**, 227-261, (2006).
- 4) M. E. Porter M.E., "Clusters and the new economics of competition", *Harvard Business Review*, Nov.-Dec., 77-90, (1998).
- 5) J. S. Coleman, "Foundations of social theory", Belknap Press of Harvard University Press, Cambridge, Mass. (1990).
- 6) A. Malmberg and P. Maskell, "The elusive concept of localization economies: Towards a knowledge based theory of spatial clustering", *Environment and Planning A*, **34**, 429-449 (2002).
- 7) J. Norton, M.E. Parry and X.m. Song, "Integrating R&D and Marketing: A Comparison of Practices in the Japanese and American Chemical Industries", *IEEE Transactions on Engineering Management*, 41, 5-20, (1994).
- 8) *Japan Economic Monthly*, "Progressive Personnel Management Promotes Japanese Business Innovation ", JETRO, October (2005).
- 9) *The Daily Muse*, "Three Reasons Employees Leave Their Managers", May 4 (2013).
- 10) L. Woolgar, A. Nagata and K. Hasegawa, "University-Industry Links Personnel and Training in Japan: A Review of Survey Results", National Institute of Science and Technology Policy, Discussion Paper No. 49, 4-24, October (2008).
- 11) T. Kastle, "Procter & Gamble: Using Open Innovation to Become a World Class Innovator", *Evolving Economic Entities*, May 30 (2012).
- 12) T. Leahy, "Management in Ten Words", Random House Business Books, (2012).
- 13) G. Rausser, R. Stevens and K. Torani, "Managing R&D Risks in Renewable Energy: Biofuels vs. Alternate Technologies", *AgBioForum*, **13**, 375-381, (2010).
- 14) Takabumi Hayashi, "Globalization and Networking of R&D Activities: Analysis Centering Around the Cases of IBM Corp., Philips N.V. and NEC Corp.", *Journal of Japan Society of Business Administration*, **4**, 39-48, (1999).