

# Innovations for Industries: Case Study of Japan

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(Abstract)

This paper investigates a case study of how a country becomes a developed one by linking innovation with industries. The industry is basically initiated by innovation so the survey and analysis of innovation creation for industries are performed in order to find a conclusion of innovation. As a case study, this paper also surveys Japanese industries and innovations in order to find a pattern of Japan and Japanese innovations. Finally, we can conclude that a country should develop itself by set up a strong basis of innovation and industry, and learn some unique characters of Japanese.

## 1. Introduction

Every country in the world desires to become rich, and tries to maintain its wealth as long as possible. When we take a look at the map of richest and poorest countries in the world based on the International Monetary Fund database (2013), it is found as a pattern that poor countries in term of GDP (Gross Domestic Product) per capita are mainly in Africa, South Asia, and South East Asia. On the other hand, the riches countries are allocated in North America, West and North Europe, Australia, Middle East, and East Asia. If we check the GDP's statistic data from the United Nation database for some countries such as USA, EU, Japan, China, Germany, Australia, South Korea, Thailand, Malaysia, and Singapore as shown in Table 1, we may find that population has major contribution to GDP. It shows that countries with large population seem to have higher GDP. However, if we divide GDP by population to obtain GDP per head as shown in the fourth column, we can see the differences implying efficiency of each country. For instance, based on the GDP per head, Thai and Chinese people have to spend approximately 10 times of working in order to gain similar salary with Japan, Germany, USA, Australia, and Singapore, 5 times and twice comparing with South Korea and Malaysia respectively. Even though Australian population is small, they can efficiently work and earn big income. Similarly, Singapore which has a small territory and small population can earn GDP per head as similar as developed economic countries. Surprisingly, Japan, which possesses less natural resources, and usually faces various natural disasters such as typhoon, earthquake, and tsunami, manages to allocate itself in the world leading level GDP. Actually, Japan was one of the poorest

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countries during the years after the Second World War ended, but amazingly emerged as a member of the world summit meeting in 20 years. For around 20 years after the war, Japan launched bullet train (Shinkansen), express way, and so on, and hosted the Tokyo Olympic as the first Olympic in Asia. Japan is a good case study for poor countries that desires to rapidly develop from nothing to wealthy.

Table 1: GDP per capita of some countries

<b>Country</b>	<b>GDP (% of World)</b>	<b>Population (Million)</b>	<b>GDP/head</b>
USA	22.91	309	0.074142395
Euro Area	21.88		
Japan	7.92	127	0.062362205
China	6.98	1336	0.005224551
Germany	5.89	81	0.072716049
Australia	1.64	22	0.074545455
South Korea	1.5	49	0.030612245
Thailand	0.42	63	0.006666667
Malaysia	0.31	28	0.011071429
Singapore	0.29	4.9	0.059183673

Source: UN in 2011

## 2. How Japan become rich

Let us look back to the past briefly for reviewing how Japan increased its GDP. In the world history, people widely recognize that industrial revolution emerging in European countries such as England, France, Germany, and Sweden from second half of 18<sup>th</sup> to the mid of 19<sup>th</sup> centuries was the great transition from agriculture style and hand production methods to machine and mass productions. Around 30 years after Europe during the end of 18<sup>th</sup> century, United States of America started its industrial revolution, and in 1870s during the Meiji leaders of Japan sent Iwakura in a mission to observe Europe and USA in order to catch up with the western way. Japan inaugurated a new Western-based education system for young people, hired more than 3,000 Westerners to teach modern science, mathematics, technology, and foreign languages, and industrial revolution was started around 30 years after USA did.

During the first and second world wars, Japan has continued to create a strong foundation of industries and infrastructure in western way for supporting people living as well as military. When the Second World War ended in 1945, Japan which had to pay reparation to many countries restarted itself from debt and poverty, and set up its target to be a world leading country. They set up the nation strategies in developing goods using advanced technologies such as electronic home devices, computer, automobiles, and so on for export. The Japanese government selected excellent companies in limited number at that time to support them aiming to

survive in world level in their respective fields; for instance, NEC, Fujitsu in computer field, Nissan, Toyota, Mitsubishi, Honda in automobile field, and so on. All of companies tried to respond to the nation strategies set up by Japanese government, and consequently they all successfully upgraded to become well-known brands in the world level soon after. In addition, it is probably a kind of pressure in the Japanese society such that other Japanese companies and industries also put big efforts to create their own know-hows, and employed advanced technologies to make new products for Japanese as well as oversea people. Japanese people who basically did not have know-hows and technologies in the beginning period learned them in limited time, modified them for solving domestic problems as well as oversea, and finally become the technological innovation crater. The Japanese industries born for mass-production using their own technologies contribute in not only dramatically decreasing the unit price of products but also taking care huge number of employees. This is a cause that had helped develop Japan from nothing to world economic leading level.

### **3. Some Case study in Japan**

First of all, let us review some samples of innovations born in Japan as shown in Fig. 1. Instant noodle is actually special food for Japanese athletes to participate Asian Games held in an Asian country. They found technology for preserving food, and it becomes popular as instant food in the world. The OVOP (One Village One Product) which was born in Oita prefecture as an activity to boot souvenir making has created many jobs for local people. This booms Japanese local economy. Time-different volleyball spike is an idea newly created during Tokyo Olympic time (1964) as a strategy. This helped make the Japanese lady volleyball team won the gold medal. Electric rice cooker was to solve the problem of house wives who have to wake up very early in the morning. This helps people to easily cook in the same standard with timer. Washing machine was also for solving house wives who had been washing cloths by hands. It saves time, energy, and does not harm hands. Karaoke is actually an original Japanese culture created for solving Japanese social problem. Since Japanese people have got stresses in everyday working, they need to release the stresses. One of best ways to do so is to sing a song. The Karaoke machine helps almost everyone to be able to sing a songs well even an amateur. Portable radio was to replace the traditional radio which was bulky, heavy, and expensive. The semiconductor technology was applied to design a small, light, and cheap radio. It becomes an excellent innovation, and shifted paradigm of traditional radio.



Fig. 1 Some samples of Japanese innovations

These samples of innovations lead to successful business and they are great contributions to Japan. In order to trace the story back to the causes of Japan economic success, we should learn the points from some cases of innovation stories as follows.

Case of a skillful expert: Mr. Masayuki Okano is one of experts in Japanese industrial society who has trained himself in steel process for long time, and become a well known person in the country. Due to his famous contribution, his story was recently written in a Japanese book entitled "ORE GA TSUKURU" meaning "I make it!" as shown in the left side of Fig. 2. He can process steel in very fine scale, and one of his well-known products is painless injection needle. He got an idea from how a mosquito suck blood from humans who feel minimal pain. He challenged himself to make an injection needle whose external diameter is as small as 0.2 millimeters, and its inner diameter is only 0.06 millimeters as shown in the right side of Fig. 2. This is an innovation that is useful in human life, and makes a great contribution in Japanese industrial society as well as Japanese economy. When we talk about innovation, we normally discuss how to design, but overlook the realization process. If there are any problems in the making process, it means implementation is impossible, and even excellent ideas and designs are useless. Therefore, this kind of challenge done by skillful persons is very important.

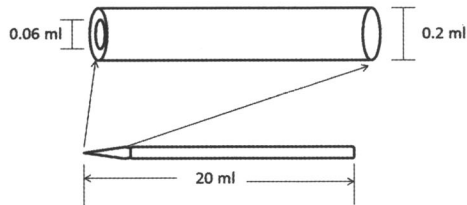
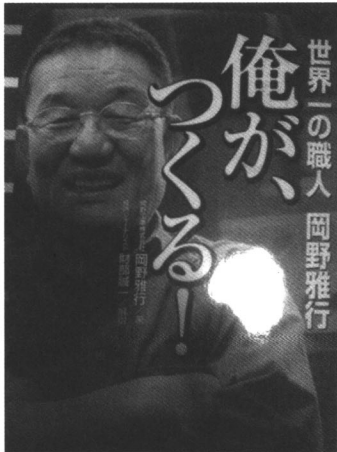


Fig. 2 A book written about painless injection needle of Mr. Masayuki Okano

Case of Sony: Mr. Akio Morita who had served in navy as a communication engineering soldier during the Second World War had a dream to create a portable radio. At that time, radios were big, heavy, and costly furniture due to using vacuum tube technology. After the war ended, he challenged himself to develop a prototype of tiny radio using the emerging semiconductor technology, and together with his friend (Mr.Ibuka) he consequently established a company called “Tokyo Tsushin” meaning Tokyo communication for producing portable radios. The mass production of the prototype radio of course makes its unit price cheap enough and affordable for general consumers to purchase. The sale was successful in the first period in Japan domestic market, and the company then decided to embark on oversea market. They also changed the company name to “Sony” which is from “Sonus” in Latin meaning sound in order to be international. Since Japanese goods at that time had a bad impression as easy to be broken even its price was very cheap comparing with others, it was very difficult for Japanese salesman to sell Japanese products. They really had long tough time for sale activities. Finally their efforts came through for not only successfully selling Sony radio but “made-in-Japan” products as well. The portable radios have become Christmas presents in USA at the time and Sony could afford to open a showroom on the luxury Fifth Avenue in Manhattan, New York.

Case of Nintendo: Mr. Fusajiro Yamauchi, the founder of Nintendo launched the factory of “Hanafuda” (meaning trump card) in Kyoto, Japan in 1889, and exported them since 1902. The business of Nintendo has gone very well for a while. However, in the mid of 20<sup>th</sup> century, people tended to love computer game which had emerged at that period. In 1975, Nintendo which was not in the computer and electronic fields cooperated with Mitsubishi Electric to develop a video game system using electronic video recording player, introduced microprocessor into the video game system in 1976, developed home-use video games in 1977, and and the home video game console called “Family Computer” that had been sold in Japan since 1893 had been started to

sell in USA in 1985. In this case, Nintendo tried to employ advanced technology at the moment to improve their products for survival. They invent an innovation even they were not involved in computer field in the beginning. Not only does it make huge profits for Nintendo, but also contributes in Japanese economic and technological societies.

Case of Yakult: During the World Wars, food was not good and caused diseases in human intestine. Dr.Minoru Shirota (1899-1982) of Kyoto University tried to solve the this problem of diseases in intestine by developing a strong strain of lactic acid bacteria which might work to destroy the harmful bacteria living in the intestines, and maintain the health of human beings. He successfully cultured the *Lactobacillus casei* strain shirota, and finally invented Yakult (derived from the word “yogurt” in Esperanto) which was introduced in the market since 1935. The *Lactobacillus* is good bacteria for human that sleeps in the circumstance of below 10 degree Celsius and will be active in upper 30 degree Celsius so that when Yakult enters human body intestine, *Lactobacillus* in Yakult starts to work. Due to such great intention of Dr.Minoru Shirota for human health enhancement, Japanese people currently achieve the highest average life expectancy in the world at 82 years old (World Bank Annual Report, 2009). Yakult has been then produced as probiotic drink and consumed by people around the world. In this case study, at the beginning, the researcher (Dr.Minoru Shirota) has done a research for solving the people problems without aiming for profits so that he could freely invent an innovation. However, if Yakult as invented innovation does not reach mass production, the unit price might not be decreased enough for general people to afford to consume. Since a healthy intestinal tract leads to a long life, this is one of the reasons that makes Japanese people maintain good health, and consequently have long life. Moreover, the mass production in manufacturing creates huge number of jobs in Japan as well as in other countries.

Case of Seiko: Mr. Kintaro Hattori who loved to collect watches founded watch and jewelry shop called K.Hattori in 1881. He tried to produce watches under brand “Seiko” meaning “exquisite” or “minute” or “success” in Japanese in 1892, and got success in producing mechanical watches in 1924. The mechanical watches are classic and look beautiful, but there are some difficult points for users such as the users have to adjust time every day. In that period, micro electronic technology incidentally emerged; he shifted the paradigm of mechanical watches with mechanical system to employ quartz and successfully invented the first quartz watch in the world in 1969 that does not need time adjustment for long period. The technology revolutionized the watch world in not only non-time-adjustment, but also very cheap price, high accuracy and simple making process without skillful experts. Seiko becomes the world-leading-watch-technology maker, and has been selected as formal clock of Olympic and FIFA many times. In this case study, Seiko challenged itself to shift the paradigm of classical watch so that it could invent a great innovation.

Case of Toyota: Mr. Sakichi Toyoda who invented Toyoda Model G Automatic Loom in 1924 had launched the Toyoda Automatic Loom Works, Ltd, and his son, Mr. Kiichiro Toyoda began research on small gasoline-powered engine in 1930. They established Toyota Motor Co., Ltd for producing automobile in 1937, and started the production in 1938. They take time for development by themselves and really had learnt everything from the fundamental. This was basically different from other Japanese automobile companies which cooperated with foreign companies in the beginning. Toyota continues learning in many aspects and always improves its own products. They have invented so many innovations such as Just-In-Time management, In-tank fuel pump, IGBT (switch for hybrid car), ABS brake, and so on. This is why it becomes the largest automobile manufacturer by production in 2012. The number of produced vehicles reaches 200 million in July 2012. In this case study, Toyota is serious to study the fundamental of the products, and always update the technology and market. This is why they can invent the innovations for survival and currently become top automobile manufacturer in the world level.

The cases explained above are some samples of many more successful cases of Japanese companies. In these sample cases we can conclude that innovation leads to industrial prototype and saleable product has to be value-added one. The innovation for industry has to be some know-how that is useful for human life, human society or related fields. Therefore, the people in industry have to be always active to partly or fully improve their own products. They also have to always monitor the advanced technology, and catch up with it for keeping themselves update. This is the survival issue.

#### **4. To construct industry in the country**

What people learn from the history of developed countries is that a country that revolutionizes industries will become wealthy. An industry creates big number of employments, and dramatically decreases the unit price of a product. To establish an industry, what do we have to start doing? As mentioned in the case study of Japan, they started from inventing innovations which are useful for humans as prototypes, and then extend the innovative prototypes to the mass production in the industry. The industry consequently sells a product with its low unit price, gets some return, and keeps trying to add more values or develop other new products. This is a kind of cycle that can be concluded as shown in Fig. 3. That is researchers working at research institutes of government or private companies, or at universities should set up research topics by picking up local problems of local people in order to improve people living. The research results done by researchers may find the causes of the local people problems and some ideas to improve the problem situations. This leads to innovation and prototype in term of know-how and intellectual property which may need corporation with industrial developers. However, the price of the prototype seems to be still expensive for general consumers to afford

to purchase so a maker should consider setting up a mass-production line to produce its copies in huge number. The products with reasonable price are then distributed in the market where local people can consume, and return benefit to all related people including researchers, developers, and so on. This success story is subsequently known in oversea, and needs from oversea people then emerge. Due to the domestic products might not be cheap enough and they sometimes have logistic problems, the product needs to be produced oversea so that other partners such as bank, maker, servicer, logistic group, and so on have to work together to arrange and set up branch industrial companies oversea for supplying reasonable-price goods to people oversea. The innovation for solving a problem of local people now becomes an international product; it makes happiness to not only local people and people oversea, but also researchers, developers, makers, and other related partners.

If we trace back the development process of goods, we may know most of them absolutely are born from some innovations. Of course, they need excellent mass-production technologies, investment, and marketing skill to become acceptable-quality goods with reasonable unit price. However, some innovations finally grow up to be hit goods sold in the international markets, but some cannot be sold even in the local market. We can conclude industry cannot be successful without any innovations, and the innovation is the most important key for starting industry which leads to huge number of jobs and nation wealth. One of main functions for producing innovations is university. University basically has a main role to produce educated persons for supporting society which in some sense means innovators. Currently many of universities not only build innovators but also create innovations. What happen if universities concentrate only on education? Radically, we cannot refuse that the university has a main role in education, but most of them simultaneously invest in researches for creating new knowledge. The created new knowledge is fed back to improve its education, and this makes the education consequently updated so that we can draw a circle of research next to the education circle as shown in Fig. 4. Universities which undertake only education without research might not be able to obtain any original advanced technology as well as new knowledge. Their education gradually becomes not up-to-date, and eventually they might not survive, since most of students who expect cutting-edge technology would not select old-style education. Therefore, in order to construct the industries in the country, all universities in the country should recognize their important roles, and put efforts in research and creation of innovators as well as innovations. Moreover, the universities and government should encourage and support the next generation to train to create innovations and establish new ventures in order to expand chances for construction of industries.



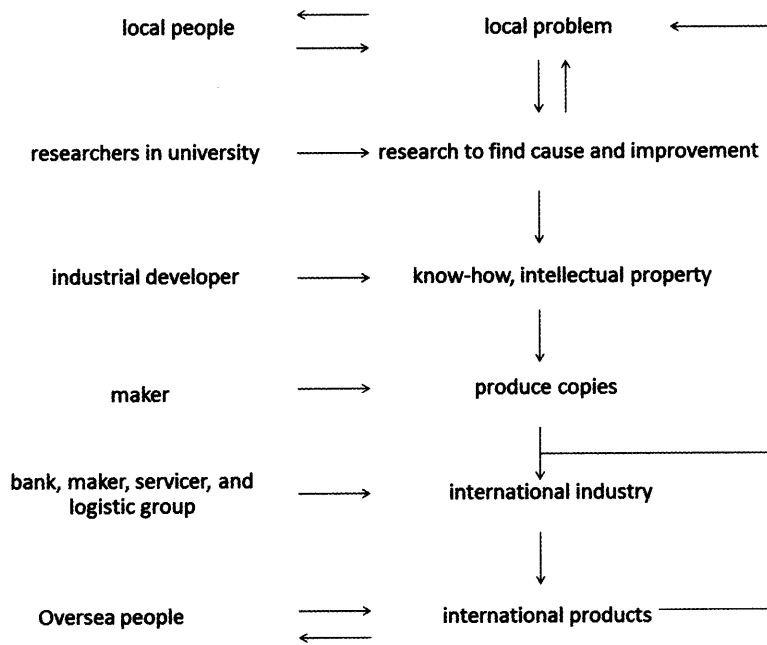


Fig. 3 A cycle of innovation to international product

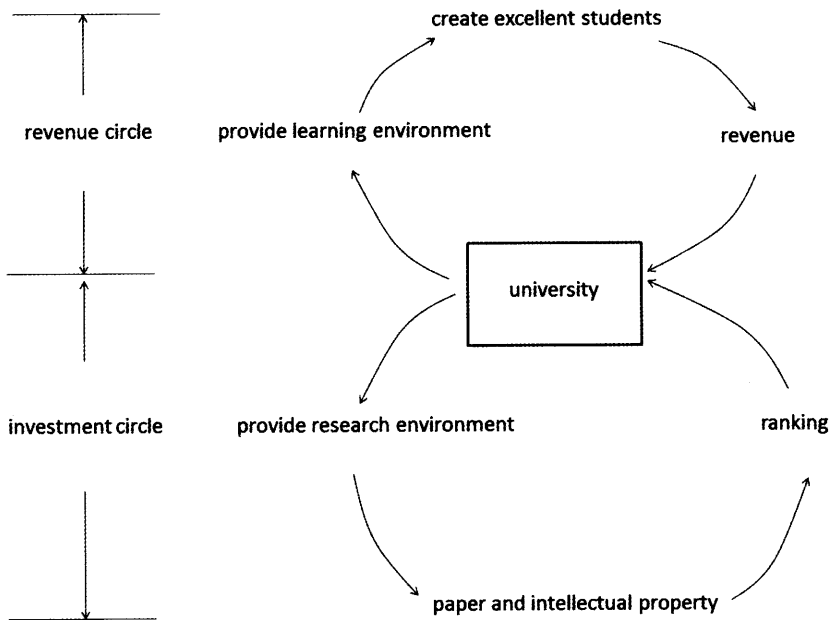


Fig. 4 A cycle of university survival

## 5. What kind of industries is suitable?

Though we know industries make country wealthy, it is not necessary for all innovations to be successful in business. We have to consider suitable kinds and types of businesses to avoid failure. In the history of developed countries, they initially changed themselves from agriculture-based to industry-based countries which we call industrial revolution as shown in Fig. 5. Actually, the material of the industry is agricultural products and natural resources mined from the ground so that it is to enhance efficiency of agricultural products. During the industrial era, they tried to improve mass production line in term of product quality, production time, and delivery time. Currently they employ computers and networks for enhancing production efficiency that we call IT industry era. The new industrial businesses that are launched from now should be considered in term of IT industry in order to be able to compete with others and survive in the markets. Since IT is a main keyword for nowadays, the people in the next generation should study the history and catch the trend of computer which is the key of the era. The computer business has started from large scale, gone into small scale, notebook, and finally tablet as shown in Fig. 6. In the previous era of notebook, computer acted as ubiquitous device that can be used anywhere and anytime. Currently, the table computers seem to serve as ambience in which machines autonomously communicate with other machine around them. People should recognize this fact, and create the appropriate industrial business based on advanced information technology.

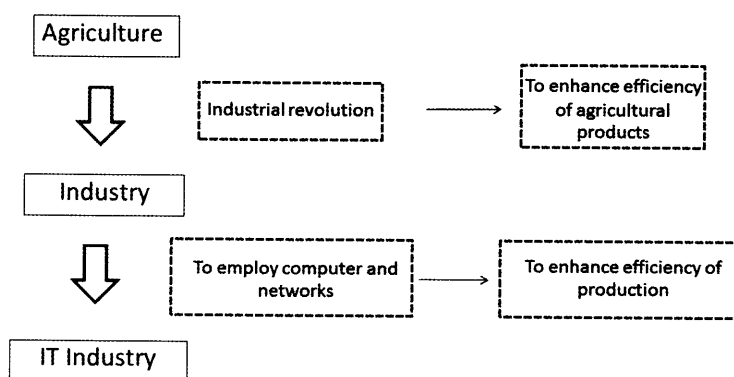


Fig. 5 Transition of industry

In the past, most of emerged innovations could lead to venture business, since there were not so many competitors. Currently, all businesses seem to be already done so that next generation people have to carefully survey and consider the survival business ventures. The research and development themes for innovations actually should be set up after decision of business. The survival of industries seems to be very serious issue, since the consumers have many choices.

In Japan, industries in steel and petroleum tends to convert themselves into VLSI and optic fiber, manufacturing is changed to service business, and heavy and chemical industries seem to move to IT business as samples shown in Fig. 7. This means people in the next generation should study what happen in the past and future, and start to create innovations for venture business establishment.

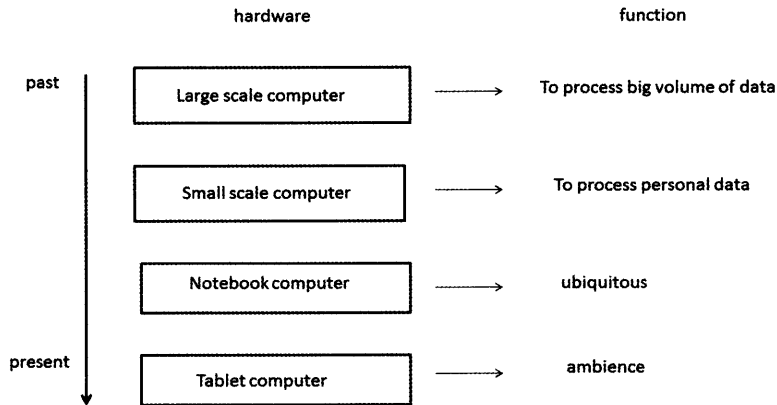


Fig. 6 evolution of computer

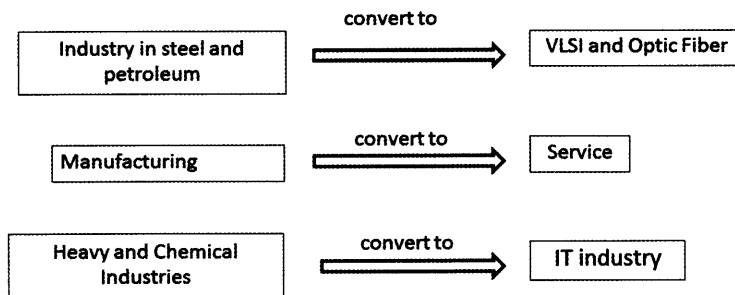


Fig. 7 conversion of industries in Japan

## 6. Discussion

We learn from history of many developed countries that industry creates nation wealth, and innovation makes industry and venture business. Innovation becomes a crucial key for successfully founding the industry and business. All countries want to have innovations and many innovative creators in their countries. The institutions which have a direct duty to educate this kind of people are universities. The universities actually have to survive by education which is the main business, but also need to invest in research for educating creative people and creating innovations. The research results which are research papers, standards, patents, and so on are then fed back to update the education contents. The universities which concentrate on

research therefore appear in the good rank, and students are consequently interested to study in such universities. The students who graduate from research universities will be able to get good jobs, and some become entrepreneur. What we have learned in this story is that a country should establish the strong foundation of creative and entrepreneurship education, and encourage people to apply innovations to venture businesses.

Amazingly, when the 2<sup>nd</sup> world war ended in 1945, Japan started from one of the poorest countries in the world, and stepped up to a member of G7 World Summit within 20 years. Even many basic innovations have been created in USA and European countries, Japanese people tried to learn it and then create their own innovations for solving their own problems during early period. These applied innovations become products, and these products made Japan as one of the richest countries in the world soon after. Recently, Japanese researchers upgraded themselves to be able to do research not only in application level but also in basic level. Nowadays we can see Japanese Nobel Prize winners in the fields related to science every year. It means Japan becomes a developed country that has strong basis to regularly produce innovations as well as innovators. Since Japan has no natural resource in the country, it is a kind of destiny to force them to usually learn advanced technology and add value to the imported material and export to other countries. Moreover, Japan has faced on serious disasters such as Tsunami, earthquake, volcano eruption and so on so that people have to work hard for surviving in this severe environment. In case study of Japan, we can conclude the character of Japanese according to the Fig. 8. Japanese people have positive attitude with enthusiasm, have business heart, and are proud of their own race. They have a concept that if people can do, they can do so that their goal is always in the top. In morality, they initially have Samurai heart which are sincere fighter, punctual, integrity, and serious in social responsibility. This makes like an impressive brand in the world so that Japanese products and companies are reliable in the international market. They are also diligent, curious to study everything, love improvement, and economize due to many disasters and no natural resource in the country. It is not so easy to educate and train people to be trained man like them due to different environment. However, people in other countries should know this, and adapt this to their own countries as possible when it is needed.

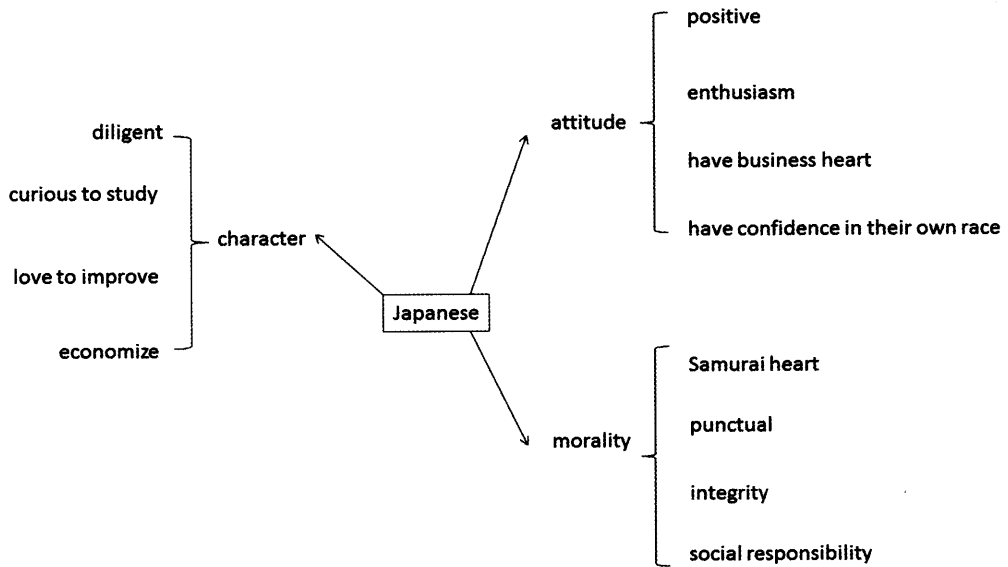


Fig. 8 character of Japanese people

## 7. Conclusion

This paper surveyed the importance of innovation, and learned how to develop a country to the developed level. We have learned that it is very important to instil function of innovation creation in every people in the country, and the businesses should be encouraged to establish by using innovation and supported to survive in long term. In addition, the case of Japan which successfully build its own country from the poorest to the richest within 20 years has been studied and discussed. We learned that Japanese people always face on natural disasters, and have to usually fight for surviving.