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# How can STPs support local manufacturing SMEs to tackle for new innovation in fast growing life science research market?
# - Lessons learned from KRP's challenge

*Parallel Session 2 :*

Innovating the commercialisation of technology


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# How can STPs support local manufacturing SMEs to tackle for new innovation in fast growing life science research market? - Lessons learned from KRP's challenge


## Executive Summary

In the commercialization of technology, most ordinary model is to utilize the technology from research institutions, such as universities. In this model, entrepreneurs andcompaniesare the ones who know the customer needs, and will be players to commercialize this technology.Kyoto Research Park (KRP), has found new innovative model for commercialization of technology.In our case, the technologiesof the regional SMEs are utilized, and the customer needs are given from the researchers.

In this paper, we will introduceourcommercializationactivity in one of the hottest life science areas, which are stem cell and tissue engineering researches.KRP has combined 3 strategic phases to support SMEs to challenge this market; "information support", "prototyping support", and "commercialization support".We will identify our activities and the key factors.

KRP wishes to share our lessons learned to accelerate regional innovation with SMEs as main players of innovation.(146 words)

## 1.Introduction

### Importance of innovation in the global world

Business has changed dramatically in this era of global economy and information society. Using internet, you can also supply your products to customers in opposite side of the globe. In terms of business outreach, we can say that the world is becoming more and more homogeneous.

As the world becomes homogenized, distinctive features to differentiate from each other will become important. The source of those features may be created fromtechnologies which cannot be copied. But this is not enough. You will also need a convincing story to show your distinctiveness. A combination of distinctive technology and story is the key to new innovation.

### Innovation model of commercialization by KRP

In this world today, it will be an important mission for STPs to vitalize these innovation activities and players of the region. STPs must find a model to support commercialization of these technologies. In an ordinary commercializing model, research institutions such as universities will be the source of technology. Entrepreneurs and companies will be players to commercialize this technology. They know where the customers are, and know what they need.

Kyoto Research Park has found a new innovative model for commercialization of technology. It is very distinctive from the ordinary model.In our model, customer needs come from researchersand the technological seeds come from the local SMEs. The researchers will also be the customers of the product.

In this paper, we will introduce which innovators we support and how we organize the supporting structure of commercialization.

## 2.Kyoto Research Park: an accelerator of innovation

Introduction of KRP

KRP, opened in 1989, is the first and the only private research park in Japan. The mission of KRP is to vitalize the local economy through innovation support.We do so by becoming the innovation hub of the region. KRP is located in central Kyoto, and has 350 tenant companies with 4,000 daytime working populations on top of 5.6 hectares of land.

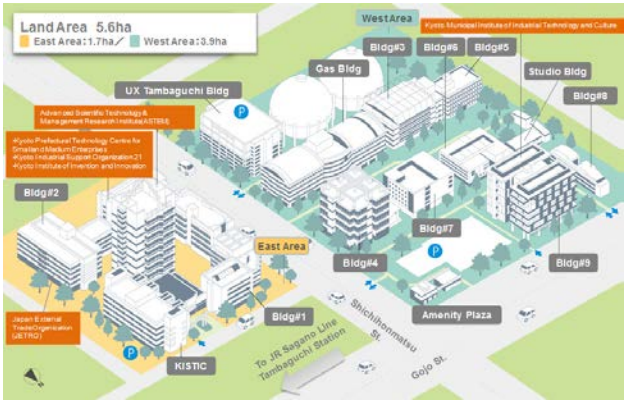


Fig. 1: Map of Kyoto Research Park

The uniqueness of KRP is that it is owned and operated by private company. By this, we have independence of operation from central/local governments or universities. This independence enables different government supported institutions to co-exist and accumulate in one place. SMEs can enjoy this accumulation, because they can obtain different kinds of support by coming to KRP.

KRP started originally as an ex-gas plant site redevelopment project of Osaka Gas Co. Ltd. Osaka Gas was manufacturing city gas from coal until the 1970s.The gas plant was producing gas for the companies and residents in Kyoto.However, in the mid-1970s, source of city gas has been changed from coal to LNG. Therefore, the gas plant was closed down and land redevelopment project was started in the early 1980s.

The most important factor of the project was to contribute to the local economic development. We looked in to the 3 distinctive features of Kyoto shown in Table 1.The project was formed in order to accelerate new innovation utilizing the distinctive features of Kyoto.With support from local governments and industries as well as central government, KRP was opened in 1989.

| Features | Distinctiveness |
|---|---|
| **Capital city** | - Over 1200 years of history (capital of Japan between 794-1868 AD)<br>- Compact city (proximity of work and living)<br>- Accumulation of traditional crafts and culture (textiles, ceramics etc.) |
| **Academic city** | - Student population >10% of 1.4 million Kyoto City population<br>- 48 universities and colleges in Kyoto Prefecture<br>- World leading research and development in universities |
| **Venture City** | - Birthplace of global high-tech companies (SHIMADZU, KYOCERA, OMRON, etc.)<br>- Accumulation of manufacturing SMEs supporting with unique technology<br>- Co-existence of high-tech and traditional industries |

Table 1: Distinctive features of Kyoto

## Characteristics of KRP

The most distinctive features of KRP are described in Table 2.

| Features | Distinctiveness |
|---|---|
| Accumulation of public support institutions | Becoming the one-stop service point for local SMEs by offering different support in fields of start-up, management, research, trade, funding, etc. |
| Accumulation of researchinstitutions | Home to Kyoto University Design School (first graduate faculty of Kyoto University outside of university campus) and other government funded R&D projects |
| Accumulation of 350 tenants | diversity of different business fields enables tenants to find new partners and collaborate within KRP |
| Open-lab facilities | Access to state-of-art instrument for very low rental price enables SMEs and researchers to accelerate their research |

Table 2: Distinctive features of Kyoto Research Park

As the operating company of the park, Kyoto Research Park Corp. offers services to realize its corporate motto “Accumulate, Interact, and Create”.Main services provided by operating company are described in Table 3.

| Services | Description |
|---|---|
| **Spatial Services** | We offer wide variety of office and research spaces to provide safety & comfort for tenants’ business life.<br>Convention venues are available to host special meetings. |
| **New Business Creation** | We aim to fully utilize the existing regional resources and strengths to find new collaboration possibilities leading to new innovation by catalyzing the regional collaboration between local industry, academia, and government.<br>4 key technology areas:life science, ICT, creative industry, energy& electronics |
| **Business Acceleration** | We provide support to maximize business growth utilizing our supporting network in Kyoto, Japan and World.<br>As the hub for new business creation, KRP provides:incubation &start-up support, business support, international business support |

Table 3: Services provided by Kyoto Research Park Corp

In this paper, we will introduce our innovation support activity in New Business Creation of Table 3, especially, in life science area.

### 3.Tissue engineering and regenerative medicine support platform at KRP

Regenerative medicine: hottest research area in life science

Regenerative medicine, such as stem cell research and tissue engineering research, is one of the hottest research areas in life science.Very fierce research competition takes place in stem cell research, such as iPS cells and ES cells.These cells, with their proliferation and differentiation properties, open the door for patients to receive tailor-made medicine using their own cells.

Still, most of researches in this field are in basic research stage. We are hoping to see more and more researches to step up to clinical stage in the future. In Japan, the clinical research using human iPS cells has just begun and is gaining more and more public attention.

Looking into the market, only a few products can be seen in regenerative medicine.Many are still in its pre-clinical and clinical development.There is a vast potential in the usage of these cells such as cell therapies, biopharmaceuticals, testing and research samples, etc.But in order to accelerate these R&D activities, development of supportinginstruments such as research equipment, instruments, culture vessel and else, are necessary.The market of these supporting instruments are said to grow substantially in the future as well. According to a report by Seed Planning Inc., the world market is said to grow from 2 billion USD in 2012 to over 40 billion USD in 2030, and over 120 billion USD in 2050 (Fig. 2).

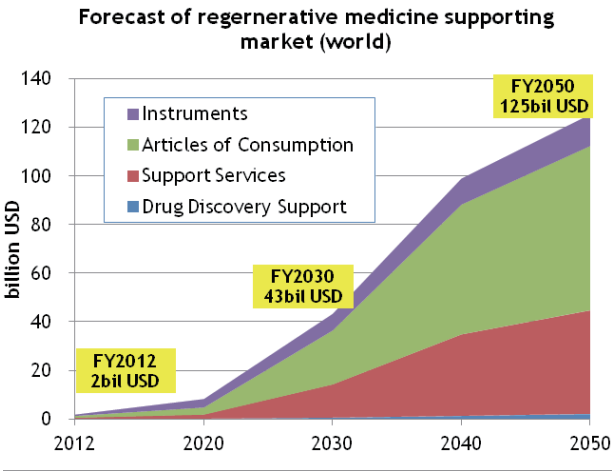


Fig.2: Global market potential of regenerative medicine supporting instruments
Source: 2012 report on SME support survey (Survey of regenerative medicine supporting market), Seed Planning Inc., Feb. 2013

As you can see in Fig.2, supportinginstrumentsmarket are not well developed at this point.So there is a room for manufacturing SMEs as long as they have the will and technology to challenge this market. Japanese government is backing up the industry development in this area.In Japan, Japan Agency for Medical Research and Development (AMED) was founded in April 2015 to facilitate R&D activity in the clinical research area.This institution was founded to unite policies which have been put out by different ministries of the Japanese government. Also, new legislative bill has passed the government to help facilitate manufacturers to enter the market.

However, life science is an unknown world to many of these manufacturing SMEs.The words used in research are very specific and difficult to understand for SMEs.Also, they don't know what kind of research instruments are needed, and don't know if their technologies can be applied.For these reasons,many SMEs cannot leap into the unknown world by themselves.

## Identifying the regional potential and target area of activity

KRP has been working on innovation support activities from its beginning.In 2009, KRP has launched an activity called "Tissue engineering and regenerative medicine support platform" to support regional SMEs to challenge in the area of regenerative medicine.Prior to the launch, KRP has analyzed the regional potential of Kyoto's academia, industry and government.

Firstly, looking into academia, there is an accumulation of high level research in this field.Especially, Kyoto University is one of the global leaders in stem cell research.Prof. Shinya Yamanaka, the founder of iPS cells, and Prof. Norio Nakatsuji, the first researcher to produce human ES cells in Japan, are both researchers at Kyoto University.

Secondly, looking into industry, a network of manufacturing SMEs with high skills is formed to create prototype industry, in which to enable customers' idea into real objects.Also, accumulation of global manufacturers with strength in analytic instruments like SHIMADZU, OMRON, and HORIBA is also seen at Kyoto.

Thirdly, looking into local government, Kyoto Prefecture and Kyoto City have developed policies to support industrial development in the fields of medical equipment and materials.Their policies are to take advantage of the regional industrial strength in analytics and nanotechnologies and help support new innovation.

With the analysis of the regional strength, KRP's challenge began.We first started with identifying the target market in order to maximize the strength of Kyoto and to accelerate innovation from SMEs in the prototyping industry. We came up with the idea to develop research instruments to accelerate research in regenerative medicine.

Comparing the market size, medical equipment has much larger market than research instruments.However, there is a very high hurdle of regulatory certification.It takes great time and money to obtain the certification. Upon entering the global market, you must repeat the process of obtaining certification in the countries you aim at.Also, the most of the research is still in the preclinical stage and it still takes time for the technology to be brought to the patients.The market potential is very strong, but it is too much of a risk for SMEs to enter in terms of money and market.

On the other hand, there are much fewer regulation problems in research instruments market. Researchers are unhappy with the situation that there are no specifiedinstruments for their research. Since the research is at the very front end, development of instruments has not caught up with the speed of research. Although the researchers have needs for instruments which they need, they don't know who to consult, or where to look for. So the researchers must conduct their research using conventional instruments or must make instruments on their own. If someone can make researcher's dream come true, the researchers can concentrate in there research.Also, there are many research competitors around the world, these researchers may become potential customers as well.The market size is not so big, it is too small for the global sized companies to enter.Therefore, once you can develop these instruments, the manufacturer can enjoy the niche market.

By identifying both regional and market potentials, we have come to a conclusion that research instruments will be the best market for Kyoto's manufacturing SMEs to challenge. Although we were able to identify the target market, there was still more to do in order to move our activity forward. This area was new and unknown to most of the regional SMEs.Their strength was originally in developing electronic components.The world of regenerative medicine was something you hear in the news, not something to work on.They did not know what kind of research activities take place and what kind of needs that the researchers had.They didn't know the words and language used in the first place.It seemed just like learning a foreign language to these manufacturing SMEs.So, even if they had interest in challenging, they did not know what to do nor know how to apply their technologies.

So, we had to find a way to develop a system to support these SMEs to initiate their challenge.

## Strategy to implement our activity

Upon launching our activity, we invited Prof. Yasuhiko Tabata of Institute of Frontier Medical Sciences, Kyoto University, to be the supervisor of our activity.He holds 3 different PhDs in the field of medicine, pharmacy, and engineering.He leads the world in research of biomaterials used in tissue engineering.He has networks to other researchers in this field and he can reframe the researchers' needs into engineering specifications. His knowledge and passion has been a great driving force for this activity.

We set our basic concept of this activity to be needs oriented, creating new business through supporting the realization of researchers' needs. For the participating SMEs, it is opening a door to the unknown world, so if they knew the researchers' needs in the beginning, they can see to themselves if their technology can be applied in making the instruments or not.They can also see the faces of potential customers upon developing the product.

KRP has combined 3 strategic phases below to develop the system for supporting the SMEs.The 3 phases are as follows:
A)information support
B)prototyping support
C)commercialization support

The phases were developed sequentially as the activity moved forward to the next stage of development.The summary of activities in each phaseis shown below.

First phase is "information support". The key factor to this phase is to translate the words spoken in regenerative medicine to words understandable by the SMEs. There are 2 meanings in translation. One is to translate the research contents, and the other is to translate the technological components of researchers' needs.In the former meaning of translation, we need to translate to SMEs what is being done at the scene of world leading research activities, and what kinds of instruments are used at the scene of world leading research activities.In the latter meaning of translation, we need to translate the specific needs of researchers into technological components such as size, material, function, and else. By breaking down into components, SMEs can evaluate if their technology can be used and can decide if they want to challenge or not.

Fig.3: Scenes of seminars done at KRP

KRP coordinates this translation process.Through its activities, KRP has set up seminars and symposiums to have leading researcher providing technological lectures (Fig.3) of their research and provide information of their needs of instruments which are needed to accelerate their research.We also have visualized the researchers' specific needs into booklets (Fig.4), so that the SMEs can understand more easily about the technology.Through these activities, KRP was able to connect researchers and SMEs both in words and in technologies.

Fig.4: Booklets made by KRP to visualize the needs of researchers
Website: http://www.krp.co.jp/sangaku/bio/booklet/

Second phase is “prototyping support”.The key factor to this phase is to match the instrumental needs of the researchers and technological seeds of the SMEs and to coordinate them to making prototypes of instruments. In coordination, most important aspect is to accumulate as much needs and seeds as possible. We need to find researchers who have specific needs for instruments and to find companies who have distinctive technologies which can be adapted into making instruments.

Effectivity and efficiency are also important aspects in this coordination. In order to bring in more members to the network, we need to show prototype examples so that they can understand that this activity is very effective.To make these prototypes, we must search efficiently to coordinate the right match of the needs and technologies. To coordinate effectively and efficiently, understanding of technology along with close communication and guidance to success are necessary skills for our coordinators.We have appointed coordinators who have had developmentexperiences of medical devices in companies. The coordinators have virtually knocked on the doors of laboratories and companies to search for instrument needs and technologies. They have made a list of over 200 needs and technologies from their visit, and moved on to screening process to find a perfect match. After the screening has been done, coordinators match the researcher with the technology holding SME to move on to the prototyping step.The coordinator will lead the communication between the researcher and the SME to help the translation and avoid unnecessary friction occurring due to difference in culture.Through this process, the prototype is formed, and researchers use the prototype to evaluate if more improvement needs to be done or not.

Through our activity, we have seen a total of 87 prototyping challenges and 58 successful prototypes.We have placed some samples of these prototypes in our booklet (Fig.4), and had them exhibited together in trade shows to make our activity visible to other researchers and SMEs.


Fig.5: Web database directory of technology for researchers
Website: http://saisei-monozukuri.jp/

To raise our activity’s visibility, we have also launched a website for researchers searching for new instruments using our database of technologies (Fig.5).In this website, we have made a guiding directory to support the search. The researchers can search the website according to the purpose of their visit, or technological requirements of the instruments, or purpose of research.The searching criteria were extracted through our screening process. It enables the researchers to search efficiently for the right SMEs to consult their instrument needs. Also, we have put in prototype examples in the website along with technologies, so that the researchers can have images of prototypes which can be made.

Third phase is “commercialization support”. Prototypes are just prototypes.They are made especially for the researcher who gave the order.SMEs can use the prototypes to evaluate whether their technology can be applied to this field or not, but if SMEs want to monetize their technology, they must transform the prototype into a product.The key factor to this phase is to improve the prototype to make it more easy-to-use for customers and to find customers wishing to use their product. KRP has been working together with the SMEs in this improvement process.Starting with the first product launch in December 2013, we have been able to support 5 products to be launched in the market so


Fig.6:“RIKAMO” introductory website or researchers
Website: http://rikamo.jp/

far. Another 5 prototypes are also going through the improvement process, preparing for market launch as well.

Through the commercialization support, KRP had difficulties in explaining the products to researchers. The researchers can’t figure out what this product is, or what this product can do when they first see it at an exhibition or at conferences.It’s their first encounter with the product, and the researchers have never thought that a product exists for that particular need. In order to solve this problem, you will need supplementary information to easily clarify the purpose, the merit and the usage of the product. If the researchers can image how it is used in their labs, they can provide beneficial information such as additional functions, shape, size, material, and else to improve the product. But this supplementary information must be easy to understand, because the researchersare not willing to read through a thick manual.

KRP has found a way to solve this problem.We have made short demonstration video for each product to explain how the product will be used in the lab and to explain what problems can be solved.At the exhibition booth, we will introduce this video along with the product, so that researchers can easily find out how this product works.We have also launched a website called “RIKAMO (Fig.6)”, which stores these demonstration videos we have made.Through RIKAMO, KRP aims to construct a system in which the researchers can search and purchase necessary instruments efficiently.We also aim to supportSMEs in the sales of the product and in retrieving feedback information of the products.

## Introduction of products which came out from our activity

We will introduce 2 examples of product which came out from our activity.First example is an instrument to prevent cross contamination upon cell culturing procedures. This instrument is our first product to be launched from our activity. The trigger to starting the development was the voice of a researcher who was growing different types of cell lines at his lab.The researcher conducts procedures in a clean bench and then puts the cell back in an incubator.The cells are stored in a covered dish and are moved in and out of the incubators when a procedure is done.The dish is slippery and there have been incidences where the dish falls from the hands when it is being moved.It not just spoils the cell inside, but it also contaminates the surroundings.So the researcher was looking for instrument to keep the lab environment clean even when an incidence occurs.But the instrument must be able to allow the air in, so that the cells can breathe inside.

The SME who challenged this development was originally an equipment developer for aerospace and nuclear parts.They were searching for new areas of business and attended the seminars at KRP.They had strength in designing equipment, so they raised their hands for the challenge.KRP’s coordinator has discussed with researcher and the company frequently to clear the contradictory conditions of closed yet breathable environment. They have worked together to identify the technological requirements.Through the discussion, additional requirement of transparency and heat resistance have been identified as well.

Thorough discussion and coordination finally lead to the successful development of the product shown in Fig.7. They have launched the product in December 2013, and have started sales in United States as well.

Fig.7:"MyCanister"aninstrument to prevent cross contamination
Ddecore Inc.: http://www.ddecore.com/index.html

Second example is an instrument to cut soft biomaterials into micro size dices. The trigger to starting the development was the voice of a researcher who was conducting research to regenerate knee joints.The researcher takes out the cartilage from the patient and cuts them into tiny pieces.He then grows the cartilage pieces in an incubator and put them back into patient.Since cartilage is very soft, it was very difficult to cut into micro size pieces.He was looking for an instrument to do this cutting procedure automatically.

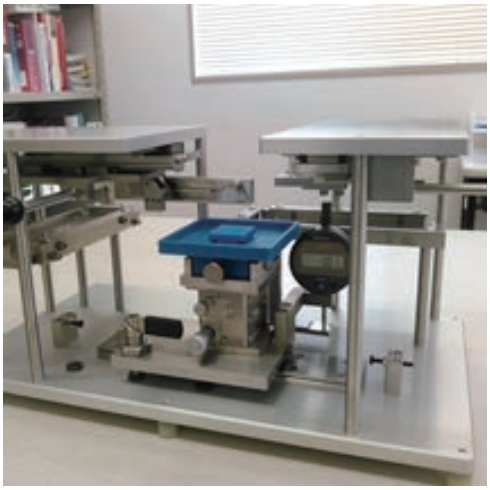

Fig.8:"3D biomaterial micro cutter" an instrument to cut biomaterials into micro size dices
Shibata System Service Co., Ltd.: http://www.shibata-sss.com/htm/hightech/en_product.htm

The SME who challenged this development was originally amanufacturer which KRP has been providing incubation support. The company was developing machines for semi-conductors and was looking for areas in which their technology can be used.Through screening of the technology, KRP's coordinator found that this company has the technological potential to take this development challenge. The coordinator had set up opportunities with the researcher to identify the technological requirements and at the same time, searched for R&D grants from the government.Through the coordination, they were able to apply for the R&D grant provided by the local government, lowering the development cost of the company. They came up with the prototype which consisted of 2 instruments to cut in 3D.

The coordinator led the improvement process and the company was able to unite the parts into one machine and make it into a product as in Fig.8.This product was launched in March 2015, and can be used by the researchers who deal biomaterials such as cartilage and skin tissues.

## Lessons learned from our activity

At KRP, we have combined 3 strategic phases to develop the system for supporting the SMEs.Through our activity, we have identified the key factors of each phase as shown in Table 4.

| Strategic phase | Key factors |
|---|---|
| **Information support** | - Translation of research contents and technological components of researchers' needs. |
| **Prototyping support** | - Screeningof instrumental needs and technological seeds to find the right match.<br>- Coordinationof researcher and SME to making prototypes.<br>- Visibility of activity, such as prototypes and technology. |
| **Commercialization support** | - Improvement process of prototype to product.<br>- Demonstration video to shortly explain the usage and merit of the product. |

Table 4:Strategic phases and key factors of Tissue engineering and regenerative medicine support platform

We are now seeing regional SMEs participating in our challenge and new products coming out from our activity.But these results are not just achieved in a short period of time. At KRP, it took 5 years to reach this point.So we believe that the most important factor is the passion and patience to continue the activity to purge through the difficulty and to invite challengers who will take part in our challenge.

We have seen not only the results but also face new challenges to overcome.Some of the challenges are as follows:
A)How to discover researchers' needs and SMEs' technologies more efficiently
B)How to raise the number and probability of product commercialization from prototyping phase
C)How to bring our products to the researchers throughout the world more efficiently

We will continue our activity to solve these problems.We are always welcome for our STP community's support in conquering the challenges.

### 4.Suggestions from KRP in commercialization of technology

Entrepreneur environment and players of innovation in Japan
Japanese economy has enjoyedstrong growth after the WWII to become the #2 country in GDP during the 1980s.But after the 1990s, Japan's economic growth has come to a plateau and has been suffering from very low growth rate as seen in Fig.9. In 2009, Japan has dropped to #3 spot in GDP, surpassed by China.

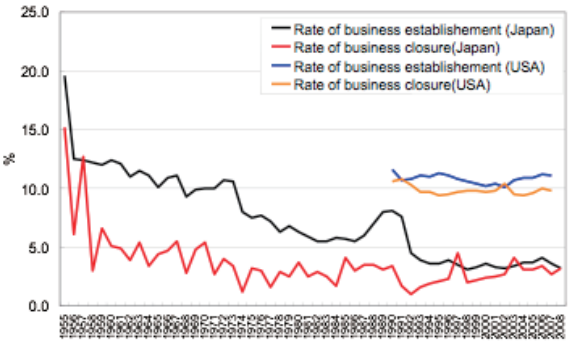


Fig.9:Global GDP transition 1970-2010
Source: International Monetary Fund

The rate of business entries and exits during this time period is shown in Fig.10.In 1955, the entry rate was almost 20%, but it fell to less than 5% in 1992 and after. On the contrast, entry rate in the United States have been over 10% showing the very low rate of Japan. We can see this in another source as well.

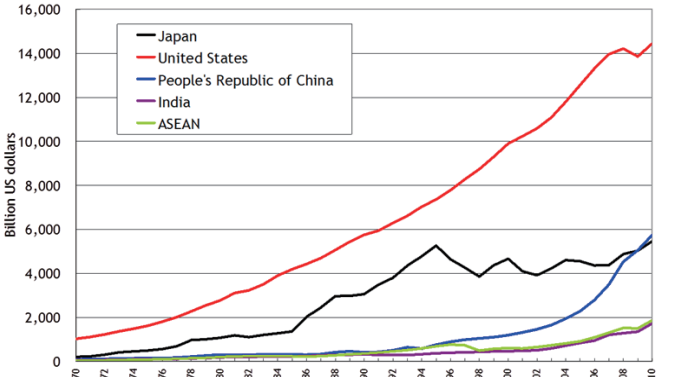


Fig.10:Comparison of business establishment/closure rate in Japan & USA
Sources:"2013 White Paper on Small andMedium Enterprises in Japan" and "U.S. Small Business Administration, The Small Business Economy"

"2014 White Paper on Small andMedium Enterprises in Japan" (white paper), has done an international comparison of new business startups.In the white paper, entrepreneur mindset and supporting environment is set to be the 2 main deficits to the low business entry rate.Taking this into count, in its revision of the "Japan Revitalization Strategy" in June 2013,Japanese government has set a goal to bring the entry rate to 10%. But since one of the main reasons is in the mindset, it will take time to change. We must look for other players of innovation.

In Japan, SMEs comprise to 99.7% of total enterprises.To supplement our problem of lack of entrepreneurs, SMEs must become the players of innovation.Many SMEs have been working closely together with large companies to support the economic growth in Japan. But the large companies are not as strong as before and SMEs cannot depend solely on these large companies anymore.They must cultivate their own market and customers through innovation. It is important to support these SMEs to create new innovation in a mature market like Japan.

## SME as the main player of innovation

As mentioned earlier, in an ordinary commercializing model, research institutions such as universities will be the source of technology. The institutions will look for a company to start a company on their own or to license out their technology.But in Japan, starting a business is not so easy. The companies are not so aggressive in taking the risks, so licensing out is also difficult in Japan.So it is difficult in Japan to proceed with this ordinary model of commercialization.

In the KRP's model, the main player of innovation is the regional SMEs.This is because we make use of the technologies of SMEs and use them in a different market. These SMEs have the will to challenge into the new market, so it is more effective to use existing resources than to start the process from developing a new technology.KRP has set up a system to coordinate these challenges, enabling SMEs to play the leading role

in our challenge of regional innovation.

## Suggestions from KRP to the STP community

Each region has its own strengths and resources.At KRP, we looked into the regional strength of Kyoto.We found our strength of academia, industry and government in the area of regenerative medicine, which brought us to our activity.

It is important to take a thorough look in your region to search for the regional potential as well as the best target area to utilize the potential and the main players to make the innovation. By identifying these elements and finding a way to utilize them, it will lead to new innovation in your area. And by sharing the lessons learned from the challenges in the STP community, KRP strongly believes that we can all contribute to the development in your own region!