Chapter 10

Innovation of Finance for Industry 4.0 in ASEAN

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Chapter 10

Innovation of Finance for Industry 4.0 in ASEAN

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1. Introduction

Industry 4.0 was proposed in October 2012 by the Industry-Science Research Alliance of Germany (Iwamoto, 2015). Its key technologies are digitalisation, data processing, and the internet; and it is a typical example of the internet of things (IoT). Industry 4.0 or IoT for industry is an irreversible megatrend in industry and will improve production efficiency through the optimisation of production processes. Its impact is not limited on the supply side but on the demand side, too, through the reduction of the loss of products by responding to demand precisely and on time. It will also push the transformation to circular economy and improve international competitiveness.

This is an irreversible global trend and the Association of Southeast Asian Nations (ASEAN) countries will be affected, both by risks and opportunities. This chapter focuses on the need for finance to realise the benefit of IoT innovation.

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2. Industry 4.0 and ASEAN

2.1. Nature of Industry 4.0

The benefits of Industry 4.0 are:

- **Improvement of productivity through the optimisation of processes**
  Industry 4.0, which connects and optimises various production processes at manufacturing facilities through the internet, can reduce wasteful energy, materials, and resources consumption. Furthermore, it can reduce the number of workers by using the digital control system, which is based on the know-how and experience of skilled workers, accumulated as a database. It is also able to scale down the production facility through outsourcing (Hongo, 2016b).

- **Reduction of loss of products**
  Demand for products can be predicted precisely and timely through the monitoring of various elements of the supply and demand chain such as sales through the point of sales system and the forecast of weather or other natural circumstance. Thus, it reduces the number of unused products. A well-known case is food loss. Annual food loss in the United States (US) and Japan is about 30 million tonnes and 6 million tonnes, respectively. The 6 million tonnes loss in Japan is equivalent to annual food demand from Tokyo with 13 million people.

- **Acceleration of innovation**
  i. Removal of the bottleneck of the supply chain for production
  Industry 4.0 can remove the bottleneck of supporting industry. For instance, when innovative products and services are proposed, designed, and planned by an entrepreneur, production capability is a barrier for commercialisation. Industry 4.0 and other IoT technologies will improve the access to producers and global supply chains and reduce the barriers for entry.

  ii. Reduction of uncertainty in market
  IoT will digitalise consumer behaviour and store the data in a database. Innovators can access potential demand directly and quickly. Thus, the IoT can reduce the uncertainty in demand.

iii. Flexibility to natural circumstances, e.g. weather forecast

Natural environments influence demand and supply. For instance, we may catch the change of ice cream sales immediately through an online system at retail shops (like point of sale) and increase its supply. If we forecast weather conditions precisely, we can respond to the demand more flexibly. This may improve quality of services, increase profit, and reduce waste. Sensor technology, particularly satellite remote sensing technology, is improving every year and observation data are accumulating. This will be the seed of innovation. It is crucial for combining the natural science, social, and economic data.

2.2. Opportunities or Threats to the ASEAN Economy

Canon, a leading Japanese camera and digital office equipment supplier, announced that it will start its fully automated factory in Japan in 2018. Canon shifted its manufacturing factory from Japan to other Asian countries after the 1990s for lower labour costs. But labour cost is no longer a critical factor with the robotics and computerised manufacturing system. Adidas, a German-based, world top brand for sports gear, also spoke about a plan to withdraw the manufacturing of its products in Asia and take it back to Germany.

When the share of labour cost is not a critical production factor, it is natural that companies will relocate their production base near their head office to connect research and development, marketing, and investment. Industry 4.0 will thus accelerate the home country regression of industry.

The other new trend is higher value of services by software. Panasonic, as a home appliance supplier, is keen to develop an online service system using its digital equipment and products. An example is the railway maintenance checking system using tablet terminals. Industry 4.0 will lower the barrier for new entrants to manufacturing and, at the same time, increase the value of network base service. Manufacturers take efforts to reduce production cost by Industry 4.0 and develop new fields through the internet and digitalisation as their long-term strategy. Assemblers have been at the top of the industry pyramid but they are losing their influence over the supply chain. System integrators are gaining more influence.

Industrialised countries will greatly benefit from Industry 4.0 because productivities and competitiveness will improve and there will be less dependence on labour cost. ASEAN economies may experience serious negative impacts by the relocation of manufacturing facilities but, at the same time, Industry 4.0 may help them 'leapfrog' their development by improving their access to knowledge and experiences, which are digitalised and stocked by industrialised countries. Industry 4.0 provides a big chance to small- and medium-sized companies and companies without manufacturing facilities too. Industry 4.0 is a serious threat but a big opportunity too. How to avoid the risk of Industry 4.0 and how to use this opportunity is a very critical agenda for ASEAN. A key is finance to support these projects and companies.

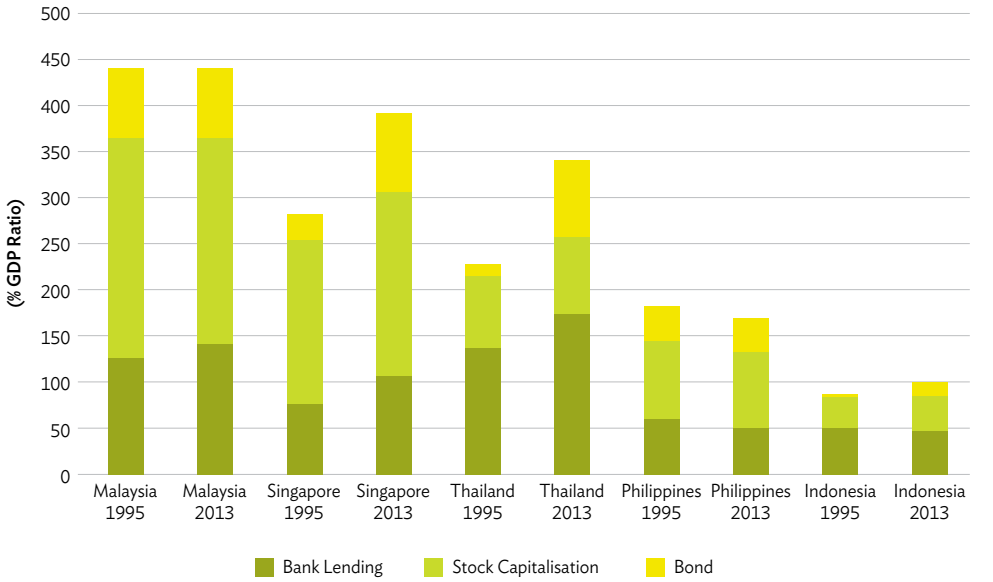
3. Modality of Finance – Innovation of Finance

3.1. Finance Market in ASEAN in General

Projects and businesses under Industry 4.0 have characteristics different from conventional projects. Thus, there is a need to develop suitable finance. Financial innovation is a condition for the development of Industry 4.0 in ASEAN economies.

ASEAN economies are growing. Their gross domestic product increased to US$2,400 billion in 2013 from US$666 billion in 1995 (up 260%), and their per capita gross domestic product also increased to US$12,291 from US$5,772 (up 130%). As well as economic growth, the financial market in ASEAN is growing. The ratio of bank lending, stock capitalisation, and bond issuing to gross domestic product in 2013 increased to 406% in Malaysia, 389% in Singapore, and 338% in Thailand as depicted in Figure 1. Domestic financial markets play more important roles in providing finance to the industry sector, even making long-term finance available. For instance, for large-scale photovoltaic power generation projects in Thailand, local finance was provided for 15 years because revenue from the project is guaranteed by the feed-in tariff system and financial risk is very low. In general, the finance market is growing and several options are becoming available.

Figure 1. Financial Market in ASEAN



ASEAN = Association of Southeast Asian Nations, GDP = gross domestic product.
Source: Daiwa Institute of Research.

However, access to finance for industrial investment and high-risk investment projects is still not well developed. Particularly for small- and medium-scaled companies and entrepreneurs, access to finance is limited. Innovative finance is needed for projects and companies under Industry 4.0 because their risks and return profiles are different from conventional projects.

These differences are summarised as follows:

- New products and services: Industry 4.0 is creating new products and services, and their markets are not confirmed. Conventional financial due diligence is unlikely to evaluate these projects properly.
- Small and medium-sized enterprises and ventures: Small and medium-sized enterprises and ventures are expected to be drivers of Industry 4.0 projects. Commercial banks are unlikely to support these projects because they are too small and do not have enough track record of borrowing.
- Engagement of many companies: More companies, including small-scaled companies, are involved in a project and burden of due diligence is bigger than that of conventional project.

We may use various finance models, like crowd finance, venture capital, industry finance, and green finance, for supporting Industry 4.0 but innovation of these finance models is needed too.

3.2. Crowd Finance

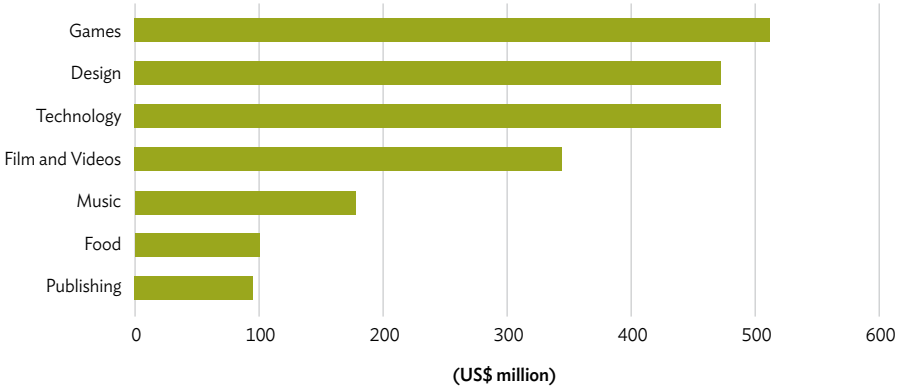
3.2.1. General

Crowd finance is defined as 'the collection of small money from numerous people (crowd) for a specific purpose'. This concept has a long history. A famous example is the Statue of Liberty in New York, which was constructed through donations from several French people for the celebration of the 100th anniversary of independence of the United States (US). The installation cost was funded by donations from the people of New York.

The diffusion of the internet and other IoT technologies will make this approach easier and it is suited to crowd funding. A typical project is a social-related one – poverty alleviation, for instance – or one that provides opportunities for education or medical services.

Crowd funding is also applicable for the development of new products. The largest crowd funding service provider in the world is Kickstarter in the US. More than 11 million people have participated in this and US$2.5 billion have been collected. It covers 15 categories and many are arts related. Technology is the second biggest category and US$467 million for 4,506 projects have been collected, which is depicted in Figure 2.

Figure 2. Kickstarter – World's Largest Crowd Funding Service Provider



Source: Kickstarter, 2016.

3.2.2. Cases of new product development

An example of funding for new product development is the compact and portable DJ mixing machine. The proposal was made by the potential user of this product and this is what they wanted. This is a typical demand-oriented product and more funds were collected than its budget (over-subscribed) because its products were what potential clients wanted to have and applications of the first product were developed following the success of the first model. Investors receive this product and are provided the right to buy additional units at a discounted price. Investors enjoy both products and the financial return.

The demand for the compact and portable DJ mixing machine was not confirmed by conventional manufacturers and, even if it was confirmed, it was unlikely to be produced because its market was too small. Hence, a new but niche market is developed by crowd funding.

Another example is the compact laser processing machine. This machine is common in industry and is of very high standard and expensive. This was proposed by potential customers who wanted a product with reasonable cost and performance. The planned budget was ¥1 million but the collected fund was over ¥46 million. Funding was 46 times bigger than the demand. This is a niche market and unlikely to be developed by a conventional manufacturer.

Both cases are scaled-down products that have not been developed by conventional manufacturers. A key for the success of these products is connecting potential demand and supply directly. The platform also arranges funding. The arrangement of the market, manufacture, and finance would be at one platform, and the procedure for investment decision is cut short.

Figure 3. Crowd-Funding Cases

Laser Processing Machine
Programme: Laser processing machine
Planned funding amount: ¥1 million
Collecting funding: ¥6 million
Reward: Discount purchase
Remarks: Initial program was completed but continued for the development of the attachment to the machine.

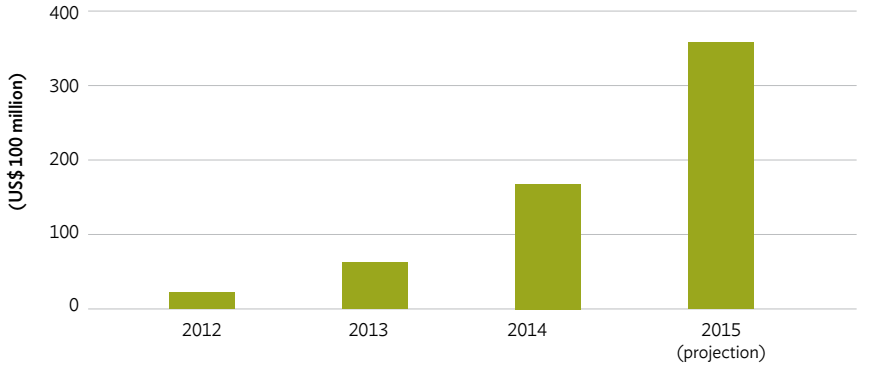
Source: Readyfor, 2016.

DJ Mixing Machine
Programme: Portable DJ Mixing Machine
Planned funding: ¥34 million
Investment: Several investment courses are prepared, from ¥27,800 to ¥79,800
Investors can purchase the machine with different discount prices
Remarks: Investors participating in the program are users of machines. Crowd funding supports not only funding but also marketing.

Source: Makuake, 2016.

The crowd funding market grew from US$2.7 billion in 2012 to US$16.2 billion in 2014. The leading market is the US, as shown in Figure 4.

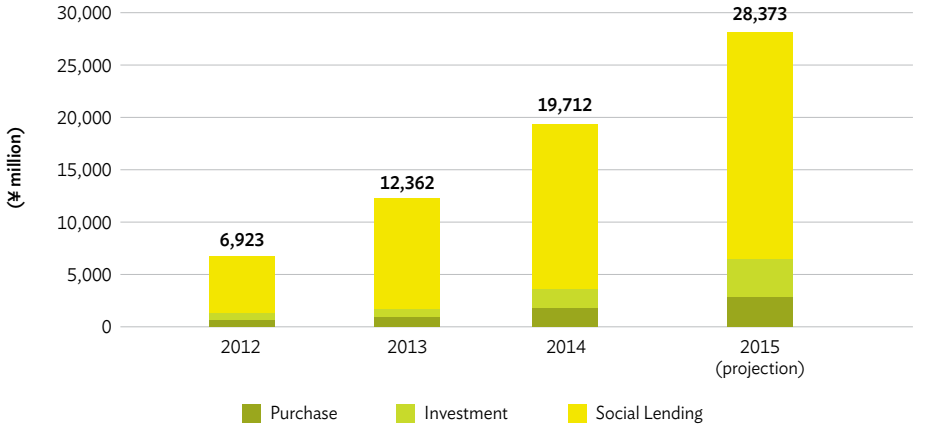
Figure 4. Global Crowd Funding Market



Source: Mitsubishi UFJ Trust Bank, 2015.

Crowd funding is spreading to many countries. The Japanese market is growing and market leaders are mostly internet service companies. The Financial Instruments and the Exchange Act was revised in 2014 to improve the investment climate through crowd funding (Mitsubishi UFJ Trust Bank, 2015). Figure 5 shows the growth of the crowd funding market in Japan from 2012 to 2014 with the 2015 growth projection.

Figure 5. Growth of Crowd Funding Market in Japan



Source: Yano Economic Institute.

3.2.3. Application and improvements

Crowd funding can be developed with a financial option for commercial projects, including Industry 4.0 projects. Sometimes the delivery of the product is delayed and, in the worst case, the plan may be suspended. We should learn lessons for further development.

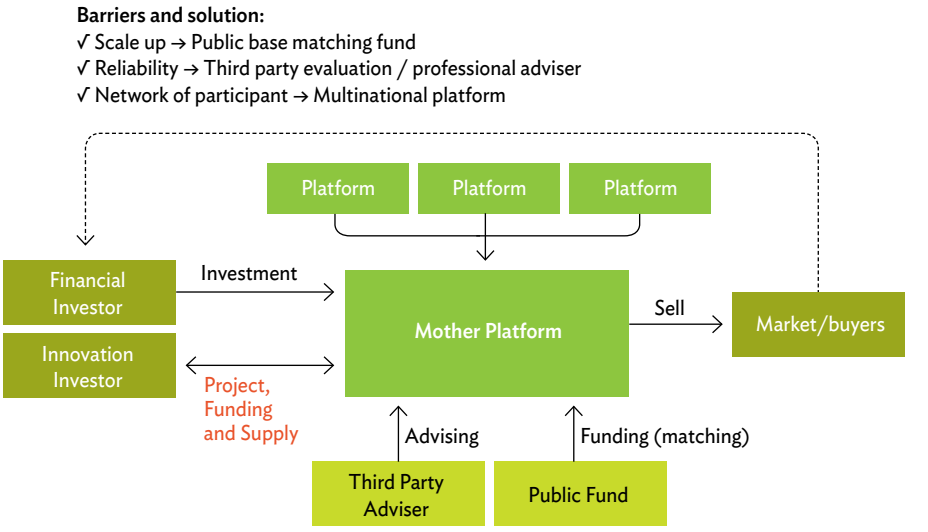
- *Scams or fake projects*
  It is easy to start funding for projects, but the risk of scams or fake projects cannot be excluded. In many platforms, a proposal is screened by the platform and developed together with the curator. Thus, the ability of the curator is important.
- *Technology evaluation*
  Proposals that are demand or technology oriented should be reviewed by experts or manufacturers to reduce technology risk.
- *Cost estimation*
  Sometimes, cost estimation is not done properly and cost overrun occurs. Experts in finance due diligence should review this to reduce the risk.

Crowd funding is still in the very early stages and has a big room for improvement. In addition to the three lessons above, we must consider ways to scale up the mobilisation of funds by applying crowd funding for projects under Industry 4.0.

One idea is having a public–private platform. The conceptual model is presented in Figure 6.

- A new platform will be established by public and private funds. This is the mother platform and it will have a partnership agreement with private crowd funding operators.
- The proposal by a private platform is submitted to the mother platform for review. The mother platform shall use advices from the advisory committee composed of experts to improve the review quality.
- Once the mother platform accepts the proposal, the mother platform will invest in the project together with the partner platform. Their investment amount depends on the amount of private fund. For instance, using 'one-to-one' leverage ratio. This is a kind of matching fund.

Figure 6. Recommendations on Advanced Crowd Funding for Industry 4.0



Source: Author.

3.3. Venture Capital

3.3.1. General

Venture capital is characterised as funds for investing in higher-return projects or companies, although the risk is high. Funds are invested in technology innovations and small-scaled companies with high-potential technology or unique products, and companies that need to restructure the business model for further growth. Private equity is a similar type of financial model. In general, private equity invests in a company that will nearly undergo floatation, while venture capital invests in the early stage of the company and project. Also, private equity is a financial investment which engages a corporate management. Some funds are a combination of these two types.

Many funds, including venture capital, private equity, and infrastructure funds, are in Singapore. Singapore is the regional hub of funds because of the following:

- Accumulation of capital stock for investment, particularly cross-border transactions.
- Information hub. Various companies and people, including finance, trading, and industry, from China, India, Japan, the US and the European Union, in addition to ASEAN countries, are based in Singapore.

> Technology. In addition to local technology, Singapore invites research and development centres from various countries by using incentives.

Singapore is an exceptional case in Asia and, in general, venture capital is not active in ASEAN countries.

3.3.2. Japan Asia Investment Co., Ltd.

Japan Asia Investment Co., Ltd. (JAIC) is a fund that invests in China and Japan. Its typical approach is not only providing funds but also engaging in corporate management ('hands-on'). JAIC invests in companies that aim to increase their corporate value and monetise their increased value through initial public offerings.

JAIC changes its business model from time to time in response to changes in the business environment. It was established in 1981 with the participation of 102 Japanese companies such as banks, trading companies, and lending industry, through the initiative of the Ministry of Finance. During its early stage, the Overseas Economic Cooperation Fund, as an official development assistance agency and now part of the Japan International Cooperation Agency (JICA, 2008a), participated as a big shareholder by inviting more private participation to JAIC ('cornerstone investor'). It exited when many private companies joined JAIC. JAIC's target was investment in infrastructure projects. After the Overseas Economic Cooperation Fund's exit (fully privatised) in the 1990s and 2000s, it shifted to industrial projects in ASEAN following the growth of the ASEAN industry. Its clients were local companies in addition to local Japanese subsidiaries in ASEAN. JAIC invested in the early stage of the project and near floatation. An example is a Singapore-based company which planned to develop and supply light-emitting diode lighting systems for fishing boats. The product was commercialised and succeeded to attain initial public offering. JAIC invested through both venture capital and private equity, and many of its investments reached until exit, followed by the growth of the ASEAN economy. JAIC was interested in both venture capital and private equity but did not have many venture capital projects because, in many cases, the projects were small and not enough upside value was expected.

However, JAIC's business model could not be continued. The Asian initial public offerings market shrunk during the financial crisis in 2008 and its cash flow position deteriorated rapidly. It was obliged to sell its assets to survive the crisis – they chose balanced contraction. JAIC received a Hong Kong-based fund as their major shareholder. It prioritised its country and its investments shifted to China and Japan, not ASEAN.

3.3.3. Japan Industry Partners Inc.

The next case is Japan Industry Partners Inc. (JIP). JIP was established in 2002 through the support of the former Industrial Bank of Japan (IBJ), which is now integrated with Mizuho Bank. The funder of JIP is someone from IBJ who has rich experiences in the restructuring of companies and supporting emerging companies. JIP's typical approach is to provide funds for the initial cost necessary to carve out a part of the business operation from a large-scale company, or merger of small-scaled business that has big growth potentials. Then, it intervenes in the corporate management, particularly marketing strategy. JIP will realise a return on its investment through initial public offerings or bilateral equity participation. It invested in Vaio personal computers, which was carved out from Sony, in BIGLOBE (computer portal site), which was carved out from the laser machine centre of NEC, and many others.

The share of Mizuho Bank (IBJ) was around 30% at the start of its business but it has been reduced to less than 10%.

The lessons from JIP are as follows:

- Financial support from bank
  Initial funding is critical because it takes time to recover the investment and it gives confidence to the proposal of the company. The reliability of JIP was supported by the expectation that IBJ, as a leading bank, will support it if additional funding for JIP is needed.
- Sourcing ability
  Networks amongst industry and access to potential clients are also crucial. The funder of JIP has long experience in industrial finance and his experience is valuable to the fund's marketing and operation.
- Market
  Engagement to restructure may realise big returns but its risk is so high and it takes time. Leading banks, like the three mega-banks in Japan, tend not to be interested in such investments. This is a niche market and JIP can avoid the competition with powerful competitors.

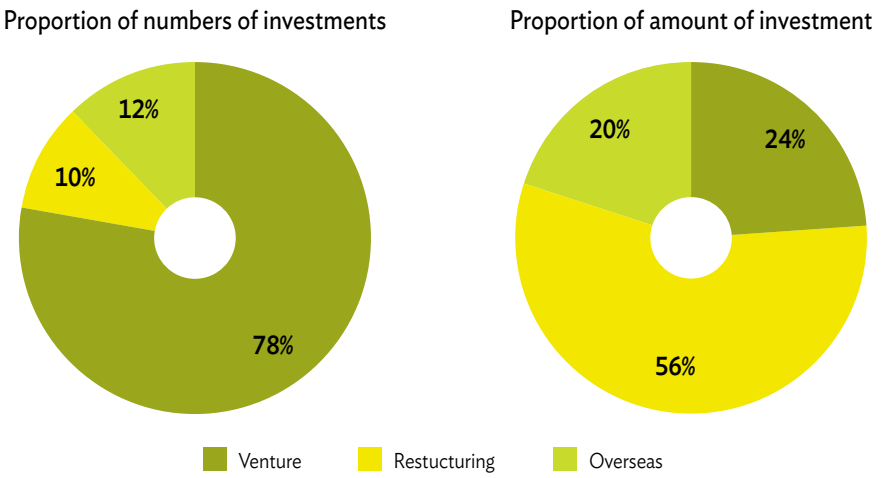
However, there are still some concerns and/or barriers. These are:

- **Financial position**
  Financial position is, in general, not strong compared with large commercial banks, and it may face a difficult situation when the finance market is depressed. A key for success is to keep sufficient financial position for surviving the economic cycle, which is about 7–10 years.
- **Staff**
  Engagement is a big burden for the fund in terms of human resources and it will limit the number of projects. Thus, securing experienced staff and maintaining the quality of the staff is important.

3.3.4. Innovation Network Cooperation of Japan

The third case is the Innovation Network Cooperation of Japan (INCJ) (INCJ, 2016). INCJ was established in 2009 and it aims to accelerate innovation, mobilisation of unused technology, and improvement of international competitiveness by restructuring the industry. INCJ supports a variety of businesses, including large manufacturing companies, small and medium-sized enterprises, ventures, and academia. It can finance both venture capital and private equity types of industrial projects.

Figure 7. Investment by INCJ



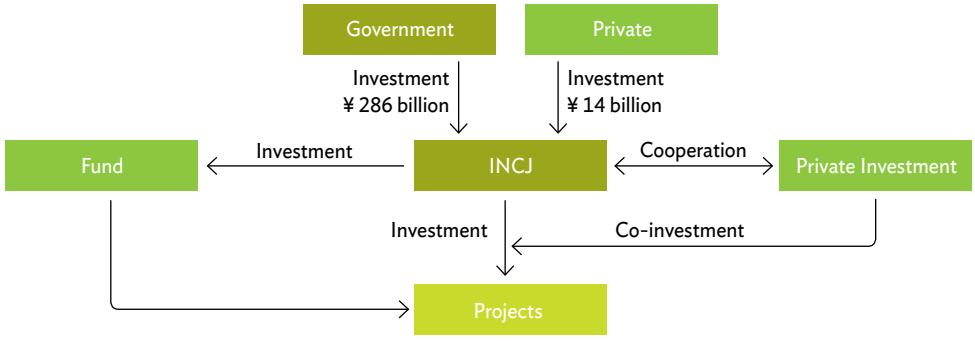
INCJ = Innovation Network Corporation of Japan.
Source: Innovation Network Corporation of Japan.

INCJ was initiated by the Japanese government, which provided ¥286 billion (95% of equity[1]). Private companies provided ¥14 billion. In addition to equity participation, the government provided a guarantee commitment up to ¥1.8 trillion for INCJ's financial operation. However, INCJ's style of operation is like the operations of private funds, and many staff are recruited from the private sector.

INCJ has a big funding capacity. In terms of its finance, 79% is venture capital and 9.7% is private equity. In terms of finance amount, 23.9% is for venture and 55.7% is for private equity (see figure 7). The average size of venture capital is ¥2.5 billion but private equity is ¥46.3 billion. The average size of venture capital by INCJ is small compared with private equity, but it is bigger than the average of venture capital in Japan (less than ¥100,000).

High sourcing ability is another strong point of INCJ because INCJ is neutral to all industrial groups and has close connections with a government technology agency. Three-dimensional (3D) robotics is a good example of strong sourcing capacity. The New Energy and Industrial Technology Development Organization, a government-owned research and development support agency, supports the research and development of 3D robotics through a Japanese university, and introduces products to INCJ for commercialisation.

Figure 8. Innovation Network Corporation of Japan
(Public–Private Venture Capital Fund)



INCJ = Innovation Network Cooperation of Japan.

Notes: Innovation Network Cooperation of Japan invests in innovation technology in addition to financing infrastructure projects. For example, 3D media for industry robots, smart metre, e-publications, microwave for chemical processing, and many more.

Source: Prepared by author using INCJ's web information, 2016.

1 The Japanese government invests through the Fiscal Investment and Loan Program Special Account. In addition to the investment, INCJ provides ¥1.8-trillion guarantee for the operation of INCJ.

INCJ also funds private venture capital funds. An example is its participation in the venture capital fund of Ricoh (digital devices company), Omron (digital device for medical service company) and Sumitomo Mitsui Banking Corporation (bank). This is a 'fund of funds' approach and it improves the investment performance of companies/projects using private venture capital. The scheme of the public-private venture capital fund by INCJ is depicted in Figure 8.

INCJ also finances infrastructure projects that have low return ratios and longer investment periods. This is to blend the different risks and return profile, and may improve the stability of the balance sheet of the fund.

Venture capital, private equity, and other fund approaches could be an option for supporting projects under Industry 4.0 because funds can take higher risks and may play a supplemental role of conventional commercial banks' financing, which, in general, are conservative to take higher risks. However, its weak points are initial fund raising, financial capacity during operation period, and technology evaluation capacity. An option to cover the weakness and enhance the strong points is a public–private approach.

Lessons learnt from public sector involvement of JAIC and INCJ

- Cornerstone investor and leverage function
  The Overseas Economic Cooperation Fund was a cornerstone investor for inviting private capital to JAIC. The share of private funds in INCJ is not so high but INCJ provides finance to projects with private finance (co-finance), or through private funds (back finance). This is the leverage function too. Both are effective to mobilise private finance.
- Sourcing
  Sourcing is very critical element for a successful outcome. The public sector is recognised as neutral to all companies and industry groups, and it also has good access to projects and the technology information of the public sector. More project information is expected to be supplied too. On the other hand, companies that are not familiar with the public sector tend to hesitate to consult with the public sector directly. Thus, the window for first contact should be improved.
- Technology and market evaluation
  The public sector is good at analysing the mid- and long-term future and overview of the market, although the private sector is good at in-depth evaluation for a specific segment. The combination of the public and private sectors is thus effective for improving analysis.
- Additional finance support
  The government provides big volumes of guarantee and this may improve the credibility of funds. Backstop finance can make the financial situation stable and improve access to market funding.

> Conflict between national and commercial interests
INCJ, as a public driven fund, has a special mission to comply with government policy, for instance, support the strategically important company and technology along with government policy. However, private shareholders focus on securing fair and sufficient returns for risk management. Balance is important. A technical solution is separate accounting in response to special missions.

3.4. Industry Finance

3.4.1. General

The ASEAN financial market is growing, but major players in project financing are commercial banks, which collect funds through deposits and provides short-term finances, like 2–3 years' maturity. However, industrial projects, particularly capital-intensive investments, require long-term finance like 5–7 years for manufacturing projects or over 10 years for energy-related projects.

An option for filling the gap is industry finance and we can see a good case in Japan.

3.4.2. Industry Bank of Japan

Industrial finance was very active during Japan's restoration from the damage of World War II and its high economic growth from the mid-1950s to 1970s. A critical barrier to restoration and economic growth was the shortage of finance, particularly long-term finance. Japan had a bottleneck of current account balance because it needed to import energy and resources, and the trade account became a deficit when domestic production was increased. The finance market was chronically tight, and access to long-term finance was very critical for industry.

After World War II, the Japanese government restructured the financial sector and transformed it into three categories: short-term finance (commercial bank), long-term finance (industry and mortgage finances), and public finance (infra-development and trade finances). Three long-term finance banks were established by reorganising the special banks during the pre-war period. They were privatised but were provided special articles of corporation (mission of bank) and status for issuing long-term bonds (IBJ, 2002).

IBJ, now Mizuho Bank, focused on financing the industry sector and provided finance not only for conventional heavy industries like steel, cement, and power, particularly after the restoration from war, but also new rising industries like automobiles, petrochemicals, semiconductors, and electronics.

A unique feature of IBJ was that it had an industry research department. IBJ analysed not only companies but also the industrial sector, whether it has growth potential and whether it may contribute to the Japanese economy. Then, IBJ provided finance following the analysis of each industry potential. It analysed corporate risk based on the project cash flow and/or the mortgage on the factory of the borrower to be financed, while most of the banks relied on collateral like real estate or financial assets. This was called 'project-based finance' compared with 'collateral-based corporate finance' and financing to small or early-stage companies. IBJ took care of these small and early-stage companies, particularly when the Japanese economy was in recession. In many cases, companies, soon after the start of the business, could not have strong a balance sheet and they were vulnerable to the economic turbulence. Therefore, this approach was very supportive of the Start-up Company and new and advanced approaches at that time.

IBJ played an important role in the restructuring of the sector for further growth, and it seconded its skilled bank staff to these companies in addition to the financial support. The merger of Nissan and Price Motor (now Nissan) and Nippon Steel by Yahata Steel and Fuji Steel (now Nippon Steel and Sumitomo Metal) are well-known cases.

IBJ's corporate message was to 'grow with industry'. A combination of long-term investment finance, sector potential analysis, and engagement in the management was its business model. Deutsche Bank had a similar business model. The role of IBJ in Japan was reduced and disappeared due to the merger of city banks because funding capacity was increased and various finance services became available.

We have learnt many lessons from IBJ that are useful in designing new industry finance to projects under Industry 4.0. These include:

Strengths

- Cash flow-based finance
  IBJ provided finance based on the cash flow of the project or mortgage on the factory, and its decision was pushed by the sector analysis. This approach was effective for the company at the start-up period.

- Long-term finance
  Industry projects need long-term finance but this is not easy for commercial banks because their funding is mostly from deposits or shorter funding sources. Special permission for issuing long-term bonds at tight market was effective for getting long-term funding.
- Independence from industry group
  IBJ was neutral to all industry groups and could fairly evaluate the growth potential of the sector. Independence brings benefit to both IBJ and the industry.

Change of business circumstances

- Slowdown of economic growth
  Investment in industry projects, including emerging companies, was decreased due to the slowdown in the economic growth of Japan. The demand for industry finance was reduced and banks shifted to financing the real estate business in the late 1980s, then the bubble boom was over in the early 1990s.
- Development of capital market
  Due to the accumulation of financial stock, in the 1980s, commercial banks increased long-term financing although their major funding source was deposits (asset and liability management was not seriously considered). Competition between long-term finance banks and commercial banks intensified and finally, in 2007, the special status for issuing long-term bonds was abolished.
- Capacity of bank (human resources and financial resources)
  Long-term finance banks could issue long-term bonds at a tight financial market but the retail business was limited to taking care of competition amongst banks. Their capacities were limited by both human resources and financial resources, and when they competed with commercial banks, limited capacity became a serious handicap.
- Return on investment
  The return on investment for long-term finance is, in general, not so high. This is a big concern when they tap on the capital market for funding because low return on investment leads to the low financial rating of these banks. This is a structural bottleneck of the industrial finance.

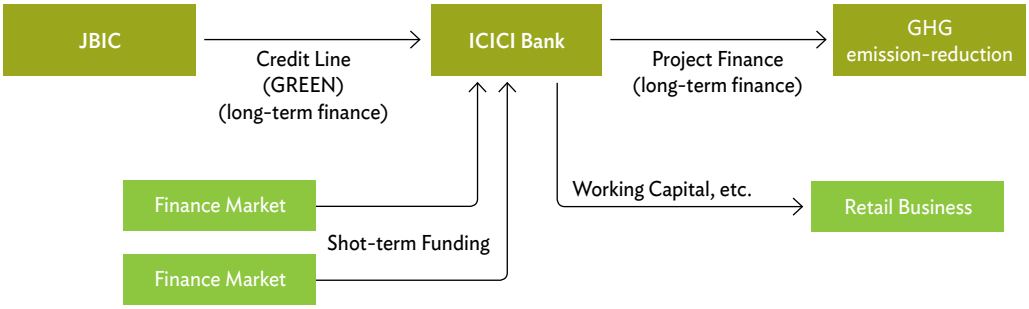
Recently, due to the low economic growth in Japan, small and medium-sized companies are expected to lead or stimulate the revitalisation of the Japanese economy. They have unique technology, capability for developing new market, and high growth potential, but their businesses lack finance. Large-scale companies can enjoy good access to finance because their financial risk is not high, and they can offer collateral if they are asked. However, the typical characteristic of funding demand by small and medium-sized companies is ‘middle risk and middle return’. This market is the air pocket of financial

services and the function of industrial finance is needed in Japan. This is the 'renaissance of industrial finance'.

3.4.3. Industrial Credit and Investment Corporation Ltd. of India

Industrial finance is not yet common in Asia and the exceptional cases are the Republic of Korea and India. The Industrial Credit and Investment Corporation Ltd. of India (ICICI) was established as an industrial finance bank but is now focusing on retail business. One of the weak points of the bank is long-term funding. ICICI borrows long-term funds from the Japan Bank for International Cooperation to support CO_2 emission-reduction projects, including energy efficiency and renewable projects (JICA, 2008b). This approach will reduce barriers to the availability of long-term funds.

Figure 9. Case of India, ICICI



GHG = greenhouse gas, ICICI= Industrial Credit and Investment Corporation Ltd. of India,

JBIC = Japan Bank for International Cooperation.

Notes: In 1955, the Industrial Credit and Investment Corporation Ltd. of India (ICICI), was established by the World Bank, the government of India, and the Indian industry for mid- and long-term project finance in India.

In 1994, ICICI Bank was established as a subsidiary of ICICI.

ICICI Banks shifted to multi functions from a development bank, but still provides finance for longer-term investments.

JBIC provides long-term finance (credit line) to support greenhouse gas emission-reduction projects, which need longer-term financing. There is a gap between demand and supply of long-term finance in India.

Source: Author.

Financing of projects under Industry 4.0 has some similarities with funding projects during high economic growth periods in areas such as project cash flow-based finance, sector approach for risk analysis, restructuring of the company (merger, integration, spin off, and the like), and long-term relationship with the borrower. Industry finance could be an option for supporting Industry 4.0, provided that some modifications and improvements are introduced.

3.5. Green Finance and Carbon Finance

Institutional investors who manage several funds at the global market are aware of the opportunities of projects and technologies for circular economy as well as the risk of global environment constraints. They are seeking new investment frontiers and varieties of 'green' finance initiatives such as green loans, green bonds, green funds, and green ratings. However, their concern is how to monetise 'green benefit'. 'Green benefit', which is in the most advanced stage for monetisation amongst 'green', is carbon dioxide (CO_2) emission reduction.

At the annual Conference of the Parties in Paris (COP21) in December 2015, the parties agreed to keep the temperature rise well below 2 degrees Celsius and to balance the anthropogenic emission and removal in the second half of the 21st century. Clearly, the additional cost will be charged to CO_2 emission. In other words, it will provide commercial value to CO_2 emission reduction. Projects under Industry 4.0 will receive additional incentives or funding when they contribute to CO_2 emission reduction.

The carbon market, the clean development mechanism under the United Nations Framework Convention on Climate Change, the Joint Credit Mechanism of Japan, the China Certified Emission Reduction, and other mechanisms have been prepared and implemented, but a concern is the demand for credits. Table 1 presents various management bodies of applied carbon markets across the countries. More than 180 countries submitted CO_2 emissions reduction targets (INDC[2]) at COP21 (Hongo, 2016a) but their implementation and monitoring mechanisms have not been determined. For the time being, the actual demand for credits is small and limited, and it takes more time for emerging actual demand.

[2] Intended Nationally Determined Contributions. As of 18 April 2016, 190 countries had submitted Nationally Determined Contributions.

This also has a technical issue. CO_2 credits and the reduction amount need to be calculated and verified in accordance with the United Nations Framework Convention on Climate Change's *Handbook on Measurement, Reporting and Verification for Developing Country Parties*. A typical reduction project is renewable energy use and energy saving through investments in equipment. However, IoT will reduce emissions through more channels like factory optimisation (production optimisation), reduction of waste (optimisation of demand and supply), or behaviour change (change of sense of values). A new methodology for evaluating CO_2 emissions reduction through IoT should be developed.

Table 1. Carbon Markets

Management Body	Outline
UNFCCC	CDM is being implemented but there is little demand. Under the Paris Agreement, Article 6, 'UN Centralized Approach' and 'Cooperative Market Approach' as international transfer mechanisms of emission reduction are considered.
International Aviation (CORSIA)	Offset mechanism is adopted for carbon neutral growth and will be available in 2021. However, early action (credit purchase before 2020) is considered.
EU ETS	Implemented from 2005. The biggest market revitalisation is planned.
US and Canada	No nationwide scheme now but subnational scheme, such as California and Quebec, is operational. Inter-state cooperation is active.
China	Seven pilot ETS are being implemented and C-CER is being developed. In December 2017, start of national ETS was announced.
Japan	Domestic and international offset credits scheme is being implemented (J-Credit and JCM).
Republic of Korea	ETS has started. International offset credit is planned after 2021.

C-CER = China Certified Emission Reduction, CDM = clean development mechanism, ETS = Emission Trading Scheme, EU ETS = European Union Emission Trading Scheme, JCM = joint credit mechanism, UNFCCC = United Nations Framework Convention on Climate Change, US = United States.

Source: Author.

4. Discussion for Future Works

4.1. Recommended Finance Option

Industry 4.0 or IoT for industry is an irreversible trend and is becoming a big stream. It provides an opportunity for ASEAN, although it poses a serious threat too. The key to utilising this opportunity and avoiding or reducing negative impacts is finance. The ASEAN financial market is growing and various financial services are becoming available. But projects under Industry 4.0 have different characteristics, like 'high risk, high return', and 'down scaling', and, therefore, innovations in financing are needed. Four finance instruments are recommended: industrial finance, venture capital, crowd finance, and green finance and carbon finance.

4.2. Public–Private Approach

The market of Industry 4.0 or IoT for industry is growing rapidly, and finance options should be prepared as quickly as possible. One way to fast track the development of these options is through public–private partnership. ASEAN member governments are recommended to take the actions below.

i. funding support, e.g. providing initial funds for the establishment of new financial vehicles;
ii. tax benefit, e.g. tax exemption from return on investments through innovative finance;
iii. legal setting, e.g. financial regulation for crowd financing (improve investment climate by setting proper financial discipline);
iv. phaseout policy (exit policy) for public money, e.g. conditions for withdrawal of public funds from public–private institutions for reducing the burden of tax payers and keeping level playing fields; and
v. rationale by economics; carbon price for removing externality.

4.3. ASEAN Knowledge Platform

These policies and measures shall be harmonised and shared amongst ASEAN members under the second phase of the ASEAN integration. I recommend that the Economic Research Institute for ASEAN and East Asia set up knowledge platforms for advocating the necessity of innovation in finance and the harmonisation of finance through local and international experts, such as academics and businesses from various fields such as technology, energy, and finance; and encouraging continuous policy dialogues with financial institutions and policymakers.

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