Young Scientists — Go to Japan for Your Career in Research!

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Introduction

If there is a field where people can think globally and act locally, it is science. In science, the path to knowledge and innovation has always been travelled best in company. More things can be achieved in science when people work together than when they work alone, because in the end research tends to be an interdisciplinary process that requires collaboration among colleagues within an institute or with other institutes beyond national borders.

For this reason, scientists now often work outside their country of origin. Because of their mobility, they are exposed to miscellaneous ways of life, different people and various cultures, and sometimes it can take months for them to adapt to a new environment. If researchers stayed in the same place throughout their career, they would miss things they might not even know existed. The benefit of global research mobility enables young scientists not only to learn from each other, but also to have a better chance to access unlimited opportunities that could lead to scientific careers at top research institutes around the world. Considering this, intellectual exchanges and collaborations with overseas research partners are indispensable in climbing the research career ladder.

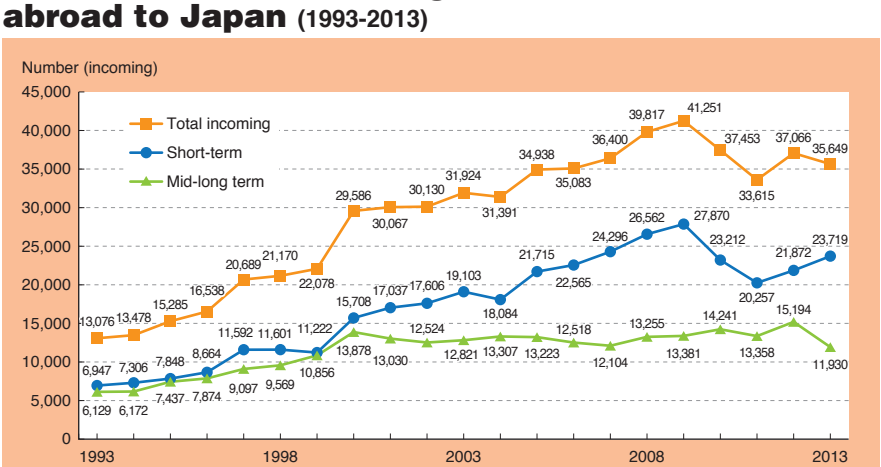
As a beacon of science, technology and innovation (STI), Japan has a long tradition of promoting groundbreaking research and technological innovations among its talented scientists. With its soft power in this field, in recent decades Japan has constantly attracted a large number of young scientists from different parts of the world to come and carry out research at its various research institutes *(Chart 1)*. While they may have life-changing experiences during their research periods, there has recently been debate among relevant stakeholders about whether or not young scientists can secure permanent academic positions in Japan.

Although Japan's scientific output in global research relies to a certain extent on their productivity and creativity, the voices of young scientist and their aspirations have so far not drawn significant attention from the country's science policy-makers. Therefore, understanding how to address their needs and what obstacles they encounter during their research stays at local institutes is very important for Japan as the host country, in order to retain its competitiveness and attractiveness as one of the world's main destinations in global research mobility.

Through a research fellowship sponsored by the Japan Society for the Promotion of Science (JSPS), I had the privilege of being exposed to and becoming integrated into the local research environment in Tokyo. In reflecting my recent experiences, this article highlights the importance of young scientists in Japan's research and innovation landscape and their contribution to the local research environment and society. Although the country has a world-class research infrastructure, generous research funding support *(Chart 2)* and highly talented manpower, there is still much room for improvement. I have therefore identified a number of possible reforms that could be undertaken by Japan not only to shape, but also to empower the next generation of up-and-coming young scientists through a variety of science and immigration policies. The successful experiences of Germany, Finland and Hong Kong in recent years could inspire Japan in formulating relevant and suitable blueprints for young scientists. By learning fruitful lessons from their best practices in implementing effective science policies, Japan will be able to make positive changes in building up its competencies through its own young scientists.

CHART 1

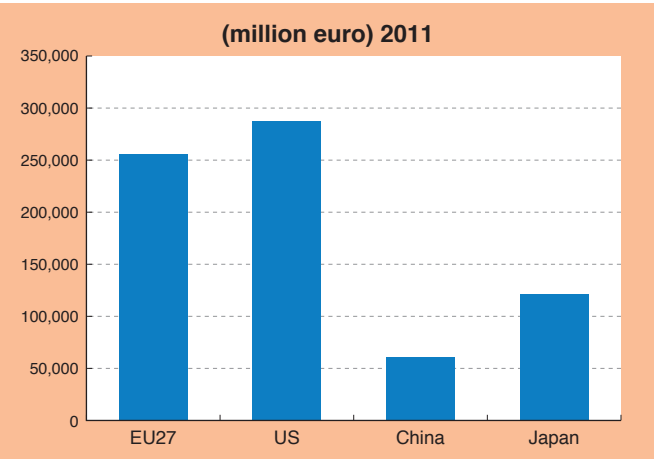
Total number of incoming researchers from abroad to Japan (1993-2013)



Source: Ministry of Education, Culture, Sports, Science & Technology (MEXT)

CHART 2

Gross expenditure on R&D in some countries



Source: European Research Council, 2012

Importance of Young Scientists in Japan & Their Roles in Knowledge-Based Economy

Research and innovation are widely recognized as the keys to attaining economic growth and socio-economic development. As the world's economies have increasingly become knowledge- and innovation-driven, cutting-edge research is required to drive innovation down the road. Without research and innovation, there is no progress; without progress, business players stagnate and become losers. Therefore, fostering seminal research to facilitate innovations and practical applications of research results are critical to the future development of a knowledge-based society.

With this in mind, attracting the best scientists, particularly young scholars, is a necessity. Young scientists play major roles in Japan by being both innovators and creators. As innovators, they are today's cornerstone of knowledge creation, diffusion and application. As the vanguard of global research mobility, today's young scientists represent a pool from which tomorrow's scientific leaders will emerge. As a major economy that has recognized the importance of knowledge for sustained economic growth, the availability and mobility of young scientists in Japan are crucial for the country's scientific potential and economic growth. Japan could benefit from their massive intellectual contribution when developing a competitive national research and innovation system based only on their excellence.

Young scientists often spend the period between being in a postdoctoral position and gaining academic tenure working on short-term contracts of between one and two years, and relocating from one country to another for subsequent postdoctoral positions. They usually recognize this as a "bottleneck" that represents the most insecure and unstable phase in their research careers. At this phase, a large number of highly qualified young scholars worldwide compete for limited faculty positions that would grant them independence in teaching and research.

In Japan, in order to be a junior group leader, presently local young academics need to have a considerable number of years of postdoctoral training experience overseas. Naoki Nagata and Shinya Yamanaka have highlighted the need to establish a number of career paths for young scientists other than securing a permanent academic job at a public university as a faculty member ("Young Researchers in Japan", *Science*, April 2013, Vol. 340). In this case, Japan should consider emulating the German model of a Junior Professorship (JP) when establishing internationally competitive career paths for young scientists. In Germany, successful completion of a JP not only represents an alternative to habilitation, but also promotes qualified young academics later to a full professorship with tenure track options. This path will open doors to young scientists with excellent credentials to start their scientific career immediately after completing their PhD degrees.

By creating a merit-based academic appointment that grants them independence in teaching and research, Japan would attract promising and talented young scientists to come and stay in the country. Such an attitude toward young scientists would reflect Japan's aspiration not only to put its scientific profile on the world map, but also to break free of traditional vertical hierarchies in academic appointments marred by seniority. Earlier studies indicate that creative and innovative breakthroughs are often made by young academics between 30-40 years old, because of their ability to think independently outside the box, especially on how to address existing research gaps beyond the scope of conventional wisdom.

With this JP scheme, promoting young scientists as independent investigators at a productive age in their professional career would revolutionize the ways of dealing with existing research methods and practices. This would help young scientists in their uncertain career progression, while improving their research output at international levels. Since they would have fewer teaching duties and administration responsibilities, the JP scheme would enable principal investigators (PIs) to focus their resources and energy on doing research alone for publication purposes. With such a scheme, it is anticipated that over the next few years more foreign young scientists would come to Japan for research and remain here to build their own career as PIs.

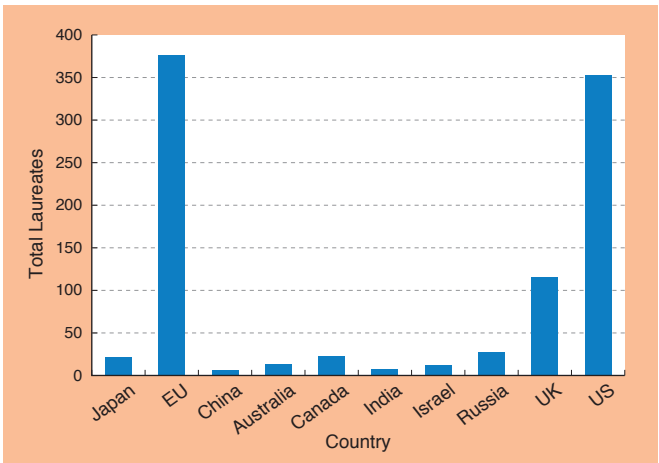
Strategic Approach to Restructure Japan's Academic Landscape

1. Nurturing Young Scientists with Soft Skills and Industrial Internships

As reflected by the number of selected OECD countries' Nobel Prize Laureates in recent decades *(Chart 3)*, Japan has been recognized as a key innovation leader in the field of basic and applied sciences ("Spotlight on Foreign Researchers in Japan: Go East, Young Man", *Nature*, December 2010). However, its research strength and potential have been limited by its unique model of faculty appointments, in which its research landscape configuration at public universities is mostly characterized by a pyramidal distribution according to

CHART 3

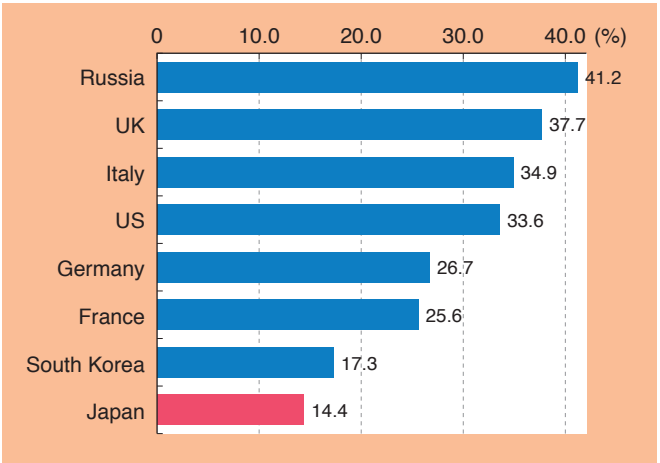
Distribution of Nobel Prize winners from several countries (1901-2014)



Source: Author, based on information on Wikipedia

CHART 4

Percentage of female researchers in 2013



Source: Ministry of International Affairs & Communications, Japan, 2013

seniority. This system has enabled a number of senior academics to build their own laboratories equipped with costly state-of-the-art facilities. However, due to a variety of administrative duties and demand for publications in peer-reviewed journals, which result from their research-funding sponsors, they often do not have time to train and nurture their research students in one-to-one relationships. As a result, they often lack the vital soft skills such as leadership, research data management and awareness of research ethics that are very important for ensuring the quality and integrity of their research work.

To tackle this issue, the country could offer its young scientists teaching assistantship opportunities. This would help them work closely with an interdisciplinary team of engineers and technicians with complementary expertise. The roles of each individual should take place within an interlocking system, which could be diversified with different kinds of functions. This nurturing of a whole system would ultimately be productive for the researchers, as they would be supervised competently to become independent scientists later on.

During their interactions, they could gain essential soft skills such as communication capability, teamwork and team building, and creative thinking in problem solving, as they would be trained to address large and complex problems requiring investigation through interdisciplinary teamwork. When a problem cannot be solved single-handedly, the team would work on a coherent and integrated plan with multiple investigations over a longer period to produce high-impact results. Ultimately, this would intensify young scientists' training in all round development so that they would be better prepared for future employment within or outside of academia.

Considering the fierce competition in today's academic job market, a tenure track academic career is limited to a tiny fraction of young scientists, while there are hardly any suitable research jobs outside of academia. Getting a tenured position is therefore one of their major concerns.

Japan could address this career issue by establishing an industrial internship scheme to support mobility for young scientists across the boundaries between academia and the private sector. In this scheme, researchers would be employed in the private business sector for a period of one year at most. This would foster the efficient and effective transfer of knowledge and technology from university laboratories to industries, and make innovation possible. This scheme would also provide the researchers with hands-on experience of Japanese business practices, such as *kaizen* and *monozukuri*, as they would participate in a variety of business sectors including manufacturing, engineering and marketing, and not limited to the R&D sector alone. An industrial internship would pave the way for young scientists to pursue a career path outside of academia if potential employers decided to recruit personnel with advanced degrees. Thus, a PhD achieved in Japan might represent a tangible benefit in the long-term if the holder pursued an industrial career later.

2. Boosting Female Scientists' Participation in Research with Gender Equality Policy

Although Japan has many highly-talented female scientists, *The Japan Times* pointed out in its April 14, 2014, edition that only 14% of the country's scientists are female, whereas the corresponding rates in other OECD countries on average are two to three times higher *(Chart 4)*. As of 2013, it is estimated that there were 127,800 female and 759,200 male scientists in Japan (*White Paper on Gender Equality*, Japanese Cabinet Office, 2013). This indicates that so far very few women have viewed science as a viable career option. This figure, which is less than those of the United Kingdom (37.7%) or Germany (26.7%) in 2013, highlights the low proportion of female scientists in a field dominated by male scientists, who often have a competitive edge over their female counterparts with respect to promotion and financial incentives. With the overall population shrinking in the next few decades, Japan needs not only to tap into women to generate high-caliber engineers in the future, but also to address the prevalent gender bias in its research system (http://www.universityworldnews.com/article.php?story=20140213133643482).

Apart from bridging the existing skills gap in the national economy, tapping the huge source of well-educated Japanese women into the potential workforce and maximizing the reserves of scientific talent among female scientists are vital for a research organization to achieve top-rate results. For this reason, Japan needs to provide equal opportunities for male and female scientists in research by advocating an equitable gender balance of staff at public universities nationwide. If necessary, the government should help public universities to provide female scientists with daily childcare support, which would enable mothers to work full-time at their office with peace of mind. With many female scientists intentionally dropping out of the workforce when they have children and very few returning to their scientific careers, the presence of childcare support is critical to keep working mothers on an academic career trajectory *(Chart 5)*. This support gives them a clear message that Japan and science need women.

To encourage greater participation by woman in science and research, public universities need to promote and apply a gender equality policy in the recruitment of new staff for academic posts. They should consider hiring female applicants when shortlisted candidates are recognized as equivalent in performance evaluation (such as research, education, and social contributions). I would argue that those who want to attract the best brains, achieve excellence and succeed in international competition have to ensure women's equality in science and research. If women are excluded from science, Japan is essentially losing half of the intellectual capacity of the nation, which eventually stifles economic development in the long-term. It is, therefore, in the interests of Japan to promote gender equality and equal opportunities for women because the presence of female scientists improves the quality of the country's performance in science and makes science interesting and rewarding work.

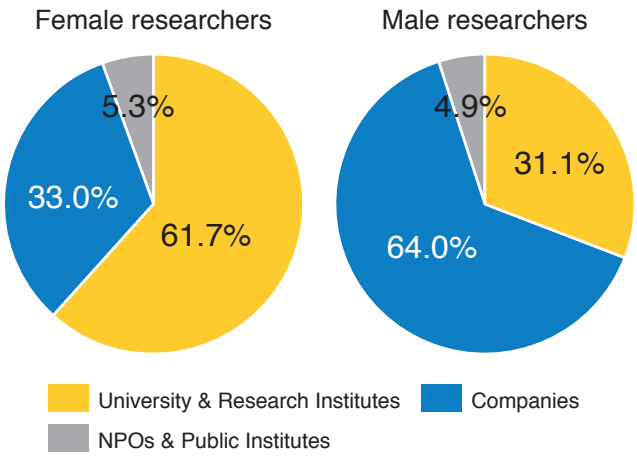
3. Attracting and Retaining Non-local Graduates with Special Immigration Arrangements

Foreign students who have completed Japan's graduate education system are well equipped not only with basic knowledge and professional skills, but also with a good understanding of the language as a medium of communication and of the cultures of both Japan and their countries of origin. Having said this, I would argue that relaxing the current work restrictions in their residence status would not only help supplement the skilled workforce required by Japan's industries, but also enhance socio-economic relations with the graduates' countries of origin. So far, however, there is no special immigration arrangement in place to attract and enable non-local graduates with special skills to live and reside in Japan continuously, in spite of both the immense interest from international talent and the immediate manpower needs of Japan.

To strengthen the competitiveness of its workforce, Japan should consider Hong Kong's experiences in assimilating talent with international exposure into the local community upon their graduation. Recently the Hong Kong Immigration Department relaxed its employment restrictions on non-local graduates by

CHART 5

Distribution of male & female scientists in Japan's workforce



Source: Ministry of International Affairs & Communications, Japan, 2013

reforming the city's immigration policy. As one such non-local graduate, I myself benefited from its simplified and streamlined visa application procedure when it was first introduced in 2008.

Since then the city has allowed non-local fresh graduates to stay in Hong Kong for 12 months without imposing other conditions of residence. New graduates account for most of those who apply to stay and work in the city within six months after graduation. In this scheme, they are free to take up employment in Hong Kong, and do not need to obtain prior approval from the Immigration Department for any change in their employment.

In addition, the Immigration Department opens its doors to non-local graduates to apply to return to Hong Kong to work after six months following their graduation. As long as they are capable of supporting their dependents financially, the returning graduates may bring in their spouse and unmarried dependent children under 18 years old. After seven years of continuous residence in Hong Kong, they may apply for the right of abode in the city.

Before the change of this policy, those who wanted to work in the city needed to seek prior approval from the Immigration Department. In fact, persons admitted to Hong Kong as a student are not allowed to work whether paid or unpaid during their period of study.

With depopulation posing a dire problem for Japan, it is necessary to address its potential threat to the nation's economy and society as a whole. By 2060, people older than 65 are expected to constitute 40% of the overall Japanese population. If international students remain in Japan to work, they might help alleviate this demographic problem. Most of the international students in Japan not only pursue an excellent standard of tertiary education at local universities, but also aspire to improve their lifestyle after their graduate studies. It would be a win-win situation for Japan if it decided to reform its immigration policies on such foreign talent. In this case, Japan could introduce a number of legislative measures for international researchers to have a special way to get a scientific visa. By building up talented human capital, Japan could maintain the quality of its

current workforce over the long term. By complementing its own workforce with high-quality professionals and entrepreneurs from overseas, Japan's economic development could be sustained steadily over the next few decades.

Relaxing employment restrictions for international graduates would bring benefits to Japan as the host country. With their knowledge of major foreign languages such as English and Chinese, such non-local graduates with proven professional abilities and/or advanced degrees represent a valuable asset for a vibrant workforce in Japan in the future. As the country moves toward a knowledge-based society, attracting and retaining international graduates will help enlarge its talent pool to meet the challenges of an aging population and declining workforce.

In fact, their employment would help local enterprises to penetrate into global markets. As more and more Japan companies expand into the emerging market economies such as China and Thailand, they will benefit from employing international graduates from those countries. Their presence in Japan's workforce would have a positive effect on the national economy and help sustain the nation's competitiveness in the global economy over the long term.

4. Promoting Partnership Between Industries and Academia/ Research Institutions

In today's knowledge-driven economy, the paths to economic success are represented by well-educated manpower, technological innovation and entrepreneurial zeal. The key lies in the strong relationship between industry and universities as the source of new knowledge and well-educated graduates, but this important message is not always well understood by policy-makers.

It is widely recognized that supply and demand are not always well aligned. As businesses are struggling to find new personnel and fresh ideas, graduates may not be able to find work that is compatible with their training at universities.

To bridge the gap, industries and academia in Japan need to have a close interaction not only to further leverage R&D outputs in the form of innovation, but also to establish the country as a home of trendsetters and early adopters, thus encouraging new ideas and critical thinking. Academic communities at universities, research institutions, and research-intensive companies in strategic areas should create a fruitful and productive environment for intellectual exchanges. This could take the form of a close-knit unit that allows researchers to move freely between the public and private domains. It would be beneficial if companies were proactive in offering internship opportunities for graduate students to write their theses. Companies would discover the new talent they need, while research students would gain practical experience of the real world of business. During their work placement, students are continuously encouraged to come up with creative ideas and to think beyond conventional solutions and methodologies. With such partnerships the bond between industries and academia could be strengthened.

In this regard, one drawback of Japan's higher education system stems from the gap between academic research and industry. Current practices in the world of research in Japan do not encourage young researchers' mobility from companies to universities. To tackle this situation, R&D experiences in Finland offer good lessons. Finnish research is well known for its close contact between industries and universities in R&D operations. Every company in Finland as a rule has an agreement-based R&D relationship with at least one local university. Its R&D actively creates new companies, businesses, and services. As a result, technology is efficiently and effectively transferred from academia to industries periodically.

What is the secret behind Finland's success in research and innovation? The keys to the success of the country's R&D system are (i) the autonomy of universities and non-university research institutions in the identification of research topics and methods in the area of innovative basic research and (ii) a long-term commitment and cooperation between companies, researchers and funding organizations driven by Tekes (Finnish Agency for Technology and Innovation) to undertake cutting-edge applied research. As the government's funding organization for R&D and innovation in Finland, Tekes is responsible for promoting the competitiveness of industry by technological means. In Finland, R&D is carried out not only by universities and public research institutes, but also by companies (both profit and non-profit) with national and international funding. The government provides fiscal treatment for companies investing in R&D by giving discounts in social security for those hiring researchers and incentives to foster the transfer of knowledge and technology.

An example of the academia-industrial partnership in Finland includes the technology cluster in Otaniemi, which is the headquarters of R&D of Nokia, the University of Helsinki's Institute of Biotechnology, and the business and economics research conducted at the Helsinki Business Campus. To enhance its partnership with academia, Nokia set up an integrated network of research centers that promotes innovation through collaboration with universities and/or research institutes. With this strategy, Nokia absorbs fresh ideas and innovations from researchers in academia.

Conclusion

Real success in research is only possible through the committed work of highly motivated researchers. Therefore, it is important to maintain research careers as an attractive option for young scientists. For a scientist who has completed a PhD, securing a tenure track academic job is like an anchor that provides stability for a ship in rough seas. To enable *crème de la crème* researchers to carry out their ambitious research plans at local universities, Japan needs to invest its resources not only in novel ideas but also in human capital. A defining moment has come for Japan to attract and retain young scientists by gradually reforming its science policy and immigration procedures. JS

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