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Japan's IT Investments and Earnings Power in IoT Era

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Summary

- Information technology (IT) continues to evolve today, as seen in higher computer processing/memory capacity, wider and faster fixed-line/wireless communication networks, and smaller devices. New concepts, such as Internet of Things (IoT) and big data, could bring drastic changes to existing business models, and are likely to be increasingly applied across industries.

- In 2012, US firms collectively invested roughly $442.6bn in IT, which accounted for around 39% of total private-sector capital expenditures that year. The US government has done its part, pushing policies that assume the increased use of IT. Meanwhile, Japan's IT investments totaled roughly Y16tn in 2012, growing rather sluggishly despite the hefty amount. In 1995, information and communication technology (ICT) capital stock accounted for about 1.9% of the private-sector capital stock in both countries. Since then, however, the US has seen the figure grow faster than Japan, resulting in the US number roughly double that for Japan.

- Aggressive IT investments in the US since the late-1990s appear to have contributed to labor productivity gains for the entire US economy, particularly for non-manufacturing industries, which are often IT users (as opposed to IT producers). While the US has called for creating added value through IT investments, Japan has spent on IT with an emphasis on improving business efficiencies and reducing costs. Their different stances have likely resulted in more modest contributions from such investments to labor productivity gains in Japan than in the US.

- The Japanese government is working to strengthen the nation's earnings power, defining the creation of added value through the use of IT as a cornerstone for future economic growth. To this end, it has implemented such initiatives as facilitating the greater use of IT in industries demonstrating relatively low productivity despite their significant contributions to the nation's creation of added value. Statistics suggest that aggressive IT investments with clear goals (e.g., business expansion) could expand Japanese firms' top line and bring other benefits.

- In Japan, more IT specialists work in industries that provide the technology than in those that use it. Fewer firms have appointed chief information officers (CIOs) in Japan than in the US. This fact suggests that Japanese firms have yet to have frameworks and a population of IT specialists necessary for promoting more effective IT use. For Japan to stay abreast of developments in the IoT era and reinforce its earnings power overall, we believe that the nation must boost IT investments both qualitatively and quantitatively.

1. IT evolution across industries

Indeed, IT is everywhere today, allowing access not just by specialists but also by almost anybody. Such easy access—underpinned by expansion of public/wireless communication networks, development of online services, and enhancement of device functions—has fueled the rapid spread of IT. More recently, the spotlight has been on IoT, which refers to the network connecting people and physical objects embedded with positioning systems, advanced communication sensors, and many other types of electronics and software.[1]

IoT technology may be viewed as an attempt to grasp the real world as accurately as possible in the computer-based virtual world through the digitization, collection, and analyses of big data (enormous amounts of information on real world). It is believed that the combination of high-speed computation in virtual settings and physical applications (e.g., robot operations) will improve efficiencies, speed, safety, and security in the real world as well as enable more accurate projections of future real-world events based on established virtual worlds. Aside from IoT, artificial intelligence (AI) has continued to evolve. The combination of IoT and AI may create a cycle consisting of the transformation of data into knowledge, the real-life application of such knowledge, and autonomous data acquisition and learning.

Such IT evolution will likely bring innovation on many fronts, improving business efficiencies through better processes (process innovation), spurring demand through new products and services (product innovation), and addressing societal issues (social innovation). Indeed, IT is likely to be used more widely than ever before, including cross-industry applications that break conventional industrial boundaries. For example, IT may enable more accurate demand forecasts in the retail industry, self-driving in the transportation sector, preventive/personalized medicine in the healthcare industry, and prevention and reduction of crimes, accidents, and disasters in the area of municipal management.

2. IT investments in Japan, US

2-1. US leading world with steady, substantial IT investments

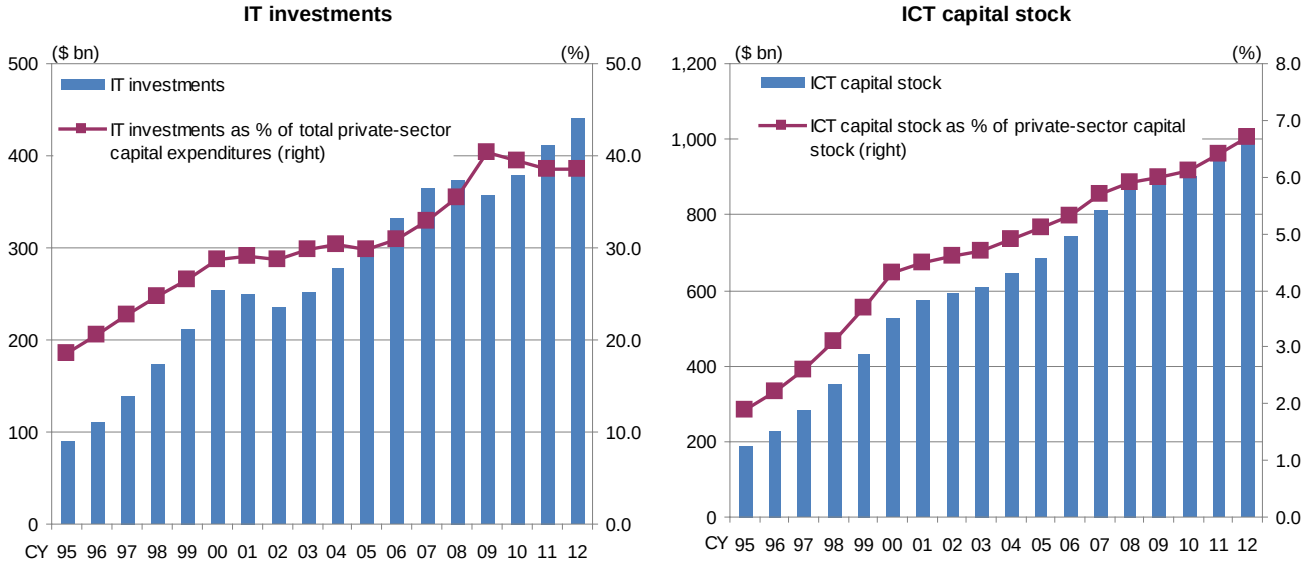
In March 2012, the Obama administration announced that it would spend $200mn in a Big Data R&D Initiative.[2] This initiative aims to facilitate the more effective use of big data in addressing the pressing issues that the nation faces. It covers R&D in such areas as scientific discoveries, environmental/ biological/medical research, education, and national security. The administration announced a follow-on theme for this initiative in November 2013.[3] In April 2013, it announced a BRAIN Initiative intended to promote innovative research to better understand human brains,[4] for which it proposed a budget of over $300mn for FY16.[5]

[1] IT industry terms (e.g., IoT, big data) are often defined loosely and, as such, are used to express very vague ideas and concepts. In this report, we used definitions in documents published by the Information Economy Subcommittee of the Commerce, Distribution and Information Committee under the Commerce and Information Bureau of the Industrial Structure Council of Japan's Ministry of Economy, Trade, and Industry, etc.
[2] *Obama Administration Unveils "Big Data" Initiative: Announces $200 Million in New R&D Investments* (29 Mar 2012); Executive Office of the President of the United States.
[3] *"Data to Knowledge to Action" Event Highlights Innovative Collaborations to Benefit Americans* (12 Nov 2013); Executive Office of the President of the United States.
[4] *Remarks by the President on the BRAIN Initiative and American Innovation* (2 Apr 2013); Office of the Press Secretary, The White House.
[5] *Obama Administration Proposes Over $300 Million in Funding for The BRAIN Initiative* (2 Feb 2015); Executive Office of the President of the United States.

In the private sector, meanwhile, five major US firms formed an Industrial Internet Consortium in March 2014.[6] This not-for-profit organization aims to facilitate the penetration of IoT technology through such initiatives as improving the interoperability of industrial equipment connected to common networks. As of 12 March 2015, the consortium had 141 members including Japanese firms.

According to a study by Japan's Ministry of Internal Affairs and Communications (MIC), IT investments in the US totaled roughly $442.6bn in 2012, accounting for about 39% of total capital expenditures in the private sector there (Chart 1). Meanwhile, information and communication technology (ICT) capital stock has continued to expand in the US, amounting to about $1tn in 2012, which accounted for around 6.7% of capital stock for all US private enterprises. Given this, US firms are leading global IT businesses with their substantial spending in the area, backed by the government's initiatives.

IT Investments in US **Chart 1**



Note: Capital stock (real net stock of fixed assets) for 2012 estimated based on chained (2009) dollar data.

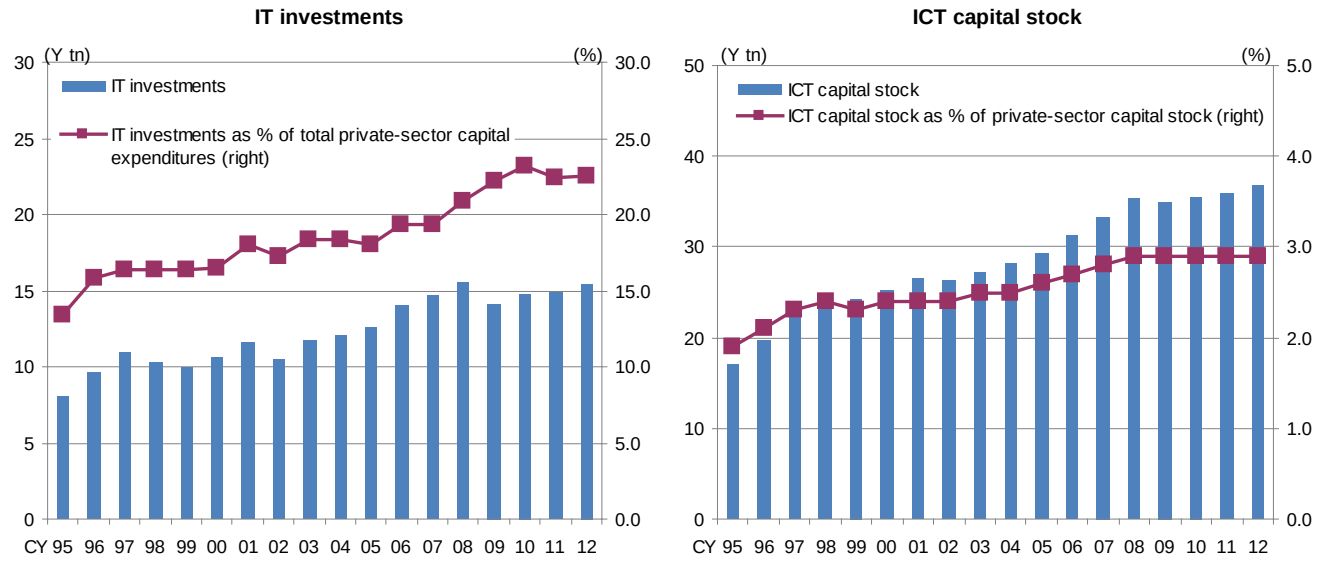
Source: *2013 Survey of Economic Analyses on ICT* (Mar 2014), MIC; compiled by DIR.
Note: Both charts based on constant 2005 US dollars.

2-2. Sluggish growth in IT investments in Japan

In 2012, IT investments in Japan totaled roughly Y16tn, accounting for about 23% of total private-sector capital expenditures (Chart 2). Meanwhile, ICT capital stock totaled about Y37tn in the same year, which accounted for around 2.9% of capital stock for all private-sector firms in Japan.

[6] *AT&T, CISCO, GE, IBM and INTEL Form Industrial Internet Consortium to Improve Integration of the Physical and Digital Worlds* (27 Mar 2014); Industrial Internet Consortium.

IT Investments in Japan **Chart 2**



Source: *2013 Survey of Economic Analyses on ICT* (Mar 2014), MIC; compiled by DIR.
Note: Both charts based on constant 2005 yen.

Chart 1 shows that IT investments in the US expanded roughly five-fold over 1995-2012, while the corresponding figure for Japan increased only about two-fold. Also, over the same period, the proportion of IT investments in total private-sector capital expenditures in the US grew from roughly 19% to around 39%, with the corresponding metric for Japan growing about 1.8-fold from roughly 13% to around 23%, equivalent to the figure recorded by the US in 1997. Despite seemingly impressive growth for Japan, the gap between US and Japan IT investments has widened in value terms.

Now compare ICT capital stocks of the two countries. Such capital stock in the US expanded roughly five-fold over the same period, while that in Japan only increased roughly two-fold. In 1995, ICT capital stock accounted for about 1.9% of the private-sector capital stock in both countries. However, the US saw the figure grow more than three-fold to around 6.7% in 2012, while the Japanese number only rose to around 2.9%, equivalent to the US figure in 1998.

The same MIC study discusses IT investments as a percent of GDP over the same period. While the US witnessed the percentage figure increase from roughly 1.0% in 1995 to around 3.2% in 2012, Japan saw it expand from roughly 1.8% to around 3.0%. Although the figure for Japan was larger than that for the US in 1995, the US outpaced Japan eventually. IT investments in Japan had remained on an uptrend but have basically flat-lined since the Lehman crisis in 2009.

To sum up, the US has aggressively invested in IT since the late-1990s and has continued to build up its ICT capital stock. On the other hand, Japan has not seen meaningful growth in IT investments. The end result is that ICT capital stock as a percent of the private-sector capital stock in the US is roughly double that for Japan. The US-Japan gap in ICT capital stock growth may explain the difference in the pace of economic growth in the two countries, in our view.

3. IT investments and productivity

3-1. IT investments helped improve labor productivity in US

Generally, economic growth (increase in value added) can be expressed as increase in the production inputs of capital and labor and/or increase in total factor productivity (TFP). TFP is the variable that contributes to growth in value added not caused by production inputs. Specifically, an increase in TFP can represent technological progress, improvement in worker skills, and greater management/ organizational efficiency. We could say that increases in capital and labor are quantitative factors that contribute to growth in value added, while increases in TFP represent qualitative factors. As Chart 3 illustrates, higher labor productivity can be explained by a rise in the capital-labor ratio (capital stock per unit of labor) and an increase in TFP.

Relationship between Economic Growth/Labor Productivity Growth and TFP **Chart 3**

Economic growth (growth in value added)	=	Capital input growth	×	Capital share	... Quantitative increase in capital stock
	+	Labor input growth	×	Labor share	... Quantitative increase in labor input
	+	TFP growth			... Qualitative improvement
Labor productivity growth	=	Rise in capital-labor ratio	×	Capital share	
	+	TFP growth			

Source: Japan Productivity Center website; compiled by DIR.

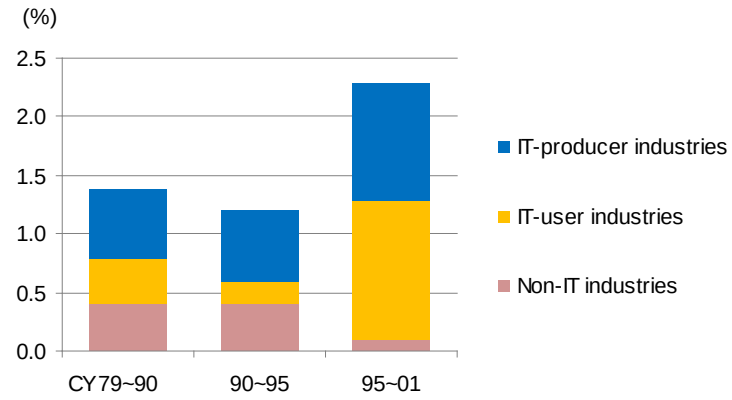
In the latter half of the 1990s, labor productivity growth in the US overtook that in Japan and Europe, according to a Cabinet Office report in 2004[7], which pinpointed the aggressive IT investment around that time contributing to higher labor productivity for the entire US economy.

Looking at the increase in labor productivity in the US during the period by industry, the IT producer and IT user industries made significant contributions (Chart 4). Additionally, among IT-user industries, service providers (non-manufacturers; such as financials, insurers, wholesalers, retailers) contributed 1.3 percentage points to labor productivity growth for the entire economy, accounting for more than half of the 2.3% increase in labor productivity for the overall economy.

The report also points out that, when looking at contributions from changes in capital stock and TFP to increases in US labor productivity, these two variables each accounted for more or less half the total increase between 1995 and 2001. An increase in IT capital contributed roughly 80% to growth in total capital stock. As for the increase in TFP, based on some data the contribution from IT-user industries was greater than that from IT-producer industries, which suggests it is possible that the IT-spurred increase in labor productivity spread beyond IT-producer industries, according to the report.

[7] Throughout this report we refer to a Cabinet Office report entitled *World Economic Trend, Spring 2004* (Apr 2004)

Contributions from Different Industry Categories to Labor Productivity Growth in the US **Chart 4**



Industry classifications are as follows:
IT-producer industries: IT manufacturing/service industries
IT-user industries: Top 50% industries, apart from IT-producer industries, in terms of the weighting of IT capital in total capital stock
Non-IT industries: All other industries

Reference: O'Mahony and van Ark, B. (eds) [2003] "EU Productivity and Competitiveness: An Industry Perspective: Can Europe resume the catching-up process?"

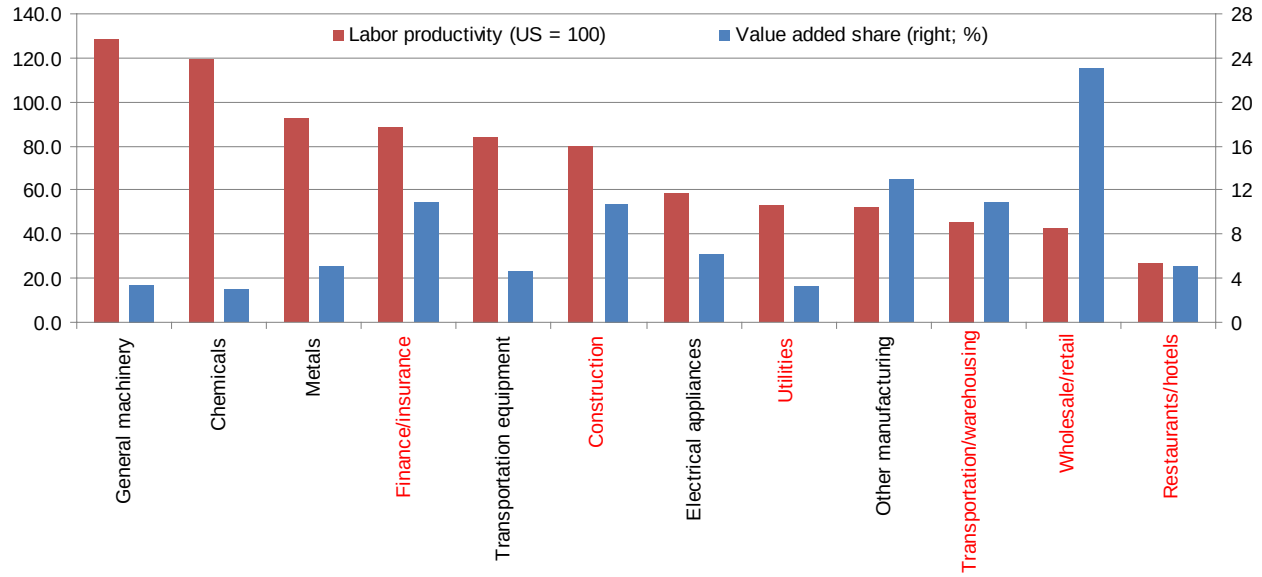
Source: Cabinet Office, *World Economic Trend, Spring 2004*; compiled by DIR.

The report concludes that, in the US, IT investments contributed to growth in both capital stock and TFP, leading to higher labor productivity for the entire economy. It also says the use of IT by both IT-producer and IT-user industries was key for the increase in labor productivity.

3-2. IT investment seen as means of improving efficiency in Japan

Labor productivity is lower in Japan than in the US for many industries (Chart 5). As Chart 2 shows, IT investment in Japan has been steady overall, without any major drops observed during the period, though it did not increase as sharply as in the US. However, the chart suggests that industries with lower labor productivity in Japan vs. the US might have seen less IT investment than other industries, or their IT investment might not have borne fruit in terms of boosting TFP.

Labor Productivity of Japanese Industries (relative to US) and Value Added Share **Chart 5**



Source: METI's 2013 white paper on trade with reference to EU KLEMS data; compiled by DIR.
Notes: 1) Red font indicates non-manufacturing industries.
2) 2003-07 averages.
3) Value added share represents each industry's share of total value added created in the entire economy excl. agriculture.

Looking at the background, a survey regarding medium-term challenges Japanese firms want to resolve through investing in IT (Chart 6) revealed a high proportion of firms giving the following answers: (1) improving the efficiency of operational processes (reduce labor and costs), (2) grasping earnings and other data more swiftly (real-time management), and (3) raising the quality and precision of operational processes (reduce mistakes and stockouts). This trend remains broadly unchanged from an earlier survey conducted in FY03[8] and shows that Japanese firms have thus far viewed their IT investments mainly as a means of raising operational efficiency and reducing costs.

Medium-term Managerial Challenges Japanese Companies Want to Solve Through IT Investment **Chart 6**

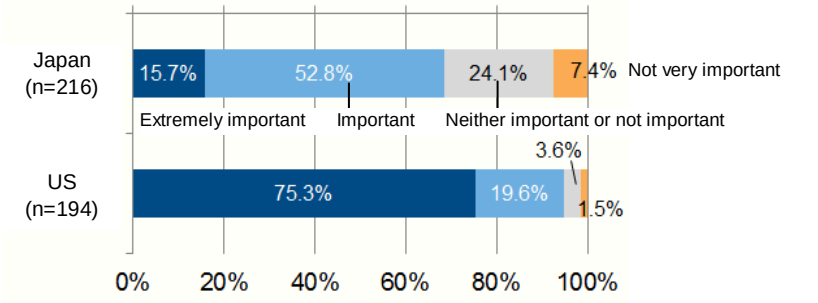
Source: First section of preliminary findings from 2015 survey of corporate IT trends (15 Jan 2015) by Japan Users Association of Information Systems.

3-3. Differences between IT investment stance in Japan and US

As Chart 7 shows, a survey on the use of IT in managing firms revealed that while 75% of US companies surveyed viewed IT/information services as extremely important, this rate was only around 16% for Japan.

[8] Based on corporate IT surveys published in 2009, 2012 (carried out in FY08, FY11), by Japan Users Association of Information Systems, etc.

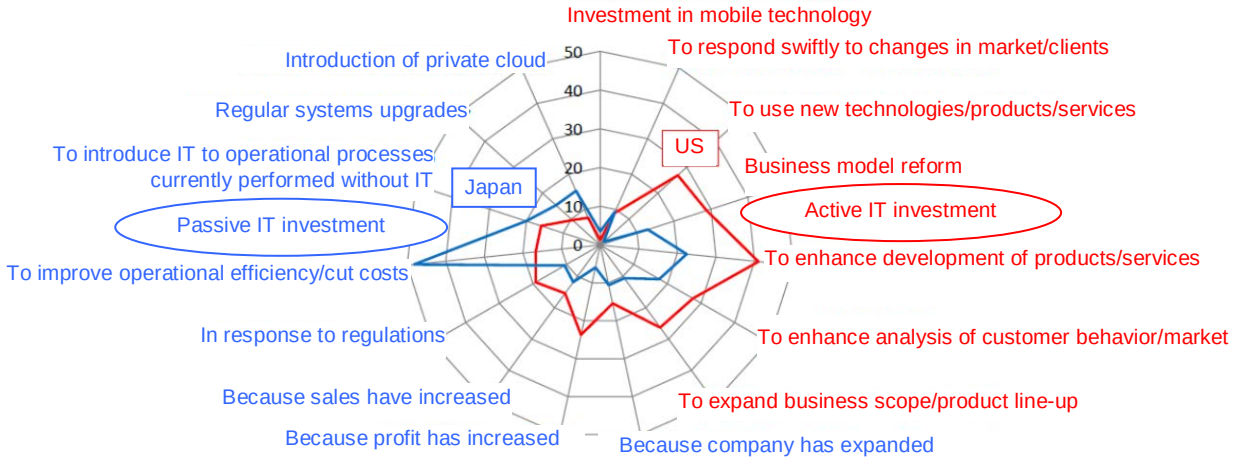
Survey on Importance Placed on Investment in IT/information Services **Chart 7**



Source: Japan Electronics and Information Technology Industries Association (JEITA), IDC Japan.

Moreover, expectations with regard to IT investment differ in the two countries. According to the survey shown in Chart 8, many firms in the US expect IT to enhance the development of products and services, help reform business models, and support the use of new technologies, products, and services. While IT investment is actively effected in the US, it is more passively done so in Japan. In Japan, the purpose of IT investment (according to corporate responses) is first to improve operational efficiency and cut costs, and then to introduce IT to operational processes currently performed without IT.

Expectations of IT Investment in Japan and the US (reasons for increasing IT budget) **Chart 8**



Source: METI release regarding JEITA survey results.

Achievement of the goals listed above as active IT investment themes pose the possibility of raising labor productivity by significantly adding to value added by offering new products/services and reforming business models. As charts 7 and 8 show, US firms see IT investment as a means of boosting value added, and that it is an ingrained mentality at many firms. With IT investment veering toward being active, but also well-balanced between active and passive themes, US firms have achieved considerable success.

In contrast, Japanese firms view IT investment as a means of raising operational efficiency and reducing costs, and therefore have much lower expectations than their US counterparts that investment in IT will lead to the development of better products and services, or use of new technologies, products, and services. Given these different attitudes toward IT investment, we think such investment might not have contributed much to boosting value added in Japan, in contrast to the US, which leads the way in terms of IT technology and IT products/services.

4. Steps to improving value added

4-1. Government initiatives

Japan Revitalization Strategy (Revised in 2014) [9] argues that it is vital to improve the earning power (profitability) of Japanese people and companies in order for the Japanese economy to embark on a meaningful recovery. The industry revitalization plan, which is part of this strategy, includes realizing the "world's leading IT society" as well as an action plan for accelerating structural reform (industry reorganization, etc.) that incorporates improving the productivity of service industries, arguing that "it is important to promote innovative business approaches, such as marketing using big data." Based on the recognition of the importance of aggressive IT investment, the strategy also contains specific initiatives for better use of IT.

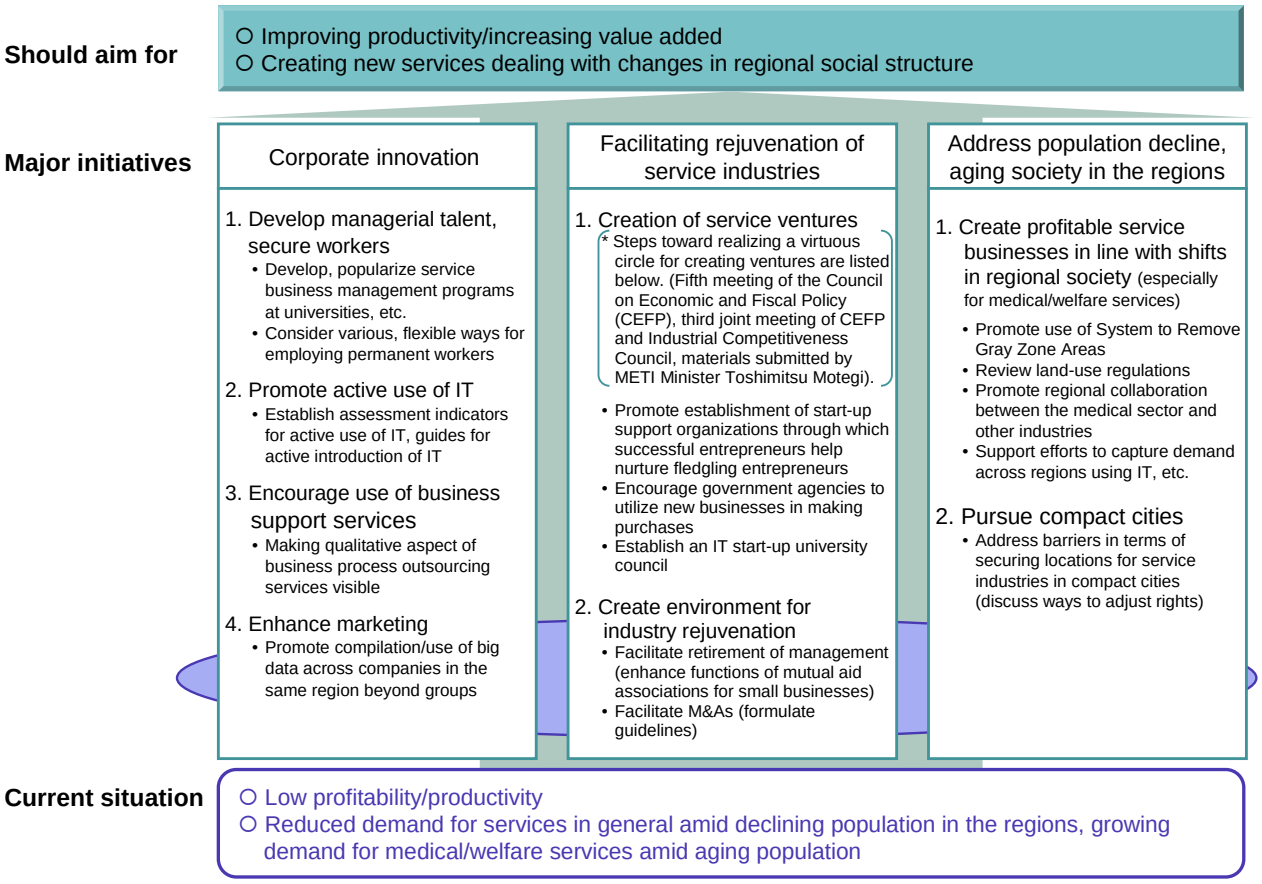
Additionally, *Declaration to be the World's Most Advanced IT Nation* (June 2014), states as a basic principle that "Japan must position IT as an engine of economic growth," adding that "the society that Japan should seek to become" is one that "encourages the creation of new and innovative industries/services and growth of industries overall."[10] Thus, Japan has positioned IT as a key driver of economic growth and aims to improve value added through the use of IT.

Compared with US counterparts as illustrated in Chart 5, the labor productivity of Japan's non-manufacturing industries is low. But, since they account for a greater proportion of Japan's overall economy than manufacturing industries, any rise in their labor productivity would be a boost to the improvement of labor productivity for the economy overall.

Prior to *Japan Revitalization Strategy* (Revised in 2014), METI established Study Group on Creating a Higher Value-added Service Industry [11], which is considering new, concrete initiatives aimed at improving the productivity of service industries and increasing value added. The study group's report focused on three points: (1) promoting innovation by enterprises, (2) facilitating rejuvenation of the industry, and (3) addressing the issues of population decline and an aging society in regional areas. It is hammering out specific policies for each. It is notable that measures related to all these points include the use of IT (Chart 9). This suggests that investment in IT is indispensable for improving productivity and value added for service industries.

[9] Prime Minister's official website; *Japan Revitalization Strategy* (Revised in 2014) (24 Jun 2014).
[10] Prime Minister's official website; *Declaration to be the World's Most Advanced IT Nation* (24 June 2014).
[11] The study group widely defined service industries as tertiary industries (excl. agriculture, forestry & fishing and mining, manufacturing, and construction). Specifically: electricity, gas & water, wholesale/retail, financial services/insurance, real estate, transportation, information/telecommunications, services (narrow definition), government services, and private-sector non-profit services. Services (narrow definition) comprises the person-to-person services of recreation, eating out, hotels (accommodation), laundry/hair dressing/cosmetics/bathing, education, medical/welfare services, along with business services including advertising, commercial product leasing, automobile/machinery repair, research. METI, *Report Compiled by the Study Group on Creating a Higher Value-added Service Industry* (9 Jun 2014).

Directions Service Industries Ought to be Aiming for **Chart 9**



Source: METI, Outline of report compiled by the Study Group on Creating a Higher Value-added Service Industry (June 2014).

Furthermore, METI has begun discussions on promoting a new stage of IT utilization in businesses in the era of IoT (Chart 10). This "new stage" is not clearly defined in materials disclosed by METI, but it seems to mean discarding the notion of mere improvement from the current status using IT and pursuing organizational management aimed to create new innovations and business models through the proactive use of IT.

METI discussions are touching on the lack of ability by management teams at Japanese companies to make use of IT, the shortage of IT human resources, suitable government assistance, including laws/systems, and the importance of security related to acquiring and handling data. As illustrated in Chart 8, undertakings in the US for the proactive use of IT are considered active IT investments, and discussions are under way to promote not only passive IT investments, with the purpose of improving work efficiency and cutting costs as seen to date, but also active IT investments[12].

[12] Based on summary of minutes from the first meeting (9 Dec 2014) of Information Economy Subcommittee, the Commerce, Distribution and Information Committee, Industrial Structure Council, METI,

METI Discussions for Promoting New Stage of IT Utilization in Businesses **Chart 10**

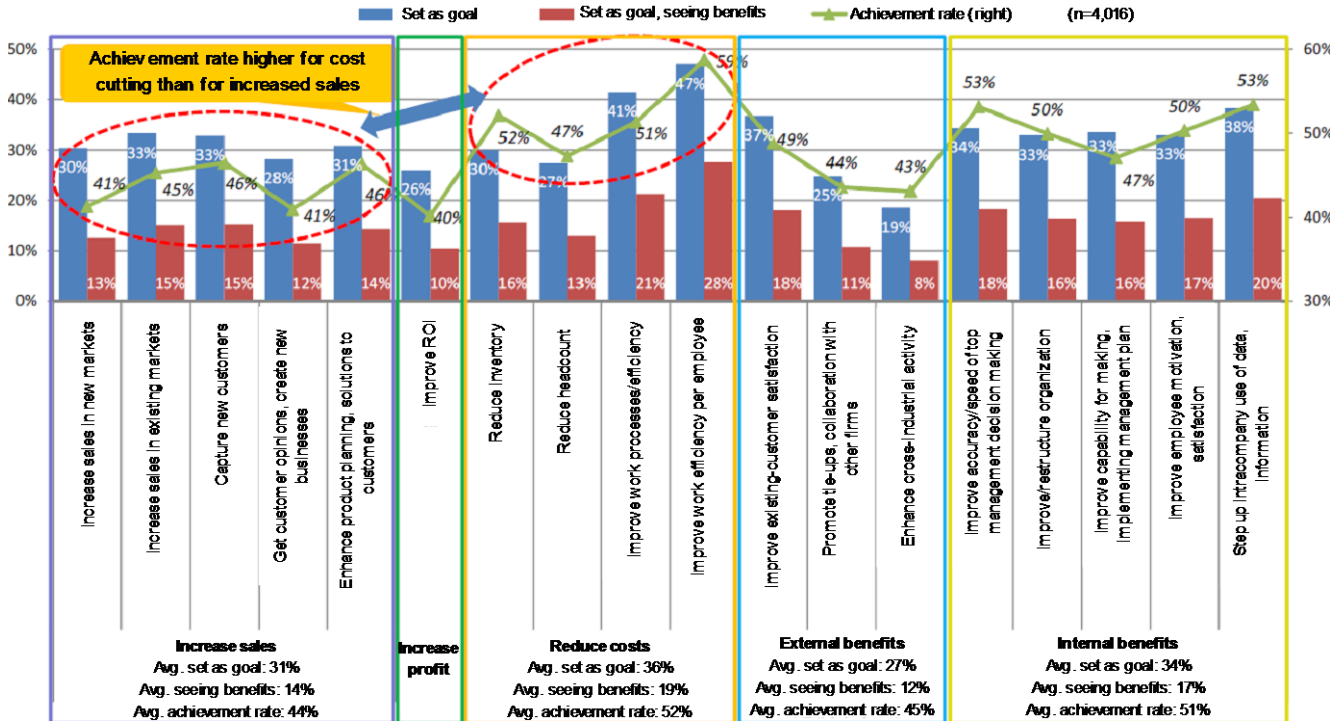
What are the reasons behind Japan's decelerating international competitiveness even though the nation has evolved in its own unique way? What framework is necessary for preventing the "Galapagos syndrome"?
Amid a major shift in the business environment due to IT innovation, how should Japanese businesses change their management methods and organization?
How should companies develop/obtain the necessary talent for management innovation and creating new business models?
How should the government respond to new business models beyond the scope of the existing system?
How should Japan develop ventures that can bring innovation to technology and business models, which are key game changers?
What shape should government technological policies take, including standardization strategies (for platform building) and R&D for related technologies?
What shape should government security policies take in the IoT era?

Source: Materials from first meeting (9 Dec 2014) of Information Economy Subcommittee, the Commerce, Distribution and Information Committee, Industrial Structure Council, METI; compiled by DIR.

4-2. Benefits from IT investments

Many Japanese firms tend to make IT investments for the purpose of cost reductions, according to a survey by the Ministry of Internal Affairs and Communications. This probably reflects their stance on such investments, as mentioned earlier (Chart 11). At the same time, roughly 30% of firms responded that they make IT investments aiming to lift sales, with nearly half these respondents saying that they have seen benefits on this front. The purpose of improving sales in this survey is classified as active IT investing. Companies that spend aggressively on IT for business expansion seem to be achieving their targets by more than a little.

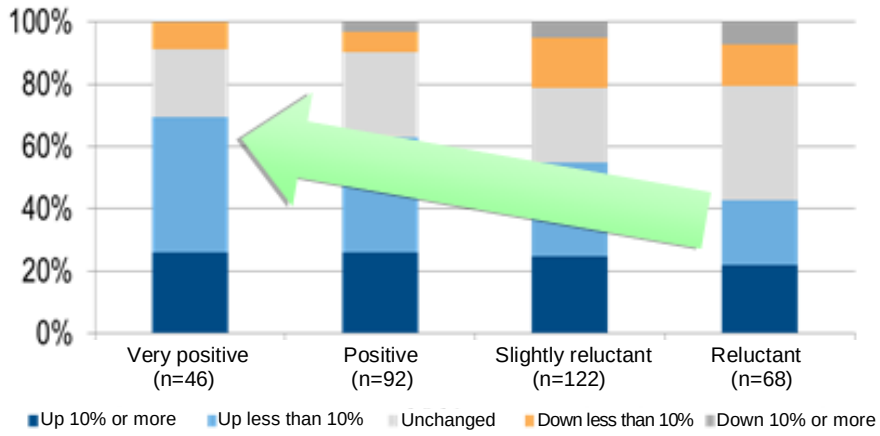
Goals, Benefits of IT Investing **Chart 11**



Source: MIC; Accelerating Economic Growth via IT investment: Problems and Solutions (Mar 2014).

Another survey shows that many companies that are positive about making active IT investment saw sales grow (Chart 12). It would still be unwise to conclude that stepped-up IT investment easily translates to higher sales. Even so, we think the results suggest that purposeful and aggressive IT investments proved to be rewarding.

Changes in Sales vs. Three Years Ago by Stance on Active IT Investment **Chart 12**



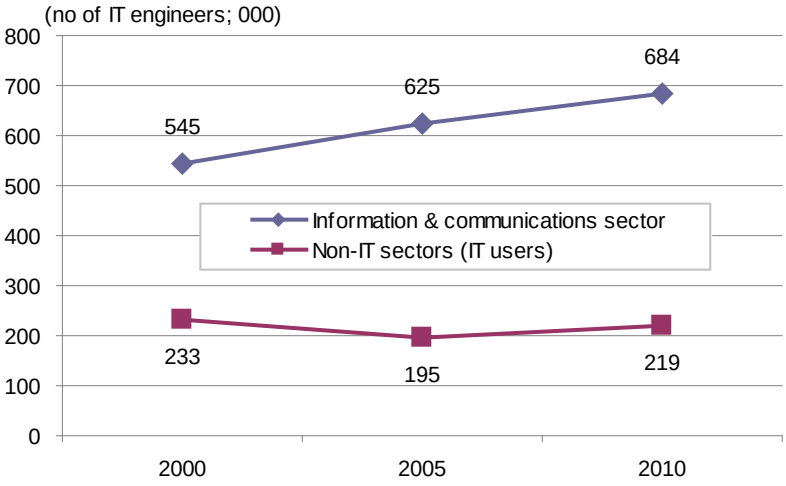
Source: JEITA, IDC Japan; JEITA survey on active IT investment by Japanese companies (23 Feb 2015).
Notes: 1) Survey as of Sep 2014.
2) Covered firms with more than 500 employees (consol.); all-industry basis, excl. medical care, education, central/local government, information services.

5. Challenges for enhancing earnings power

According to the aforementioned analysis by the Cabinet Office in 2004, competitive market conditions such as moderate regulations and a flexible labor market are necessary for enabling IT investments to boost labor productivity. Furthermore, firms should manage their organizations so as to enable them to make efficient use of IT.

As of 2010, however, IT engineers were disproportionately placed among sectors (Chart 13)—roughly 680,000 engineers were in the information & communications (IT) sector, while less than a third as many, or only about 220,000, were in non-IT sectors (users of IT).

Chart 13: IT Engineers in Japan **Chart 13**

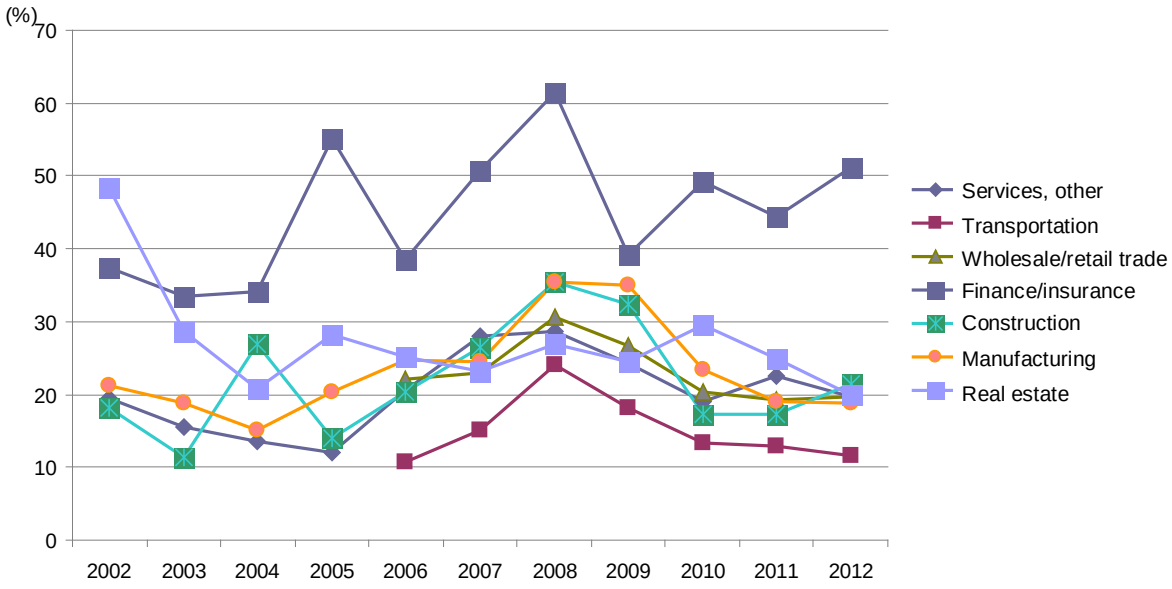


Source: Census, handout in working group regarding IT Engineers (first meeting held 22 Jan 2015) at Information Economy Subcommittee of Commerce, Distribution and Information Committee under Commerce and Information Bureau of Industrial Structure Council of Ministry of Economy, Trade and Industry; compiled by DIR.
Note: Skilled IT engineers defined as the total number of information-processing engineers in 2000, system engineers and programmers in 2005, system consultants/designers, software developers, other information-processing/telecom engineers in 2010.

As of 2000, the ratio of IT engineers in the IT sector and non-IT sectors was roughly 7:3. Since then and through 2005, the number of IT engineers in the non-IT sectors dropped by about 17%. While the number increased again 2010, the number of engineers in the IT sector also rose, further widening the gap. In a working group regarding IT engineers held in January 2015 at the Ministry of Economy, Trade and Industry (METI), it was shown that the distribution of IT engineers in the US was different from that in Japan, with roughly 70% belonging to non-IT sectors[13].

In corporate organizations, there were no major changes through 2012 in the percentage of Japanese firms that have chief information officers (CIOs)[14], according to a communications usage trends survey by the Ministry of Internal Affairs and Communications (MIC; Chart 1.4). To make effective use of IT, it is thought to be efficient for a firm to adopt a top-down approach. This would involve factoring in IT investments in the firm's business strategy and compiling a plan to benefit from such investments over the medium/long term. It would also involve achieving internal consensus, managing the budget/progress, and reflecting the impact on performance indicators. These would all be a CIO's role. In the MIC survey, however, only about 19% of firms (all industry) had CIOs in 2012. In contrast, 82.7% of US firms had CIOs, according to a survey held in 2010 by METI. The same survey showed that the ratio was 55.4% for Japan[15]. The discrepancy in the number with the MIC survey is likely due to the difference in how the two surveys define CIO. In any case, both surveys suggest that there are few executives at the board member level that oversee IT strategies of Japanese firms, and that the situation has not improved.

Ratio of Japanese Firms with CIOs by Industry **Chart 14**



Source: Ministry of Internal Affairs and Communications, *Communications Usage Trend Survey*; compiled by DIR.
Note: Shows percentage of firms that have either full-time CIOs, CIOs with other roles who use most of their time for IT-related work, CIOs with other roles who use some of their time for IT-related work.

[13] Handout in working group regarding IT Engineers (first meeting held 22 Jan 2015) at Information Economy Subcommittee of Commerce, Distribution and Information Committee under Commerce and Information Bureau of Industrial Structure Council of METI.
[14] Chief information officers are usually board members in charge of information and information technology. That said, the title is not defined by any Japanese law, and sometimes includes directors and heads of IT departments.
[15] METI research report regarding company usage of IT (Feb 2011).

To reiterate, the number of IT engineers in non-IT sectors is much smaller than that in the IT sectors in Japan, and the ratio of firms that have CIOs is also very small. To enhance the added value of firms investing in IT, not only the quantity but also the quality in making effective use of increased IT investment is key. As we have discussed thus far, the process of linking IT investment to higher added value can be narrowed down to the following three: (1) encouraging a more active mindset toward IT investment, (2) securing manpower, and (3) improving organizational structures.

First, the potential of IT should be re-examined in all industries, with encouragements made toward a more proactive approach such as pursuing business reforms and other innovations with IT. Second, securing manpower should have a bottom-up effect, with IT helping to generate new added-value of products and services on-site. Last, organizational structure improvement should have a top-down effect—CIOs and other top executives would need to have a good understanding as well as decision/action-taking capabilities regarding IT investment. The government also appears to acknowledge the importance of these processes, calling for active IT investments after nurturing managers and securing manpower.

According to MIC, the data traffic volume in Japan expanded roughly 8.7-fold between 2005 and 2013 in nine industries (services, information & communications, transportation, real estate, finance/insurance, commerce, utilities, construction, manufacturing)[16]. Growth was seen in all the sectors, showing that data has become useful for a variety of industries. Further enhancement of quantity and quality of IT investment is required to accurately follow trends in the Internet of Things era and boost the earnings power of Japan.

[16] MIC, survey on measuring data in big data era in *2014 White Paper Information and Communications in Japan* (Mar 2014).