• TODD radically pragmatic

How the Economics and Regulation of Mobile Platforms Affects Japan's Digital Transformation and Cybersecurity

DR. MICHAEL MANDEL PROGRESSIVE POLICY INSTITUTE

MARCH 2023

🛫 @ppi | 📑 @progressivepolicyinstitute | in /progressive-policy-institute

MR. MICHAEL MANDEI

MARCH 2021

How the Economics and Regulation of Mobile Platforms Affects Japan's Digital Transformation and Cybersecurity

SECTION 1. INTRODUCTION

In 2018, the Ministry of Economy, Trade, and Industry (METI) published the "Digital Transformation (DX)" report, warning the Japanese economy would suffer from massively slower growth without increased investment in IT hardware and software. Moreover, Japanese companies were encouraged to place a greater emphasis on digital business models. A series of followup reports, notably DX Report 2.1, identified four different strategies companies can employ toward transforming to create a digital industry.¹

More recently, Prime Minister Fumio Kishida has described his vision of a Digital Garden City Nation, where investment in innovative digital technologies would help revitalize regional economies.² This includes implementing digital services to solve rural issues.³

An essential aspect of digital transformation and innovation is the heavy use of mobile platforms and apps to provide these digital services to users. Mobile apps are essential for the digital transformation of industries such as healthcare, manufacturing, agriculture, energy, and transportation. For example, the digital transformation of health care requires linking doctors, nurses, and other health care professionals wirelessly with patients and with electronic health records. Digital transformation of agriculture requires the use of precision wireless sensors and mobile apps to allow farmers to monitor conditions in the fields for optimal productivity. Digital transformation of manufacturing requires mobile apps that allow factory workers to monitor robots and sophisticated machinery.

How important are mobile apps and mobile platforms for digital transformation and innovation? By PPI's analysis, roughly 25%

of the help-wanted ads for tech workers In Japan mention the need for App Economy skills such as knowledge of the iOS or Android mobile operating systems.⁴ That suggests that Japanese employers see a strong need for workers who have the ability to develop and maintain mobile applications.

Indeed, the current mobile application ecosystems, built around the iOS and Android operating systems and the mobile app stores, can provide a good role model for overall digital transformations. These ecosystems have proven successful over the past 15 years in accelerating innovation and encouraging the development of new applications. First, the mobile application ecosystems provide low-cost distribution services for small- and medium-size app developers that they cannot provide themselves. Second, while the iOS and Android ecosystems take somewhat different approaches, the current mobile app stores devote large amounts of technological and human resources to screening out malware and enforcing security standards. The result is that users are willing to download and adopt innovative apps.

Given the effectiveness of the current system in encouraging innovation, this paper addresses the question of whether new regulations now being considered for mobile app stores have a negative impact on security and business activities, with the potential to delay or hinder the digital transformation of the Japanese economy. The problem is that regulators may accidentally undermine the very features of the app stores that make them so effective at encouraging innovation. In particular, regulations that mandate sideloading make it more difficult for the existing app stores to screen for malware and other security issues can lead users to be less trusting of innovative new applications that might control their homes, their cars, their medical devices, and their factories.

Already, Japanese government websites have come under attack by Russian hackers. National security considerations suggest that the security of the mobile application ecosystem should be a high priority for regulators. Less effective screening of new apps, if mandated by government regulators, will also make the digital transformation of the Japanese government more difficult.

- In section 2, **"The App Store Ecosystem and Digital Transformation (DX),"** we show how app innovation is essential to Japan's digital transformation (DX). In particular, mobile apps are essential for allowing users to interact with enterprise-level IT systems.
- In section 3, "Quantifying the Economic Importance of the App Store Ecosystem for Digital Transformation and Innovation," we estimate the contribution of the app store ecosystem to digital transformation. As noted earlier we find that roughly 25% of tech job postings in Japan require app economy skills. Our methodology is described in the Appendix to the paper.
- In section 4, "The Economic Link Between Innovation and a Secure App Store Ecosystem," we show that developers and consumers both benefit from a secure app store ecosystem. The ability of users to download new apps in safety has fostered innovation, and the expansion of app markets, which in turn had fed back to more innovation.
- In section 5, "Allowing Sideloading and Other New App Store Regulations May Hinder Digital Transformation," we show how new

app store regulations can reduce security and hurt developers and users. The result, from an economic perspective, will be to hinder the process of digital transformation.

 In section 6, "Why the European model of tech regulation doesn't work in Japan," we discuss the European model of tech regulation, and show how it has led to slower productivity growth and less innovation. This has important implications for Japan, which has been considering an even stricter version of the European approach.

SECTION 2. THE APP STORE ECOSYSTEM AND DIGITAL TRANSFORMATION (DX)

In this section, we discuss the importance of the App Store Ecosystem for digital transformation (DX). Apple first introduced the App Store in 2008, followed soon by Google's introduction of Android Market (now Google Play). The concept of a central repository for mobile applications, which could be downloaded on smartphones globally, unlocked the economic potential of mobile networks. Large telecom providers had invested large sums in building out highcapacity mobile networks and developed unique expertise in maintaining and operating these networks. However, the telecom provider had little experience nurturing the development of applications for the new capabilities. The mobile app stores filled in the innovation gap.

More broadly, the mobile app store ecosystem was an enormous innovative and economic breakthrough when compared with previous generations of software ecosystems. In the past, it was hard for users to find and safely try out innovative new software programs. The app stores made it possible to download reliable and trustworthy programs and use them with little fear of introducing malware. The result was a blossoming of creativity and innovation across the globe which transformed the way that consumers spend their day. Apps were created in a wide variety of areas, including games, banking, education, travel, research, social networking, health and the consumption and creation of content.

That leads us directly into Japan's digital transformation. We note that digital transformation has two aspects. First, Japanese corporations need to invest in and modernize their enterprise-level IT systems in order to reinvigorate Japan's growth, which reflect both lagging productivity and declining population. We note that productivity growth in both Japan and Europe trails the United States. The OECD's June 2022 Economic Outlook Database reports that Japan's ten-year labor productivity growth rate was -0.1%, compared to 0.2% for the Euro zone, and 1.0% for the United States.⁵ (As we discuss in a later section, this comparison is relevant as Japan considers whether to follow the European regulatory model.) The economic impact of Japan's weak productivity growth is worsened by the country's falling population and low fertility rate, which has become a key focus of the Kishida administration.⁶

Second, Japanese corporations need to create and embrace new ways for workers, customers, and other users to interact with enterprise-level IT systems. It's not enough to simply upgrade the IT systems, which would be the traditional approach.

To achieve digital transformation and faster productivity growth, corporations need to make it easy for workers, customers, and other users to take advantage of the new capabilities of the advanced IT systems.

It's clear that mobile devices such as smartphones and tablets are the most effective way to interact with many enterprise-level applications, especially for people who have gotten used to the ease of smartphones. For example, a factory worker monitoring a machine wants a tablet that is always with them, rather than having to repeatedly return to a fixed console. The same is true for a doctor working in a hospital, who wants to keep up to date with the state of their patients as they move through their rounds. On the other side, patients may be able to go home earlier from hospital procedures if they can be remotely monitored in a way that's visible to both them and their health care providers.

Moreover, these mobile devices, which interact with enterprise-level applications, have to be supported by a strong and secure infrastructure and ecosystem of developers. Worker productivity can be amplified by tablets that are connected with central corporate databases, but that connection makes security of the devices even more important.

SECTION 3. QUANTIFYING THE ECONOMIC Importance of the APP store ecosystem for Digital transformation and innovation

This section quantifies the importance of the App Store ecosystem for digital transformation and innovation. The single most important resource for Japan's digital transformation is a skilled tech workforce. If Japanese companies want to innovate and digitize their operations, they need workers with good programming skills. Indeed, Japan has struggled with a "serious shortage of skilled tech professionals."⁷

Many software developers will be working on enterprise-level applications such as databases, but others are needed to develop the programs which allow workers, customers, and other users to interact with the enterprise-level applications. As we saw in the previous section, many of these interactions will take place on mobile devices.

However, software developers need a specific set of skills to develop mobile applications. In particular, they need to know how to work with either iOS or Android, the two major mobile operating platforms, or they need knowledge of related tools for building mobile applications.

What percentage of software developers have these App Economy skills? Using a real-time database of job postings for Japan, as described in the Appendix to this paper, we analyzed the skills that Japanese employers are looking for. We focused particularly on the labor market for information technology professionals such as software developers and engineers, database designers and administrators, and software quality assurance personnel.

Based on our analysis, we estimate that roughly 25% of job postings for IT professionals require App Economy skills such as knowledge of iOS or Android.⁸ (This figure is somewhat higher than the comparable number for the United States). In other words, roughly one-quarter of Japan's current move towards digital transformation is associated with the mobile app ecosystem.⁹

We would expect this share to rise in the future, as mobile bandwidth and data speeds rise, making mobile data connections increasingly important for both businesses and consumers. In his January 2022 speech and subsequent public statements, Prime Minister Kishida mentioned the importance of 5G for digital transformation.¹⁰

SECTION 4. THE ECONOMIC LINK BETWEEN INNOVATION AND A SECURE APP STORE ECOSYSTEM

Mobile apps are essential for digital transformation (DX), and the app stores play a key role in ensuring that mobile apps are safe and secure for workers, consumers, and other users. Apple places more emphasis on privacy and only allows apps to be downloaded from the official App Store.¹¹ But both Apple and Google invest large amounts of money in screening apps and continuing to develop technologies to suppress malware in order to maintain positive reputations. They also require developers to meet standards for safety and security.

The app store protections against malware and the standards for safety and security are an essential reason why the App Economy has grown as fast and as large as it has. The ability of users to download new apps in safety has fostered innovation, and the expansion of app markets, which in turn had fed back to more innovation and faster digital transformation.

The current app ecosystem relies on the app stores to screen for malware and for badbehaving apps. The app store screening process gives developers an important incentive to balance security and innovation in a way that is beneficial to both users and developers.

Here's how it works: App developers have to decide how much to invest in new features and how much to invest in security (Step 1 in Figure 1). New features and capabilities can be easily demonstrated to potential users.

However, the more money that developers spend on adding new features, the less money they have available for testing and improving security. The level of spending on security is not immediately visible to potential users. Indeed, developers can make claims about security that users cannot easily test.

The role of the app store screening process (box 2 in Figure 1) is to require app developers to devote some reasonable level of resources to security and safety. In the long run, this benefits both developers and users. Users keep using the apps because they are not driven away by malware and bad security (box 3). In turn, this larger market provides more resources for developers, making it possible for them to spend more on both new features and security (box 4 and back to box 1 again).

Why is app store screening essential to this process? From the economic perspective, the security performance of applications suffers from what economists call "asymmetric information." Asymmetric information means that security is not easily observable by outsiders. As a result, developers know much more about the security of their applications than buyers do.¹²

This asymmetric information is reinforced by the fact that trade publications that report on apps typically don't have good ways to test security either, and therefore, tend to focus on visible features. It is much easier to analyze how fast an app is than whether it leaks data or is easy to hack. It is expensive to do a substantial analysis of security of an app.

So the strong security model of the current system of app stores counteracts the asymmetric information about security. In this case, developers have an incentive to underinvest in security, in the absence of app store screening.

For example, when a Japanese security services firm LAC surveyed Japanese app developers in

2021, they found about half of the respondents answered that they "inspect security through using tools" and "consider security from the design stage" as security measures. But as many as 20% answered that they do not implement security measures.¹³ Furthermore, more than 30% of companies answered that they could not secure enough budget and personnel when developing and releasing smartphone apps, revealing that they have to choose between marketing and security. It would be fair to say that small and medium enterprises comprise a large share of those companies who don't have enough resources to handle both marketing and security.

FIGURE 1: DEVELOPER CHOICES WITH APP STORE SCREENING



SECTION 5. ALLOWING SIDELOADING AND OTHER PROPOSED NEW APP STORE REGULATIONS MAY HINDER DIGITAL TRANSFORMATION

In this section, we show up how allowing sideloading and other proposed app store regulations may hinder digital transformation. To summarize the previous sections:

- The current system of app stores accounts for roughly 25% of Japan's progress toward digital transformation (Section 3).
- App innovation and digital transformation is fueled by the strong security model of the current system of app stores (Section 4).

With the rationale of increasing competition, Japanese regulators are exploring the option of opening the mobile app iOS and Android ecosystems to third-party app stores or other alternatives for distributing apps.¹⁴ This may mean requiring that Apple allow sideloading or Google expand access to sideloading, where

apps can be installed by users without going through the app store screening process at all. Other proposed policy options include forcing Apple to open up iPhones to non-Webkit browsers and giving developers access to more features of the underlying operating system.

But these measures, intended to increase competition, run the risk of creating what economists call a market in "lemons." First described by Nobel Prize-winning economist George Akerlof in 1970, "lemons" are an English word for describing products that perform poorly.¹⁵ With asymmetric information, buyers cannot assess which products are "lemons," so sellers have no incentive to improve their products.

It is increasingly accepted in economics that cybersecurity is a classic "adverse selection" or "lemons" situation, where "bad" or insecure apps drive out the "good" ones.¹⁶ What happens is that over time, users become discouraged and disappointed in the unsafe apps, and uninstall them.¹⁷

The strong security screening of the current app store ecosystem stops this bad situation from happening, as shown in Figure 1. The danger is that requiring app ecosystems to allow sideloading — and perhaps restricting security risk warnings during the installation process--will lower user security. We've seen this with the Windows operating system, which allows sideloading and is also the target of a continuing stream of cyberattacks. It is perhaps not a coincidence that the Windows Phone mobile ecosystem did not succeed.

The economic implication is that increased sideloading will lead to less adoption of innovative apps and slower progress toward digital transformation. Let us look at this result from the economic incentive perspective. In the absence of robust app store security screening, app developers have a choice between prioritizing flashy new features that attract users, versus the less glamorous task of prioritizing safety and security. (See Box 1 in Figure 2). Users see the new features, but they find it hard to assess the safety and security of a new app.

If developers choose to prioritize new features (box 2a in Figure 2), they get more users at first. But the users are disappointed in the level of security once they use the app and uninstall it (box 3 in Figure 2). But if developers choose to prioritize security (box 2b in Figure 2), then users are disappointed by the lack of new features and never install the app in the first place.

App developers aren't stupid. In the absence of app store screening, developers will lean towards providing apps that sell more, at least initially. That means emphasizing apps that support new features rather than safety and security.

In the absence of the app store protections, users would be much less likely to download new and innovative apps, fearing the possibility of malware. And developers would engage in a competition with weaker standards for security, resulting in a "race to the bottom" where consumers and business users choose to use lower security platforms and/or install lowersecurity apps.

A race to the bottom among developers and app stores will discourage users from trying out new and innovative apps. In turn, a smaller market means fewer resources for innovation and slower introduction of the apps needed to drive digital transformation (box 4 in Figure 2).

Alternatively, prioritizing acquisition of new users and other short-term goals, while underinvesting in less visible features such as better security, also leads to disappointed users and a smaller user base. The result is a slower rate of innovation and adoption, which undermines the goals of digital transformation in the mid to long term.

Users want more monitoring and security, not less. For example, nearly 70% of respondents to one survey by LAC answered that they are seriously or somewhat concerned about security and privacy when downloading apps. The most common security measure they answered was to download from the official app store, which indicates that the trust in the "official" app store is high as it conducts pre-screening of apps.¹⁸

LAC surveyed users in the Z generation (app. 25-40 years old) and found that more than 70% answered that they feel reluctant to register personal information on their installed apps, and more than 60% of them are somewhat conscious of privacy and security for the use of apps.¹⁹ On the other hand, another survey showed that less than 10% look into the developer information and the privacy policy of the app; even 20% of them answered they do nothing in particular.²⁰

Instead, the response to a troublesome app is to stop using it or simply uninstall it. A study on mobile apps released by Apps Flyer shows that more than 50% of the world's apps have been uninstalled within 30 days.²¹ Indeed, uninstallation without any trouble may be a relatively good outcome; if a troublesome malware were to attack smartphones and result in abuse of personal information, uninstallation may not solve the problem. The other issue is that businesses are increasingly requiring employees to use smartphones and other mobile devices as part of their work. This is especially true for remote work. These businesses want to have the option of picking a mobile app ecosystem that is safer and more secure because it doesn't allow sideloading. Government regulations that force access to sideloading would deprive businesses of this choice.

From the economic perspective, regulations that require app ecosystems to allow sideloading raises security costs for businesses. Instead of the app stores handling screening at an early stage, businesses will be forced to screen all the apps that they use separately. Third party app stores will compete on the basis of who can be more permissive, rather than investing enough resources to review apps, protect consumers from malware, and take the expensive route of maintaining a high-quality reputation.

These issues will become more prevalent as more companies use 5G as part of their daily operations. Unstable digital platforms would pose risks to those promoting DX through using apps and installing 5G mobile apps and thus hinder industry development/innovation.



FIGURE 2: HOW INNOVATION BREAKS DOWN WITH SIDELOADING AND WITHOUT APP STORE MONITORING



SECTION 6. WHY THE EUROPEAN MODEL OF TECH REGULATION DOESN'T WORK IN JAPAN

Japan has in many ways been emulating the European Union's approach to tech regulation. Indeed, some proposals made by Japan's regulators have been stricter than Europe has tried. In particular, Japanese regulators are proposing a level of government intervention in the operating system update process that goes beyond what European regulators are requiring. This could lead to slower responses to changing technological conditions.

In recent years, the European Union has systematically introduced new regulations governing the tech sector in general, and the App Economy in particular. These include the General Data Protection Regulation, or GDPR, which was introduced in 2018, and the Digital Markets Act, or DMA, which entered into initial force in November 2022, with further deadlines for individual provisions. The GDPR implements a set of comprehensive privacy regulations for apps and websites. The DMA imposes multiple obligations on "gatekeeping platforms," such as app stores, including requiring the app stores allow sideloading.

European supporters of increased tech regulation claimed that more government controls would increase innovation and growth. As one author wrote:

Europe's Digital Markets Act (DMA) is based on the idea that if we regulate digital platforms in the right way then smaller European platforms, content and service providers, will have a fighting chance

to digitally resurrect Europe's economic growth.²²

In particular, Europe's hope was that tech regulation would boost lagging productivity growth and innovation.

But quite the contrary: The economic data continues to show deep and persistent productivity weakness in Europe, as strict tech regulation dampens innovation. Meanwhile in the United States, where tech regulatory bills have consistently failed to be enacted, productivity growth is much stronger.

Consider this: Productivity growth slowed in the European Union just over the period when new tech regulations were being imposed and considered. In the period from 2016 to 2019, productivity growth averaged 1.1% annually in the 27 countries that make up the European Union, according to data from Eurostat (Figure 3) But productivity growth in the 2019-2022 period fell to only 0.8% annually. A similar productivity slowdown shows up in Germany and France. For example, Germany went from 1.0% productivity growth in the 2016-2019 period to 0.7% productivity growth in the 2019-2022 period.

This slowdown could be due to the pandemic. But in the United States, which was hit even harder by the pandemic, productivity growth actually accelerated from 1.1% in the 2016-19 period to 1.5% annually in the 2019-2022 period. This is total economy productivity, which is comparable to the European figures. Nonfarm business productivity in the US accelerated as well, but not by as much. A deeper dive into the economic statistics shows that one source of Europe's relative weakness was the information and communications sector, which was the industry most affected by tech regulation. In the European Union, the growth rate of output in the information and communications sector slowed in 2019-2021 compared to the previous three years, going from 6.6% growth to 5.1% growth. In Germany, the growth rate of the information and communications sector went from 5.4% in the 2016-19 period to only 1.8% in the 2019-21 period.

By contrast, in the United States the information sector grew faster during the pandemic years, without the extra weight of tech regulation, as Table 1 shows. The growth rate of the economy as a whole slowed from 2.6% in the 2016-29 period to 1.6% in the 2019-22 period. But the growth rate of the information sector accelerated from 7% to 9%, and the growth rate of the computer systems design industry rose from 7.6% to 8.7%.

There is no evidence that the European Union's zeal to regulate tech has paid off in faster productivity growth. Europe has adopted a strategy of detailed regulation of tech standards, and such an approach is not flexible enough to deal with fast changing technologies and external events like a pandemic. The nature of the government regulatory process does not react well to rapid changes in technology. The private sector is more nimble and can respond quickly to constantly changing digital trends.

2016-19* 2019-22**





** 2019IV through 2022IV for US and Germany, through 2022III for EU and France. Data: Eurostat, Bureau of Labor Statistics

TABLE 1: WITHOUT HEAVY-HANDED TECH REGULATION, GROWTH IN THE U.S. INFORMATION INDUSTRIES ACCELERATED DURING THE PANDEMIC

	GROWTH RATE OF REAL OUTPUT	
	2016-IV- 2019IV	2019IV- 2022III
Gross domestic product	2.6%	1.6%
All private industries	2.7%	1.7%
Information sector	7.0%	9.0%
Includes: Data processing, internet publishing, and other information services	12.0%	14.1%
Computer systems design and related services	7.6%	8.7%

Data: Bureau of Economic Analysis

In addition to aggregate data, more specific studies bear out the negative effect of regulation on innovation. For example, one study of the impact of GDPR on innovation analyzed data on 4.1 million apps at the Google Play Store from 2016 to 2019, across the period when the GDPR was introduced. The researchers found that:

GDPR induced the exit of about a third of available apps; and in the quarters following implementation, entry of new apps fell by half ... we find that GDPR reduces consumer surplus and aggregate app usage by about a third. Whatever the privacy benefits of GDPR, they come at substantial costs in foregone innovation.²³

Part of the problem is that tighter regulation induces unintended consequences as companies focus more on compliance than on innovation. That may be the outcome of the DMA, as it goes fully into effect in 2023 and 2024.²⁴ As one author wrote:

These unintended consequences include fewer services from digital ecosystems, greater cybersecurity risks, poorer quality of data privacy because of data combination requirements, and also consumer harm generated out of prohibitions to offer services that may benefit consumers.²⁵

We also note that the aggressive European approach to tech and telecom regulation has not benefited the uptake of 5G, another policy goal of the Japanese government. The latest report from the European 5G Observatory suggests that the US has twice the number of 5G subscribers than Europe, despite having a smaller population.²⁶ Part of the problem is that European efforts to require sideloading is potentially exposing users to insecure 5G-enables apps. There is a growing realization that 5G, at least in the early years will be more vulnerable to hostile hackers than the current systems.²⁷ Moreover, the security of 5G-enabled mobile applications will be difficult to measure, give their level of complication, their ability to interact with the physical world, and the large amounts of data they can handle. This is a point that cannot be stressed too highly. We believe that security in the coming wave of 5G-enabled apps is better supported by the current arrangement, in which digital business is tan incentive to invest in mobile security research and enhancement.²⁸

This same principle applies to Japan as well. A recent consumer survey sponsored by LAC found that respondents were generally skeptical of government intervention and monitoring of app stores.²⁹ A higher percentage of respondents raised concerns about the delay in the development of flexible technology and innovation compared to other countries, in the case of implementation of government intervention/monitoring.

Finally, we come to the relationship between regulation of the app stores and national cybersecurity. The Japanese government has experienced a series of attacks by hackers from Russia, China and Iran, including a variety of government sites being taken down in September 2022 by Russian hacker groups.³⁰ At about the same time, the foreign ministers of Japan, U.S., India, and Australia (commonly known as the "Quad" security grouping) came out with a joint statement on ransomware aimed at combating state-sponsored cybercrime coming from these countries.³¹

One response to these attacks may be to form a new cyber ministry.³² But regulators should also consider whether their strategies for opening up the app stores may unwillingly end up creating more avenues for malware, including apps that have been subverted by hostile foreign governments.

SECTION 7. CONCLUSION

Mobile apps are an essential part of digital transformation. The current mobile application ecosystems do a good job balancing innovation and security. Developers know that to get into the major app stores, they have to meet certain security standards. This encourages developers to devote resources to security and gives users the confidence to download new apps without worrying that they will installing malware. The result is an environment that has fueled the development of millions of apps.

Japanese regulators are considering ways to increase competition by mandating alternative app stores and requiring mobile operating systems to allow sideloading. Unfortunately, as we have shown, these proposals have the potential to create a "lemons" market for apps, which could reduce both innovation and security. This result, in turn, could undermine the process of digital transformation of Japan's economy, which depends on companies having safe and secure distributional channels for innovative apps. Moreover, there is no evidence that Europe's attempts to adopt similar tech regulations have boosted productivity growth, which after all is the long-term goal. Europe's information and communications sector struggled during the pandemic, while the comparable part of the U.S. economy boomed.

Regulators should therefore adopt caution when implementing changes in the current store system. When you try to fix something that is working well, the outcome may not be what you expect.

Appendix

The Progressive Policy Institute has been analyzing the App Economy since 2012. Our methodology for estimating App Economy employment uses online job postings for workers with app-related skills as a real-time measure of App Economy employment. This methodology has been applied to a wide variety of countries and languages, including the United States, the individual countries of the European Union, Japan, Canada, Australia, Korea, Mexico, Brazil, Vietnam, Argentina, India and others.

We call an ICT-related job that uses App Economy skills — the ability to develop, maintain, or support mobile applications —a "core" App Economy job. How do we tell which jobs require App Economy skills? The key is to look at help wanted ads — also called job postings — where enterprises actually describe the skills and knowledge they are looking for.

For this paper, we apply our analysis of job postings to understand what percentage of tech job postings use App economy skills.

The key quantities that we need to estimate are:

Postings(App) = number of job postings for core App Economy jobs

Postings(ICT) = number of job postings for ICT jobs

We want to calculate the App Economy share of tech job postings, or Postings(App)/Postings(ICT). This is the number highlighted and discussed in section 3, "Quantifying the Economic Importance of the App Store Economy for Digital Transformation and Innovation."

The source of the job posting data for Japan is jp.indeed.com, which is the Japanese site for Indeed. com. Indeed, which calls itself the "#1 job site in the world," is available in more than sixty countries. For each country, the associated Indeed site accepts Boolean search expressions, and outputs the number of job postings in that country fitting those criteria. We use Indeed wherever possible because it gives us the ability to use the same search terms in different countries and know that they will behave consistently.

Step 1: Identification and validation of core App Economy job postings

Using summary statistics generated by searches on the Indeed website, we identify online job postings containing one of the following key words: "iOS," "Android," "mobile," or the Japanese term for mobile.

By the nature of the data, a keyword search for core App Economy workers will typically include some irrelevant job postings. For example, the word "mobile" can appear in a job posting for a security guard who needs to use a mobile app on the job. In order to adjust for these and other irrelevant job postings, we manually examine a sample of the job postings from step 1 to eliminate those that do not fit our



criteria of a core App Economy worker. This validation ratio yields us an estimate of Postings(App).

2. Identification and validation of ICT job postings

We construct a keyword list to identify ICT job postings, appending Japanese language terms as appropriate. As in the previous step, we manually examine a sample of the job postings to eliminate those that do not fit our criteria of an ICT occupation. This validation ratio yields us an estimate of Postings(ICT).

3. Calculation of core app economy job postings as share of all ICT job postings

We calculate Postings(App)/Postings(ICT), which gives us core app economy job postings as a share of all ICT job postings. This percentage differs between countries, but tends to be relatively stable over time.

Using this methodology, and taking into account the history of the data series, we estimated that roughly 25% of job postings for IT professionals require App Economy skills such as knowledge of iOS or Android.

ABOUT THE AUTHOR

Dr. Michael Mandel is Vice President and Chief Economist at the Progressive Policy Institute.

References

- 1 "「DX推進指標」とそのガイダンス (DX Promotion Index and its Guidance)," Japan's Ministry of Economy, Trade and Industry, July 2019, https://www.meti.go.jp/press/2019/07/20190731003/20190731003-1.pdf
- 2 "Policy Speech by Prime Minister KISHIDA Fumio to the 208th Session of the Diet," Prime Minister's Office of Japan, January 17, 2022, https://japan.kantei.go.jp/101_kishida/statement/202201/_00009.html
- 3 "Vision for a Digital Garden City Nation: Achieving Rural-Urban Digital Integration and Transformation," KIZUNA, January 25, 2022, https://www.japan.go.jp/kizuna/2022/01/vision_for_a_digital_garden_city_nation.html
- 4 Author tabulations. For full methodology, see Appendix.
- 5 "OECD Economic Outlook No 111 (Edition 2022/1)," OECD Economic Outlook: Statistics and Projections, 2023, https://doi.org/10.1787/5cdec7d9-en
- 6 "Japan PM Says Country on the Brink Over Falling Birth Rate," BBC, January 23, 2023, https://www.bbc.com/news/world-asia-64373950
- 7 "Low IT pay stifles Japan's digital transformation," NikkeiAsia, June 12, 2022, https://asia.nikkei.com/Spotlight/Datawatch/Low-IT-pay-stifles-Japan-s-digital-transformation
- 8 Based on data from November 2022.
- 9 More broadly, Apple has reported that the company supports more than 1 million jobs in Japan, including a vibrant IOS developer ecosystem: "Apple Accelerates Investment in Japanese Suppliers, Spending Over \$100 Billion Since 2018," Apple Newsroom, December 13, 2022, https://www.apple.com/jp/newsroom/2022/12/apple-accelerates-investment-with-suppliers-in-japan/
- 10 "Policy Speech by Prime Minister KISHIDA Fumio to the 208th Session of the Diet," January 17, 2022, https://japan.kantei.go.jp/101_kishida/statement/202201/_00009.html
- 11 "App Security Overview," Apple Support: Apple Platform Security , May 13, 2022, https://support.apple.com/guide/security/app-security-overview-sec35dd877d0/web
- 12 "Asymmetric information," Corporate Finance Institute, December 25, 2022, https://corporatefinanceinstitute.com/resources/wealth-management/asymmetric-information/
- 13 "「スマホアプリ開発者の日常と心配ごとーラックがセキュリティ意識調査- (Daily Life and Concerns of Smartphone App Developers Security Awareness Survey), LAC Co., Ltd., 2021, <u>https://www.lac.co.jp/lacwatch/pdf/202202_mobileappdev_secsurvey.pdf</u>
- 14 See, for example, "Competition Assessment of the Mobile Ecosystem, Interim Report Summary," (English), Secretariat of the Headquarters for Digital Market Competition, Cabinet Secretariat, April 26, 2022, https://www.kantei.go.jp/jp/singi/digitalmarket/pdf_e/ documents_22220601.pdf
- 15 "The Market for Lemons," Wikipedia, last updated February 25, 2023, https://en.wikipedia.org/wiki/The_Market_for_Lemons
- 16 "Cybersecurity: The Cutting Edge Market for Lemons," Cornell University, December 16, 2020, <u>https://blogs.cornell.edu/</u> info2040/2020/12/16/cybersecurity-the-cutting-edge-market-for-lemons/
- 17 See discussion of 2001 Nobel Prize in Economic Science: https://www.nobelprize.org/prizes/economic-sciences/2001/press-release/



- 18 "スマートフォンのセキュリティに対する意識調査 (Survey on Smartphone Security Awareness)," LAC Co., Ltd., 2022, <u>https://www.lac.co.jp/</u> lacwatch/pdf/202209_mobileappdl_secsurvey_w22s.pdf
- 19 "Z世代スマホアプリのセキュリティ 意識調査結果 (Generation Z: Smartphone App Security Awareness Survey Results)," LAC Co., Ltd., 2022, https://www.lac.co.jp/lacwatch/pdf/202203 appsec_report_genz_01.pdf
- 20 "About 70% of People Are Aware of the Privacy Settings on Their Smartphones!," PR Times (Spacolo Co., Ltd., August 5, 2021), https://prtimes.jp/main/html/rd/p/00000025.000060722.html
- 21 "2020 Benchmark Survey of Uninstall Rates in the App Industry," AppsFlyer, 2020, <u>https://www.appsflyer.com/ja/resources/reports/app-uninstall-benchmarks/</u>
- 22 "Focus on the DMA: Will the DMA Really Help Europe Grow?", Gobal Digital Foundation, February 2022, <u>https://www.globaldigitalfoundation.org/will-the-dma-really-help-europe-grow</u>
- 23 Rebecca Janßen et al., "GDPR and the Lost Generation of Innovative Apps," National Bureau of Economic Research, May 2022, https://doi. org/10.3386/w30028
- 24 Jay Peters and Mitchell Clark, "Apple Is Reportedly Preparing to Allow Third-Party App Stores on the iPhone," The Verge, December 13, 2022, https://www.theverge.com/2022/12/13/23507766/apple-app-store-eu-dma-third-party-sideloading
- 25 Aurélien Portuese, "The Digital Markets Act: The Path to Overregulation," Competition Policy International, June 13, 2022, https://www.competitionpolicyinternational.com/the-digital-markets-act-the-path-to-overregulation/
- 26 European 5G Scoreboard," 5G Observatory, accessed 2023, https://5gobservatory.eu/observatory-overview/interactive-5g-scoreboard/
- 27 "5G Networks Are Worryingly Hackable: A shift to the cloud is opening the industry up to new attacks," August 2022, <u>https://spectrum.</u> ieee.org/5g-virtualization-increased-hackability
- 28 Michael Mandel, "Regulation and the Productivity Revolution in Japan's Handset Market," Progressive Policy Institute, January 19, 2019, https://www.progressivepolicy.org/publication/regulation-productivity-revolution-japans-handset-market/
- 29 "スマートフォンのセキュリティに対する意識調査 (Survey on Smartphone Security Awareness)," LAC Co., Ltd., 2022, <u>https://www.lac.co.jp/lacwatch/pdf/202209_mobileappdl_secsurvey_w22s.pdf</u>
- 30 "Pro-Russia Hacker Group Declares 'War' against Japan," Nikkei Asia, September 8, 2022, <u>https://asia.nikkei.com/Politics/Ukraine-war/</u> <u>Pro-Russia-hacker-group-declares-war-against-Japan</u>
- 31 Shubhajit Roy, "In a First, Quad Moves to Act against Cyberattacks Coming from China-Led Axis," The Indian Express, September 25, 2022, https://indianexpress.com/article/india/in-a-first-quad-moves-to-act-against-cyberattacks-coming-from-china-led-axis-8171039/
- 32 Takahashi Kosuke, "Japan Needs a Cyber Ministry: Former JGSDF Major General," The Diplomat, September 19, 2022, https://thediplomat.com/2022/09/japan-needs-a-cyber-ministry-former-jgsdf-major-general/

The Progressive Policy Institute is a catalyst for policy innovation and political reform based in Washington, D.C. Its mission is to create radically pragmatic ideas for moving America beyond ideological and partisan deadlock.

Founded in 1989, PPI started as the intellectual home of the New Democrats and earned a reputation as President Bill Clinton's "idea mill." Many of its mold-breaking ideas have been translated into public policy and law and have influenced international efforts to modernize progressive politics.

Today, PPI is developing fresh proposals for stimulating U.S. economic innovation and growth; equipping all Americans with the skills and assets that social mobility in the knowledge economy requires; modernizing an overly bureaucratic and centralized public sector; and defending liberal democracy in a dangerous world.

© 2022 PROGRESSIVE POLICY INSTITUTE ALL RIGHTS RESERVED.

PROGRESSIVE POLICY INSTITUTE 1156 15th Street NW Ste 400 Washington, D.C. 20005

Tel 202.525.3926 **Fax** 202.525.3941

info@ppionline.org progressivepolicy.org