



Taiwan's digital imperative:

How a digital
transformation can
re-ignite economic
growth

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Regaining competitiveness through a digital transformation

Digital technology is changing the way business is done, enabling new competitors with new business models to disrupt entire industries. Digital technology is also changing many aspects of daily life. The advent of social media, for example, has transformed the way people connect with each other, and has enabled businesses to quickly attract thousands or even millions of new customers from around the world.

Taiwan is feeling the impact of the digital revolution that is sweeping the world. Long a global leader in high tech sectors such as consumer electronics and semiconductors, Taiwan should be well-positioned to capture the digital opportunity just as well as, or even better than, other advanced economies in Asia. And yet, according to our extensive analysis of the Taiwan economy, we find enormous gaps between where Taiwan stands today in terms of digital readiness, and where it needs to go if it hopes to leverage the full potential of digital technologies.

In this report, we assess the current digitization level of three of the most important sectors of Taiwan's economy – high tech, finance, and the public sector – and we outline some of the strategies that both government and business need to pursue to tap fully into the digital opportunity. The following is a brief summary of the contents of this report:

Chapter 1: The case for digitization

Since the Great Recession that began with the global financial meltdown in 2007, the competitiveness of Taiwan's economy has progressively eroded. Productivity, one of the biggest drivers of economic growth, has dropped across all industry sectors. These sectors have pursued revenue growth at the expense of profits. As a consequence, Taiwan's share of the global profit pool is gradually declining.

According to our research, there is a positive correlation between a country's rate of productivity growth and its level of digitization. Our Industry Digitization Index indicates that Taiwan's economy is digitizing unevenly, with wide variations across sectors, and overall it lags other advanced economies considerably. Clearly, Taiwanese companies need to embrace digitization and develop robust digital strategies that will allow them to compete with leading companies globally.

Chapter 2: High-tech's \$5 billion opportunity

High-tech is Taiwan's most critical industry: it contributes 18 percent of the country's GDP, with electronic manufacturing companies making up the bulk of the sector. Over the past decade, profit margins dropped as the sector faced commoditization. Digitization would allow high-tech manufacturers to realize greater value in their core businesses. Automation, digital systems, and advanced analytics offer a myriad of ways to improve operational efficiency and productivity in businesses where margins are slim.

Digital tools also provide opportunities for Taiwan's electronics manufacturers to develop high-margin manufacturing services and solutions.

Chapter 3: Banking on innovation

Given the challenges of margin and continued growth, traditional banks need to expand their digital capabilities, while fintech startups need to double down on innovation opportunities.

Finance is the second most digitized sector in Taiwan. For traditional banks, however, significant challenges – low asset utilization, high fixed costs, and low interest rates – weigh on profit margins and growth potential. To become more competitive, banks need to further digitize operations, innovate IT infrastructure, deploy advanced analytics, and pursue external investments and partnerships.

Fintech startups, the more digitally advanced part of Taiwan's banking sector, face their own challenges, which include a conservative regulatory environment that constrains innovation.

Chapter 4: The next step for e-government

Taiwan's government has invested heavily in digital infrastructure but needs to improve communication with its citizens and promote wider data sharing between agencies.

The government of Taiwan faces financial obstacles. An aging population puts more demands on the budget, which at 16 percent of GDP, is low to begin with. E-government initiatives can help streamline workflows, manage data, enhance the delivery of public services, and expand communication channels.

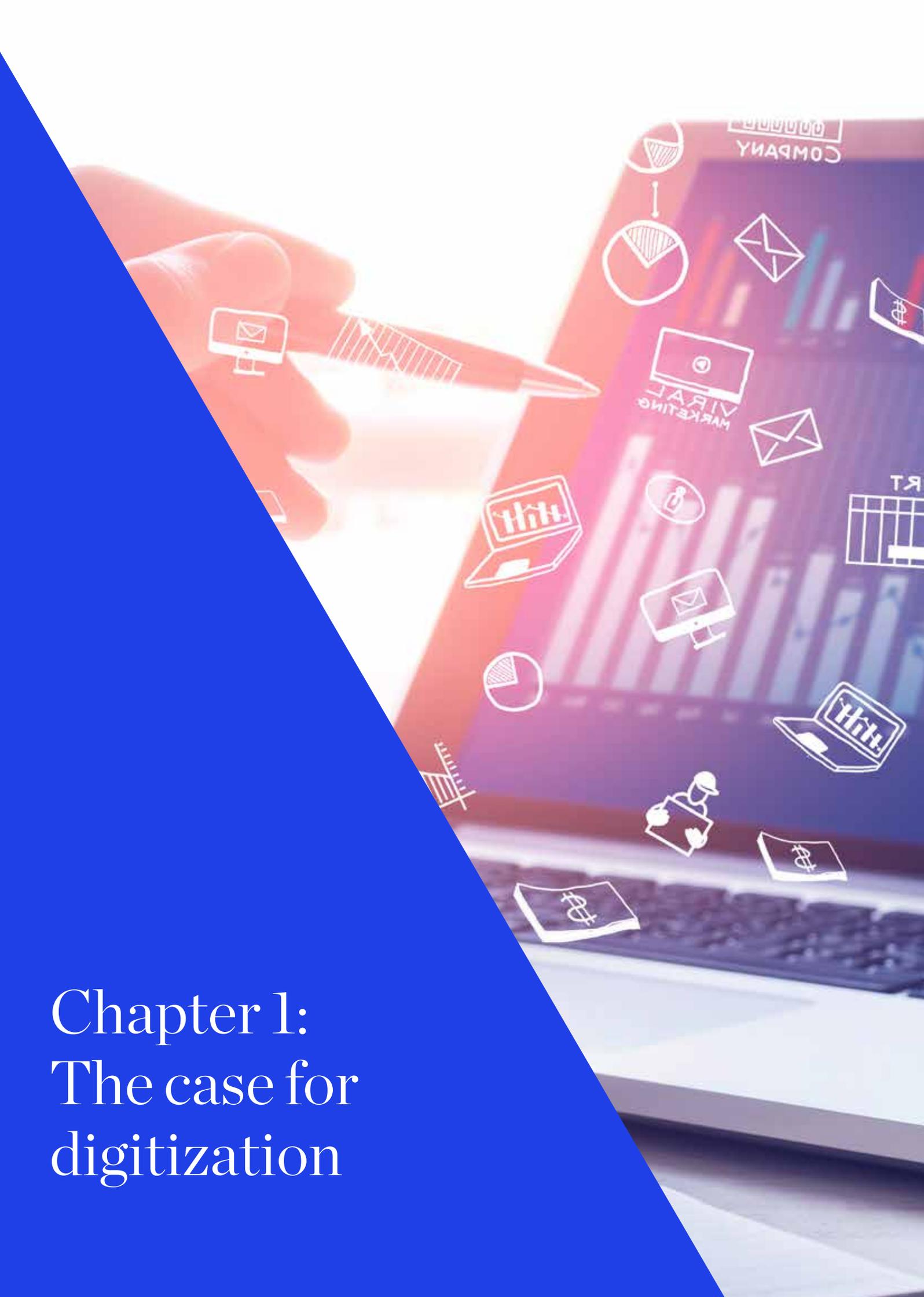
The government is one of the most digitally advanced sectors in Taiwan. Yet it is not at the level of international best practice. Realizing there is work to be done, the government has allocated nearly half of its digitization budget to digitizing internal operations and processes. To facilitate more transparent and useful communications with its citizens, the government should automate internal operations and promote broader sharing of data with people, as well as between government agencies. It should also create apps that enable government agencies to deliver better public services and improve the user experience. The government also needs to leverage data analytics technologies to improve the effectiveness of policy-making.

Conclusion

Capturing the full potential of digital technologies takes more than just identifying the right digital levers. The organization has to commit to a journey of transformation: one that integrates digital and business strategy; attracts and retains suitable digital talent; facilitates the shift to an agile culture and way of working; and builds commitment to the realization of the digital organization.

As part of this process, Taiwan's government should continue its efforts toward digitization, while encouraging greater participation among businesses and its citizens in the digital economy. In addition, the government should play a leading role in promoting the adoption of digitization via a system of dedicated departments tasked with cooperating with business on digital innovation.

Fully capturing the benefits of digital opportunities will require substantial investment, and the ability to move quickly and flexibly. Done right, Taiwan's digital transformation will help accelerate productivity growth, boost economic growth, and restore its competitive position among the advanced economies of the world.



Chapter 1: The case for digitization



Taiwan has undergone an extraordinary economic transformation. In just a few decades, Taiwan has vaulted from its position as a poor agricultural economy, to become one of the world's largest industrialized economies. In 1961, per capita GDP was just \$1,353 (in 1990 prices). By 2011, thanks to annual average economic growth of 8 percent, per capita GDP had leapt to \$37,000. Today, Taiwan is the 22nd largest economy in the world, and controls the fifth largest holding of foreign exchange reserves.

After the Great Recession of 2007-2009, however, Taiwan's economic growth has stalled, calling into question its competitive position among the world's leading economies. Slowing growth and declining productivity have led to shrinking profits across all of Taiwan's most critical industries.

There has been much debate in recent years about what Taiwan needs to do to pull itself out of its economic slump. But one thing our recent research has made clear is this: if Taiwan wants to re-ignite growth and regain its competitive position in the world, it must embrace digitization.

In this chapter, we analyze the key challenges facing Taiwan's economy today, and we take a brief look at how digitization can help Taiwan overcome them. In subsequent chapters of this report, we take a deeper look at the potential for digitization to transform three key sectors of Taiwan's economy: high tech, finance, and the public sector.

Taiwan falling behind

One of the biggest drivers of economic growth is productivity, and on this metric, Taiwan is lagging substantially behind the US and Japan (see Exhibit 1).

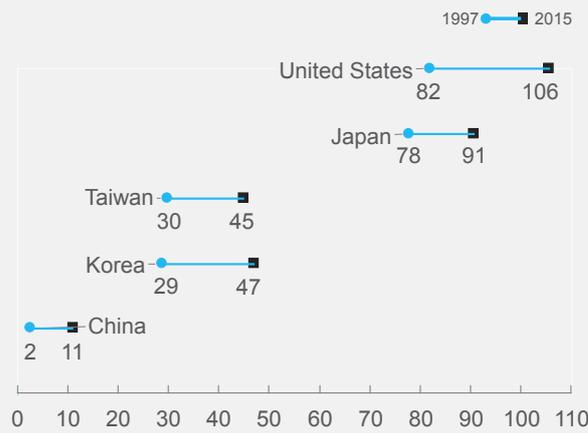
Unlike the US, Japan, Korea, and China, where productivity growth has been relatively stable, Taiwan's wildly fluctuating rates of productivity growth over the past two decades have made it difficult to close the productivity gap with these countries. (see Exhibit 2).

Exhibit 1

Productivity, 1997-2015

Productivity level¹

GDP (in constant 2010 US\$) per labor in 1997-2015
(in 000s)



US vs. country's productivity Multiple²

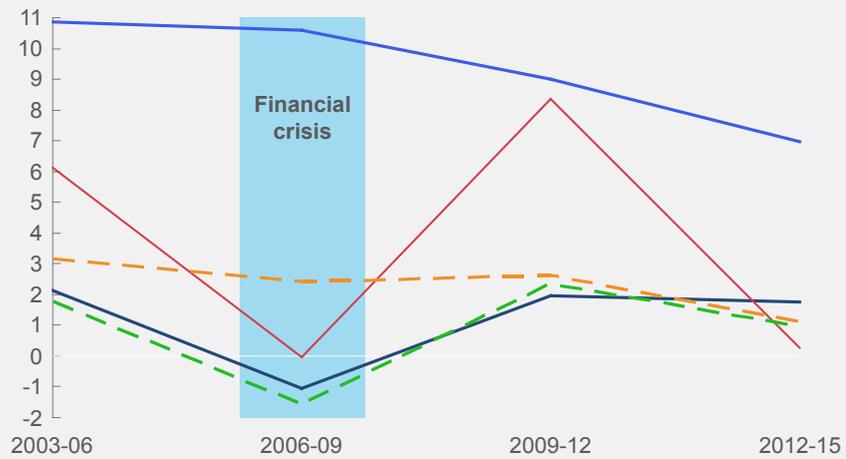
	1997	2006	2015
United States	1.1x	1.1x	1.2x
Japan	2.7x	2.8x	2.3x
Taiwan	2.9x	2.5x	2.2x
China	33.2x	19.0x	9.6x

¹ Productivity is calculated as country RGDP (in constant 2010 US\$) divided by labor force in active population
² US productivity level divided by productivity of a given country
SOURCE: Economist Intelligence Unit; OECD; Worldbank; CIA WorldFace; team analysis

Exhibit 2

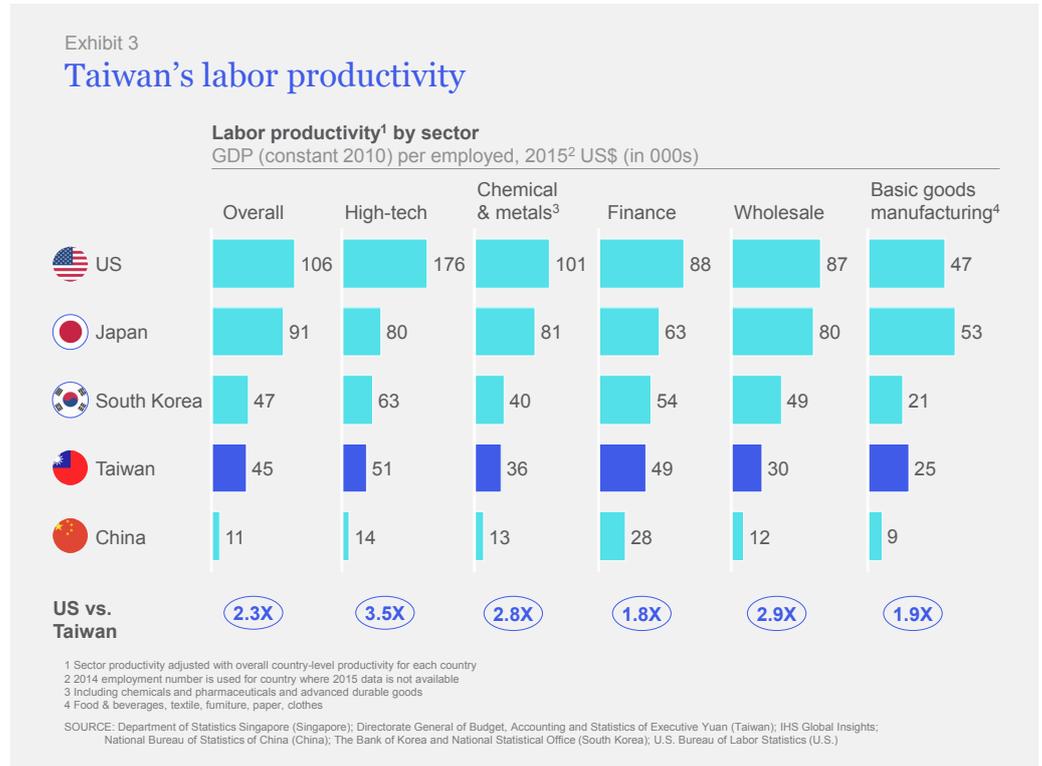
Taiwan's productivity growth rate, 2003-2015

Productivity growth in 3-year period CAGR %



SOURCE: Economist Intelligence Unit; OECD; Worldbank; CIA WorldFace; team analysis

Not surprisingly, therefore, US and Japanese productivity are consistently the highest in the individual sectors we examined (see Exhibit 3). The greatest disparity between the most productive and least productive countries occurs in the high tech space; productivity in the US's high tech sector is more than double that of Japan.

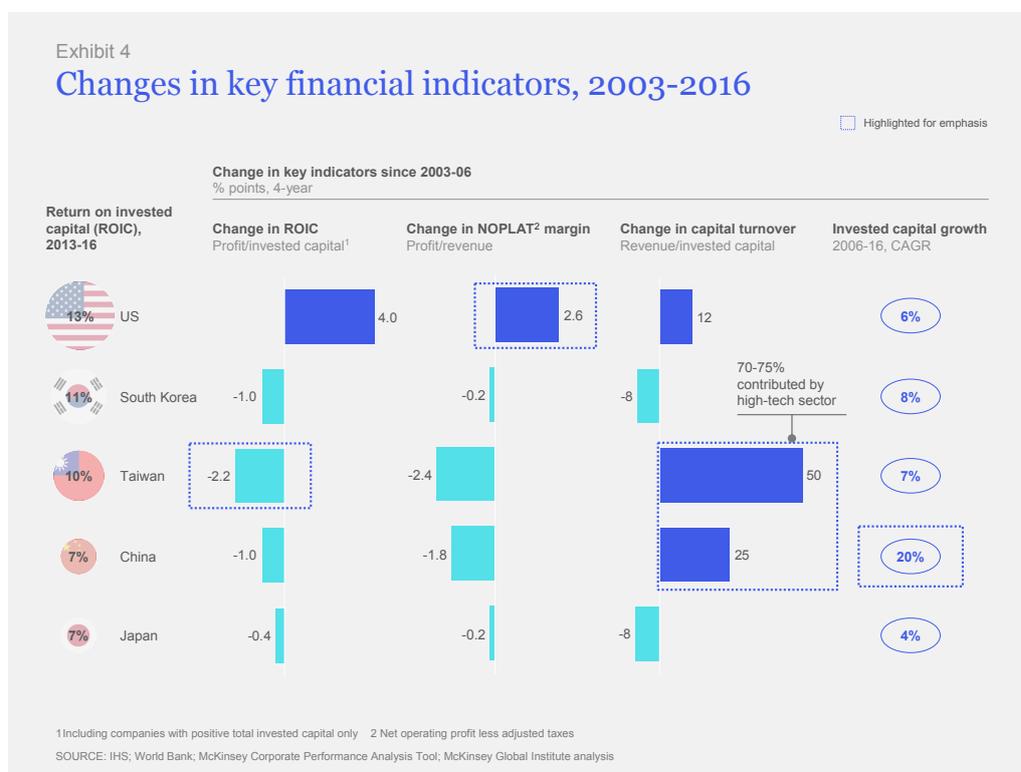


While productivity in Taiwan's high tech sector is the highest of all sectors in the economy, tech productivity in Taiwan nonetheless trails that of all the other countries we assessed in our study, with the exception of China. This can likely be explained by the fact that Taiwan's high tech companies still primarily manufacture commoditized products at the low end of the value chain, where margins are thin.

Rising revenue, falling profits

Productivity is not the only area where Taiwan is falling behind. It's also experiencing unprofitable revenue growth and declining return on invested capital (ROIC). Of the five economies we studied, Taiwan experienced the largest ROIC decline over the past decade. Only the US exhibited ROIC growth during this period (see Exhibit 4).

Exhibit 4 Changes in key financial indicators, 2003-2016



ROIC consists of two measures: net operating profit less adjusted taxes (NOPLAT), times the change in capital turnover (net sales divided by working capital). The US has experienced a 2.6 percent increase in NOPLAT margins during the past decade, driven mainly by ROIC growth of 4.0 percent. Growth of both NOPLAT and ROIC in the US were the highest among the countries we examined.

The very large increase in capital turnover in Taiwan over the past decade indicates substantial investments in top-line revenue growth. Yet, profits remain elusive: both ROIC and NOPLAT margins in Taiwan have experienced the steepest drop among all of the countries we studied, and today they are the lowest of the Asian countries in our study.

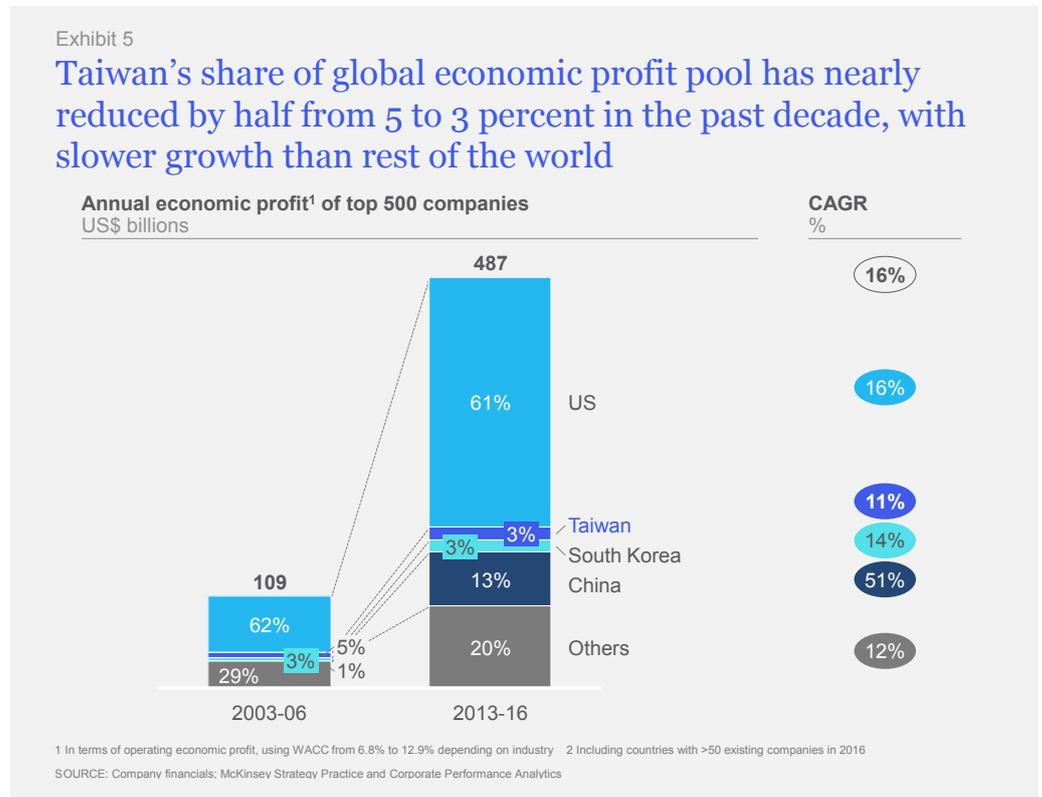
These metrics indicate that Taiwanese companies are indeed making investments – but they are investments to grow revenue rather than profits. According to our analysis, for every dollar of top-line revenue growth, Taiwan’s companies have sacrificed profit margins by approximately 5 cents. Thus, they are pursuing small profit margins at the low-value end of the value chain. Notably, 70 to 75 percent of Taiwan’s capital turnover increase comes from the high-tech industry.

By contrast, revenue of China’s high tech firms has grown at almost triple the rate of Taiwan’s firms and more than twice the rate of high tech companies in other countries in our study. Whereas Taiwan’s invested capital has grown at 7 percent per year between 2006 and 2016, China’s has grown a staggering 20 percent.

Shrinking share of the global profit pool

Changes in the global profit pool, the sum of the annual economic profit¹ of each market's top 500 companies, underscore Taiwan's declining competitiveness.

To better understand how the distribution of profit has changed globally, we compared the global profit pool between 2003-2006 and 2013-2016 (see Exhibit 5). The pool has been expanding on average 16 percent per year, driven largely by the growth of the US and Chinese economies. The US has maintained its strong hold on the global share of profit for the past ten years: US "giants," which represent 10 percent of the total number of global companies and include marquee brands like Amazon, Google, and Apple, now represent more than 60 percent of global profits. During the same period, China has experienced explosive growth, with its share of the global profit pool skyrocketing from 1 to 13 percent.



By contrast, Taiwan's share of the global profit pool has declined by nearly half, from 5 percent to 3 percent. In addition, Taiwan's economic profit annual growth rate of 11 percent, which lags the global average by five percentage points, has been slower than that of China, South Korea, Hong Kong, India, and Japan for the past decade. This sluggishness stems from not investing enough in innovation, and from not being able to use whatever innovations it possesses to drive profitable growth. It is essential for Taiwan to break this trend to prevent its share of the global profit pool from eroding further.

Shrinking profits and a smaller share of the global profit pool make one thing abundantly clear: Taiwanese companies are losing competitiveness, both in Asia and globally.

¹ Economic profit is defined as NOPLAT less the operating invested capital adjusted by weighted average cost of capital, which varies depending on the industry.

The role of digitization in productivity growth

The connection between digitization and productivity growth in advanced economies is a subject of ongoing debate. To better understand this connection, we compiled the Taiwan Digitization Index, which assesses the digitization of different sectors (see Sidebar, “The Taiwan Industry Digitization Index”); we then looked at these findings in the context of the productivity growth rate of countries and individual sectors (see Exhibits 6 and 7).

Our analysis suggests that, while the degree of digitization is not the sole driver of productivity, countries with high productivity levels tend to positively correlate with an overall higher level of digitization across their industries. A similar correlation can be detected at the industry level. For every point increase in digitization in a given sector, the productivity level increases by 0.7 percent. China and some European countries (e.g., the UK, Netherlands, Sweden, France, and Germany) exhibit a similar pattern.

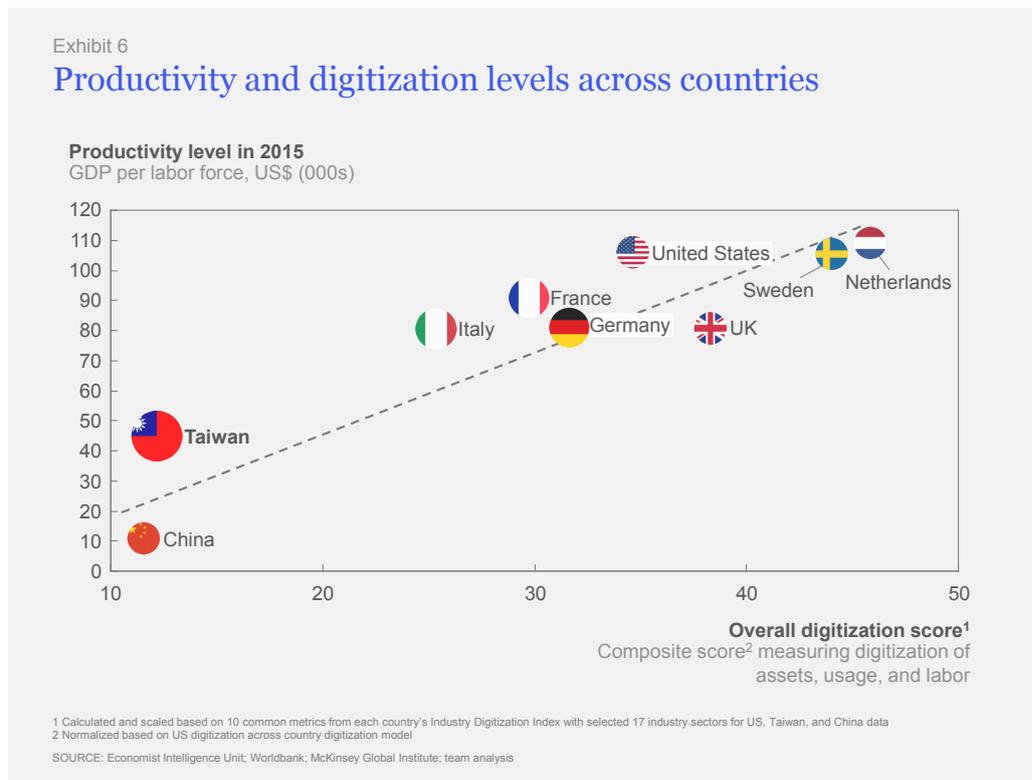
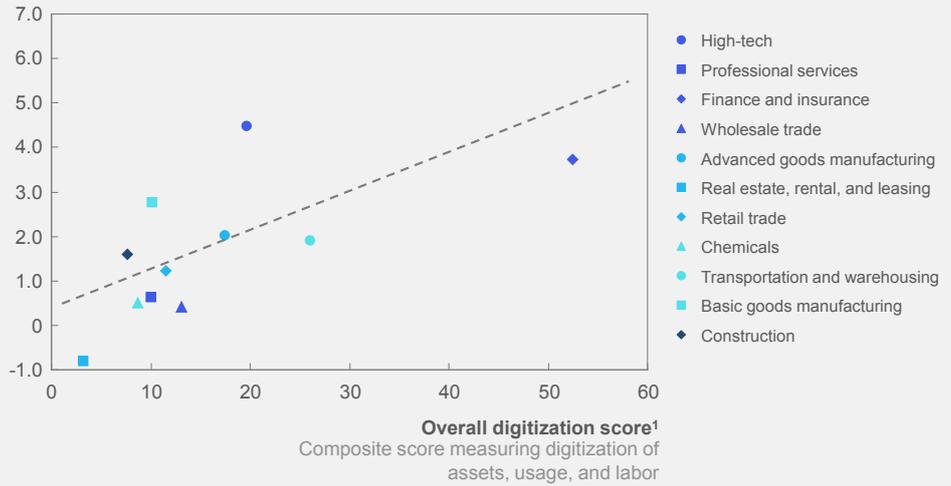


Exhibit 7

Taiwanese industry digitization levels and productivity growth rates

Productivity growth CAGR

Real GDP per labor force, 2010-15, %



¹ Calculated and scaled based on 10 common metrics from each country's Industry Digitization Index
SOURCE: Economist Intelligence Unit, Worldbank; McKinsey Global Institute; team analysis

The implications are clear: capturing the digital opportunity can improve productivity across sectors. Moving forward, Taiwan should double down on increasing its digitization efforts if it wants to improve productivity. We will explore this challenge further in the sector-specific chapters of this report.

Box 1

The Taiwan Industry Digitization Index

The Taiwan Industry Digitization Index, which draws on the methodology used by the McKinsey Global Institute Digitization Index¹, examines the major sectors of the Taiwanese economy through the same three lenses: digital assets, digital usage, and digital labor. In total, the Taiwan index uses ten metrics to measure the digitization of a given sector (see Exhibit A).

Exhibit A

Taiwan Digitization Index Metrics

	Metric	Description
Assets		
Digital spending	▪ Hardware spending	▪ Share of total expenditures spent on ICT hardware (e.g., computers, servers)
	▪ Software spending	▪ Share of total expenditures spent on software (e.g., enterprise resource planning [ERP] software)
	▪ Telecommunications spending	▪ Share of total expenditures spent on IT services (e.g., broadband access, mobile data services)
	▪ IT services spending	▪ Share of total expenditures spent on IT services (e.g., IT consulting, IT architecture and implementation)
Usage		
Business processes conducted internally	▪ Front and back-office digitization	▪ Adoption of enterprise resource planning (ERP) and customer relationship management (CRM) spending as an estimated share of total IT expenditures
	▪ Vertical-specific digitization	▪ Vertical-specific software spending in sector as total IT expenditure
Labor		
Digital spending	▪ Hardware spending on workers	▪ ICT hardware (e.g., computer, servers) expenditures per full-time-equivalent employee (FTE)
	▪ Software spending per worker	▪ Software (e.g., enterprise software licenses) expenditures per FTE
	▪ Telecommunications spending per worker	▪ Telecommunications (e.g., broadband access, mobile data services) expenditures per FTE
	▪ IT services spending per worker	▪ IT services (e.g., IT consulting, IT architecture and implementation) expenditures per FTE

SOURCE: MGI; team analysis

Exhibit B illustrates the level of digitization across 14 sectors, which fall into four categories.

- **Knowledge-intensive industries** are highly digitized across most dimensions. Financial services such as banking and insurance, and high-tech, are the most highly digitized sectors of Taiwan’s economy. The financial services sector invests the highest percentage in digital assets, especially in telecoms and IT services.
- **Public industries** in Taiwan are, notably, fairly advanced digitally. The government is the most digitized public sector of all, having invested at least US\$200 million every five years since the 2000s in digital assets, process, and labor². Citizen Digital Certification, a government development plan, helps people in Taiwan to easily engage in government-related activities through online platforms.

¹ *Digital America: A tale of the haves and the have-mores*, McKinsey Global Institute, December 2015.

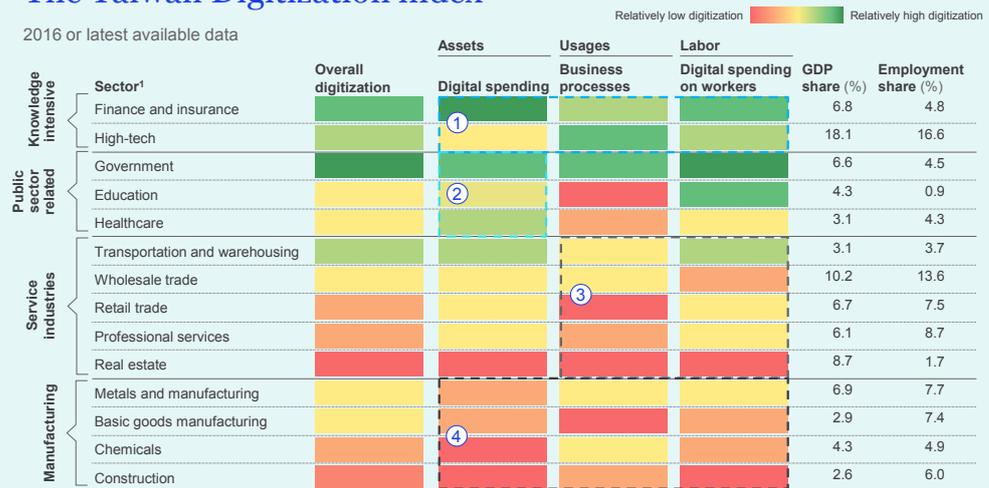
² Taiwan National Development Council: e-Government policy (<http://www.ndc.gov.tw/>).

Education and healthcare are less digitized, however. For instance, although the National Health Insurance Card has existed for 20 years, Taiwan is still in the process of transitioning toward an electronic medical record storage and retrieval system that would enable different medical institutions to have ready access to patient data³.

Exhibit B

The Taiwan Digitization index

2016 or latest available data



- 1 Knowledge-intensive sectors are highly digitized across most dimensions; however, high-tech has room to improve in digital spending, e.g., investing in infrastructure assets such as devices and data centers
- 2 Public sector is moderately digitized; while government has clear spike, education and healthcare can improve in process-related investment
- 3 Service sector follows the global pattern:
 - It has high variance in degree of digitization among industries, with further room to digitize internal process and tools for the workforce
 - However, transportation is most digitized among asset-intensive sectors, while the other sectors have further room for improvement
- 4 Manufacturing follows global pattern with major gap in digitization to close

¹ Only displayed sectors with GDP contribution at 2%+

SOURCE: Gartner; Taiwan Directorate General of Budget; McKinsey analysis

- **Service industries** vary widely in their level of digitization, as is the case globally. Transportation is the most digitized among Taiwan’s service sectors, mainly because of a booming e-commerce market and an increase in online services and transactions. For example, for several years, customers in urban areas have enjoyed 24-hour delivery of products purchased online, as well as online delivery tracking and processing⁴.

Other service sectors such as wholesale and retail trade are relatively less digitally advanced. The wholesale sector, the second largest contributor to Taiwan’s GDP, accounts for 10.2 percent of total GDP. Yet many of Taiwan’s wholesalers are small to medium-sized businesses, which in general are far less digitized.

Overall, Taiwan’s service sectors have further room to digitize, especially when it comes to internal processes and tools for the workforce.

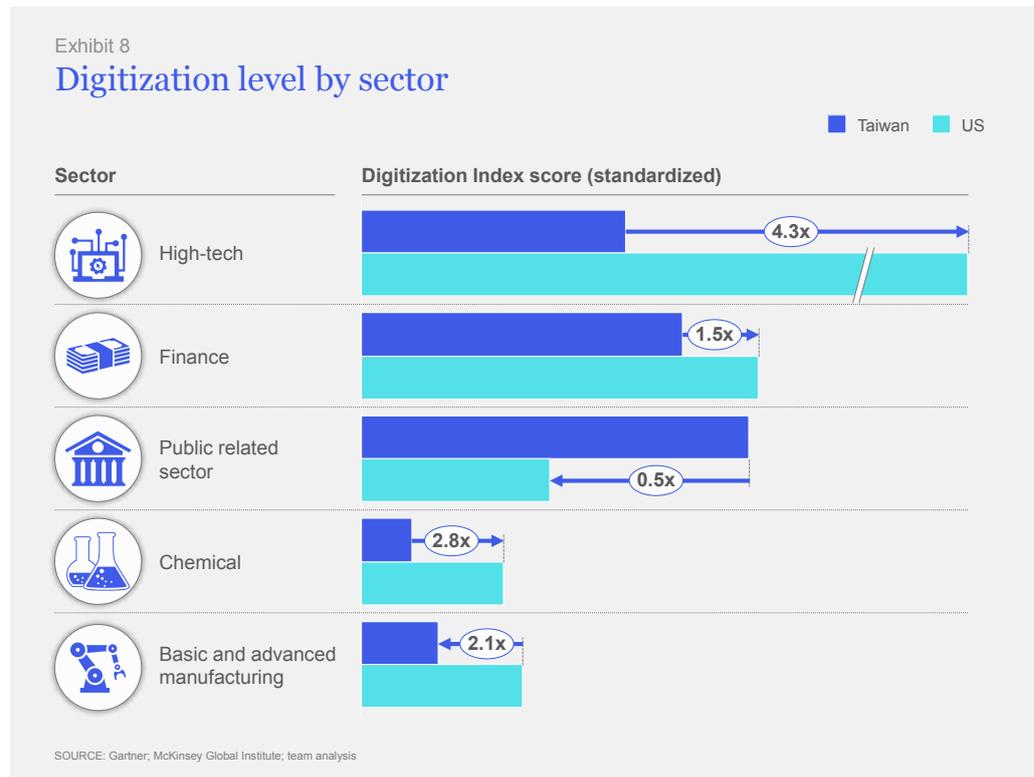
- **Manufacturing industries** in Taiwan, like elsewhere, have been slow to digitize. Chemicals manufacturing, which represents approximately 10 percent of Taiwan’s GDP, is less digitized than other manufacturing sectors because it has not invested sufficiently in upgrading its factories and management systems.

³ Taiwan National Health Institution Administration, Ministry of Health and Welfare (<https://www.nhi.gov.tw/>).

⁴ Ministry of Economic Affairs, “我國 B2C 網路商店經營現況研析報告,” 2016.

Taiwan's Digitization Potential

As measured by the Digitization Index score, the gap in digitization between the US and Taiwan stands at 2.7. To better understand the digitization gap at the sector level, we analyzed five major sectors (see Exhibit 8):



- **High-tech:** As one of the most knowledge-intensive industries, high-tech tops the digitization chart in both Taiwan and the US. However, Taiwan's high-tech sector lags the US significantly, with a Digitization Index score gap of 4.3. The US's much stronger innovation capabilities allows it to occupy a pivotal position in the global high-tech value chain, with a leading presence in high-margin software development, web services, and patent-protected hardware design.
- **Finance:** Banking is one of the most digitized sectors in Taiwan, as reflected in the fact that the digitization gap with the US banking sector is only 1.5. Taiwan's banks have been increasing their investment in digitization in recent years. However, there is still room to enhance digitization, for instance, through broader adoption of digital payments and peer-to-peer lending.
- **Public sector:** The public sector includes government, education services, and social and healthcare services. Unlike other countries, Taiwan leads in digitization within the public sector, especially in government and healthcare. Of these, government is the most digitized sector in Taiwan, mostly because of the government development plan².

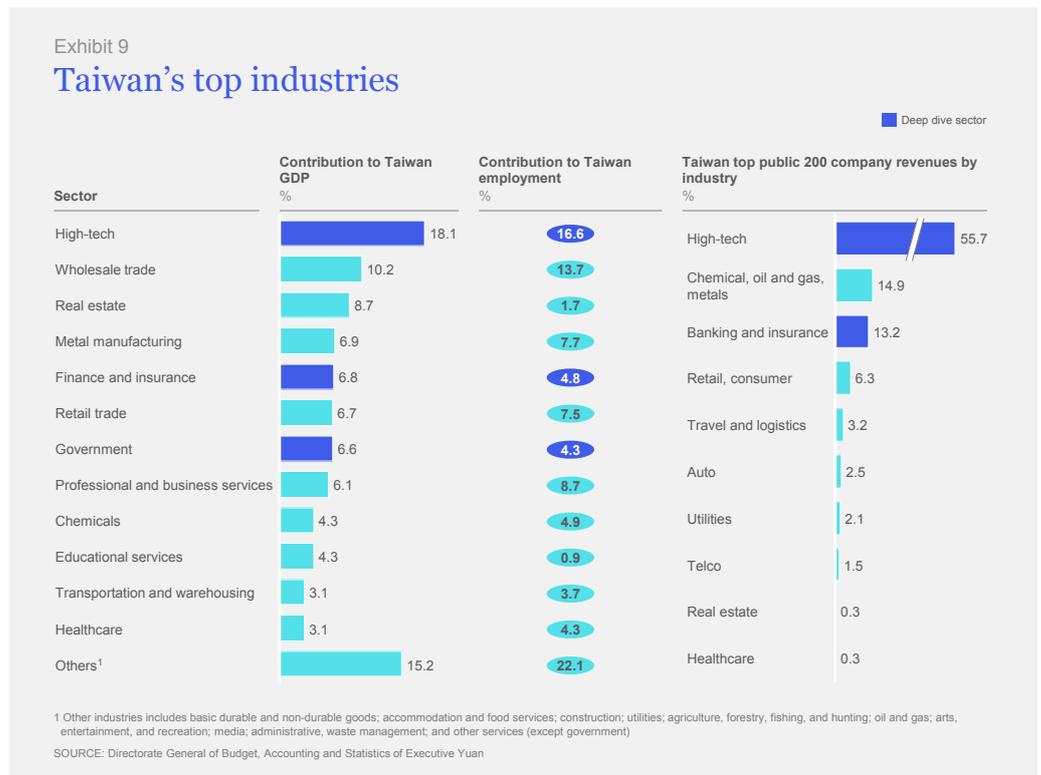
² Taiwan National Development Council: e-Government policy (<http://www.ndc.gov.tw/>).

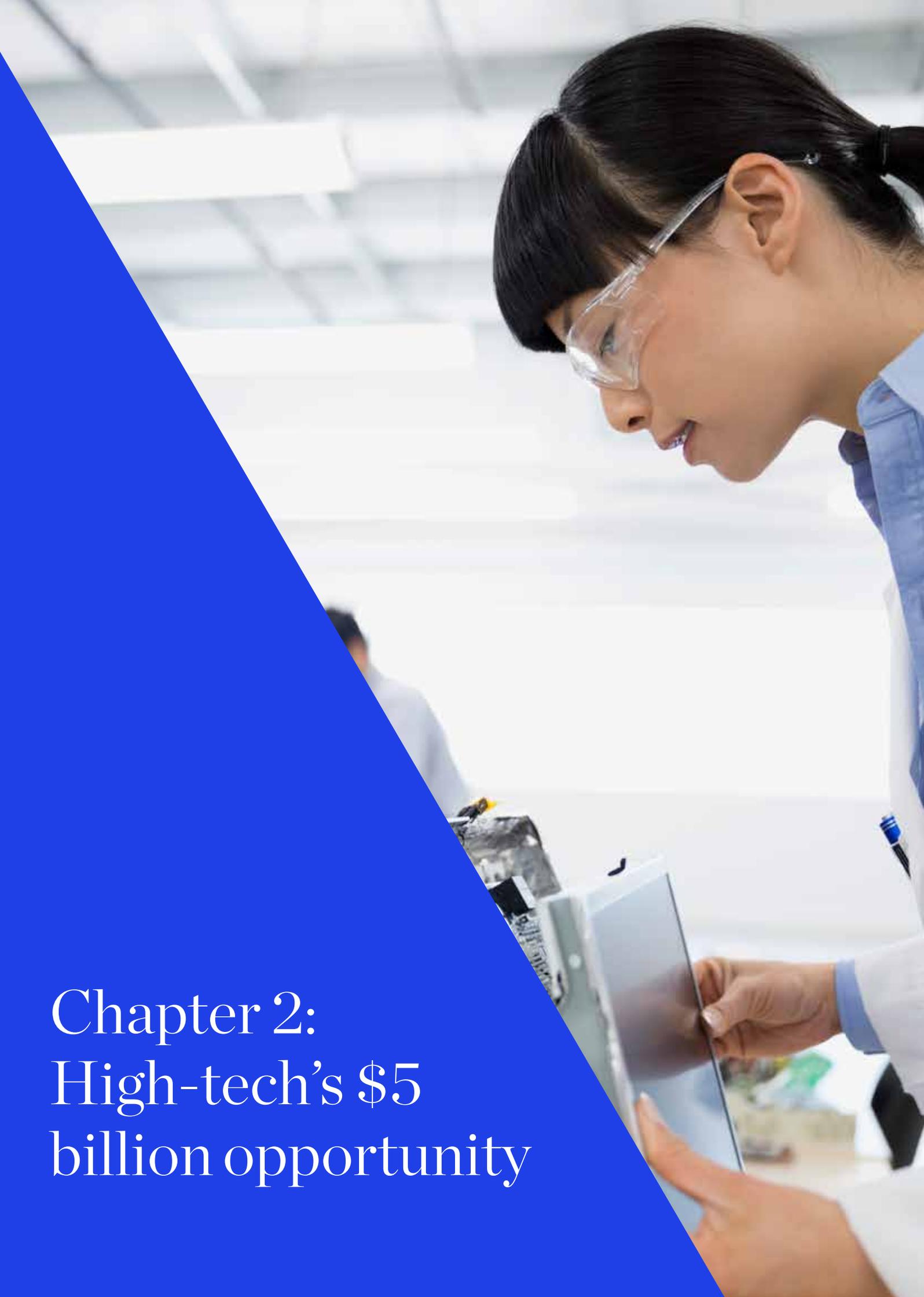
- Chemicals and basic/advanced manufacturing:** Globally, manufacturing lags other sectors. Taiwan manufacturing exhibits even lower digitization than the US with a digitization score gap of 2.1. The chemicals sector, a major manufacturing sector in Taiwan, is the least digitized, with a gap of 2.8 times compared with the US. This indicates that the industry has not invested enough in digitization of factories and management systems.

The adoption of digital technologies in Taiwan has been inconsistent. The potential productivity gains from digitization in laggard sectors are very large. Eventually, as Taiwan’s industry sectors undertake a digital transformation of processes, organizational structures, and supply chains we should expect to see substantial productivity gains at both the sector and economy level.

What follows

The following chapters lay out the challenges and the potential impact of digitization for Taiwan’s high-tech, financial services, and government sectors. These sectors are major contributors to Taiwan’s economy, representing a total of 31.5 percent of GDP and 25.7 percent of employment in 2015 (see Exhibit 9). Their digitization, therefore, has the potential to substantially impact Taiwan’s economy.



A woman with dark hair tied back, wearing clear safety glasses and a light blue lab coat, is focused on working on a laptop. She is in a laboratory or cleanroom environment, with another person visible in the background. The scene is brightly lit with overhead fluorescent lights. A large blue diagonal shape is overlaid on the left side of the image, containing white text.

Chapter 2: High-tech's \$5 billion opportunity



High tech is the largest sector of Taiwan's economy: 18 percent of GDP, and about 55 percent of the revenue of Taiwan's top 200 public companies, are generated by Taiwan's tech companies.

Yet the sector faces a series of challenges that threaten to erode its position: sluggish growth in the consumer electronics market, razor-thin profit margins from highly commoditized product portfolios, and intense competition from Chinese competitors that are shifting from making hardware to offering more profitable solutions and services.

As is the case with other sectors, Taiwan's high-tech companies need to fully embrace digitization. But while the sector is the largest contributor to the economy, it is only the third most digitally advanced, according to our research. By comparison, high tech is the most digitized industry in the United States and many European countries³.

While challenges remain, they are not insurmountable. The effort to go digital will be worth the effort for Taiwan's tech companies. In addition to substantially improving efficiency and productivity, a digital transformation will allow Taiwan's tech manufacturers to shift their focus from competing at the low end of the global electronics value chain to the high end, where higher growth and fatter profit margins reside. The upside potential of such a transformation is considerable: between US\$3 billion to US\$5 billion in additional annual profits.

Taiwan's high-tech sector is missing the growth wave and losing its competitive advantage

The high-tech industry in Taiwan comprises consumer electronics companies that specialize in original design manufacturing (ODM), electronics manufacturing services (EMS), electronic components, semiconductors, and original equipment manufacturing (OEM). Once among the fastest-growing and most profitable companies, Taiwan's top tech companies today face shrinking margins and stagnating growth.

Shrinking demand for consumer electronics

Demand for mobile devices and PCs has been slowing. Between 2010 and 2015, growth of Taiwanese smartphone revenues has declined significantly, from 37 percent to -6 percent over the past five years, while PC revenue growth has consistently hovered in negative territory for the past six years (see Exhibit 10).

³ *Digital America: A Tale of the Haves and Have-Mores*, McKinsey Global Institute, December 2015; *Digital Europe: Realizing the Continent's Potential*, McKinsey Global Institute, June 2016.

Even as revenues continue their downward slide, costs continue to rise. And while many Taiwanese electronics manufacturers have moved their plants to China over the past two decades to reduce labor costs, wages are on the rise in China. Over the past decade, labor costs have risen 11 percent per year, and are projected to grow 9 percent per year over the next five years.

As a result of these trends, profits of Taiwanese ODMs and EMSs are declining (see Exhibit 11). During the PC and smartphone boom of the early 2000s, EMSs and ODMs enjoyed operating profit margins of 5 to 7 percent per year. However, as the market for consumer electronics matured, profit margins have shrunk to just 3 percent today.

Taiwan's OEMs face an equally challenging situation. Their profitability hit a record low following HTC's dramatic loss of market share in 2012. OEMs now face annual growth of less than 5 percent.

As long as Taiwanese EMSs, ODMs, and OEMs continue to operate in the lower part of the value chain, profits are likely to remain thin.

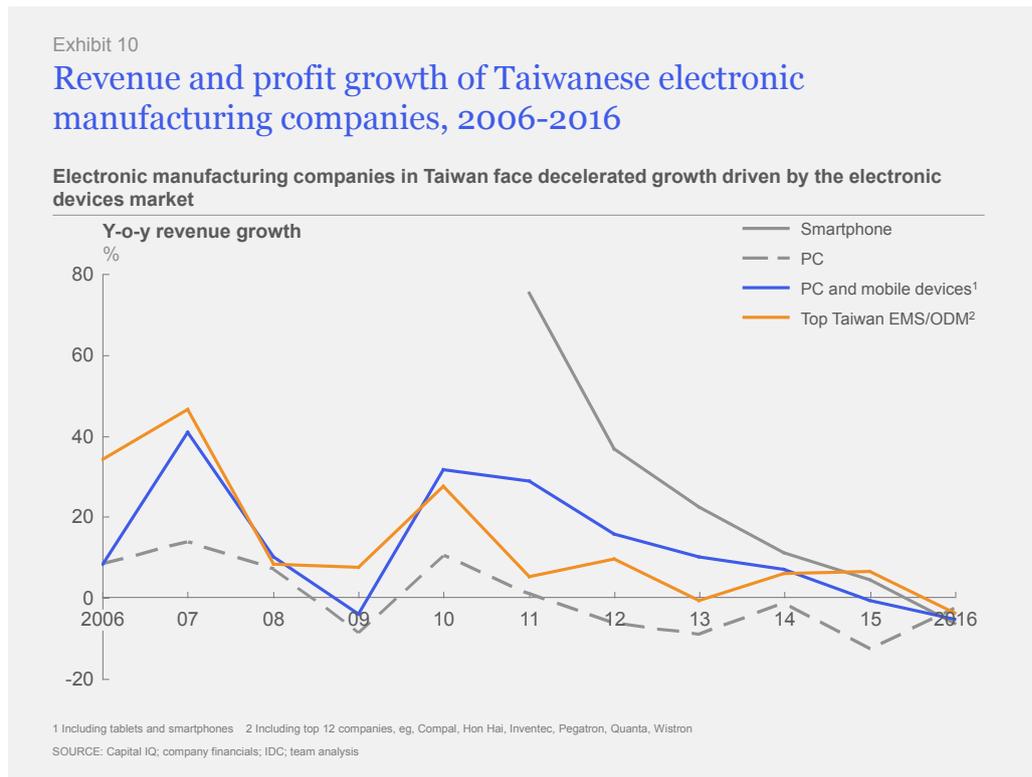
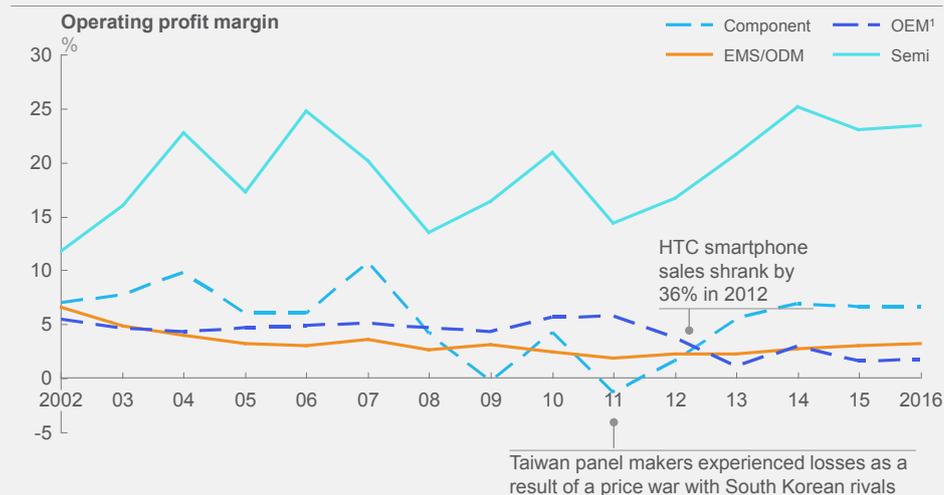


Exhibit 11

Revenue and profit growth of Taiwanese electronic manufacturing companies, 2006-2016

Taiwan EMS/ODM profitability is facing a downward trend, while OEM profitability also hit a record low after 2012



Component suppliers in Taiwan have also faced their share of challenges. Although revenue has increased over the past decade, profits have declined – and this decline has proved much steeper than in other countries.

The only high-tech subsector in Taiwan that is not facing severe challenges is semiconductors. Over the past decade, semiconductor makers have maintained healthy profit margins. The leading example is Taiwan Semiconductor Manufacturing Company (TSMC), the world’s largest independent semiconductor foundry and the largest high tech manufacturer in Taiwan. Known for its investments in R&D, cutting-edge technology, and high manufacturing yield rate, TSMC maintains an impressive 40 percent operating profit margin.

Shrinking share of the global profit pool

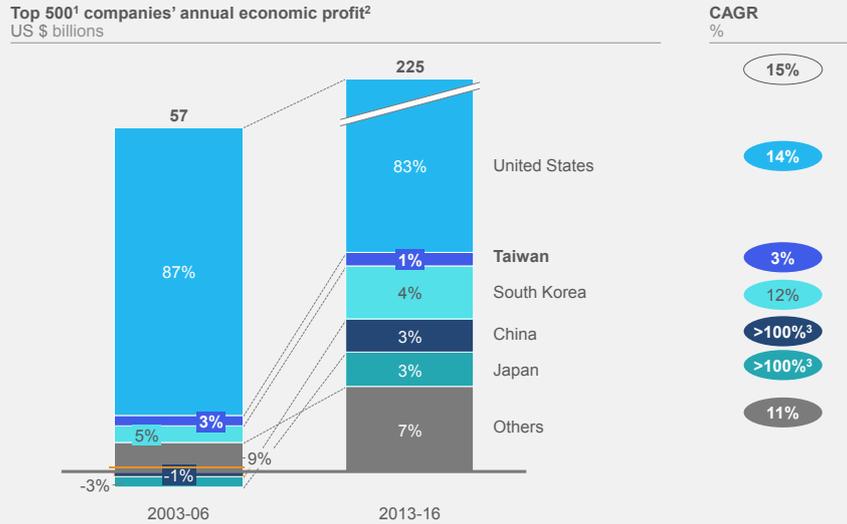
Over the past decade, profits of global high tech firms have grown an average of 15 percent per year, largely driven by the growth in profits of high-tech companies in the US. Indeed, US companies today comprise more than 80 percent of the global high-tech profit pool (see Exhibit 12).

By contrast, profits of Taiwan’s high tech firms have grown by an inconsequential 3 percent per year, driving Taiwan’s share of the global high-tech profit pool down from 3 percent to just 1 percent over the past decade.

In the meantime, mainland Chinese high-tech companies have lifted their share of global profits to 3 percent.

Exhibit 12

The global high-tech economic profit pool, 2003-2006 and 2013-2016



1 Top 500 in terms of revenue in 2016 and 2006 in each country where company's HQ is based; select countries with >50 existing tech companies in 2016; total of 3,658 companies and 17 countries included.
 2 In terms of operating economic profit, using WACC from 8.4-22.6% depending on country 3 Adjusted CAGR with negative beginning value
 SOURCE: Company financials; McKinsey Strategy Practice and Corporate Performance Analytics

Chinese competitors rising

The emergence of Chinese companies as a key component of the global high-tech profit pool reflects the success they have been enjoying in the high-tech manufacturing space. There are two main drivers of their success: lean operations with competitive cost structures, and the ability to compete in the upper end of the high tech value chain.

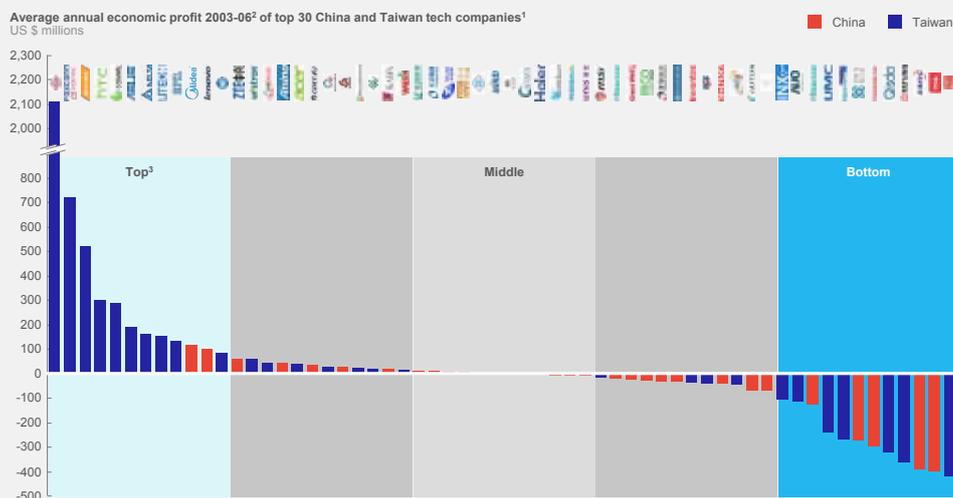
China's biggest electronics manufacturers like Lenovo, Huawei, ZTE, and Cool are experiencing rapid growth at the low end of the market. Haier, the world's largest white goods manufacturer, has also built a large set of offerings in smartphones and other consumer electronics.

Their success has proved a boon to mainland mobile phone ODM companies such as Wingtech, Longcheer, SimTech, and Hua Qin. In 2016, Chinese ODMs shipped more than 500 million units, nearly 25 percent of the global outsourced smartphone market. Their R&D, manufacturing, and supply chain capabilities are lean and efficient, allowing them to dominate the low-end of the mobile phone market.

There are also a number of young electronics companies investing heavily in innovation to build robust brands. Eyeing the "smart factory" market, Midea has acquired German-based advanced robotics company Kuka. Midea's goal is to build a complete offering for upgrading traditional plants into smart factories.

Exhibit 13

A decade ago, Taiwanese companies dominated the top quintile



¹ Top 30 in terms of revenue in 2016 and 2006, based on companies existing in 2016; 81 companies in total in either of the 2 periods, with 72 companies having EP in both periods, 39 companies remaining in top 30 revenue in both periods, 21 companies emerging after the 2003-06 period, and 21 companies falling out of top 30 revenue in the 2013-16 period
² WACC data from McKinsey proprietary CPAT solution
³ Top: top 20% percentile of economic profit ranking; middle: 20–80% percentile of EP ranking; bottom: below 80% percentile of EP ranking

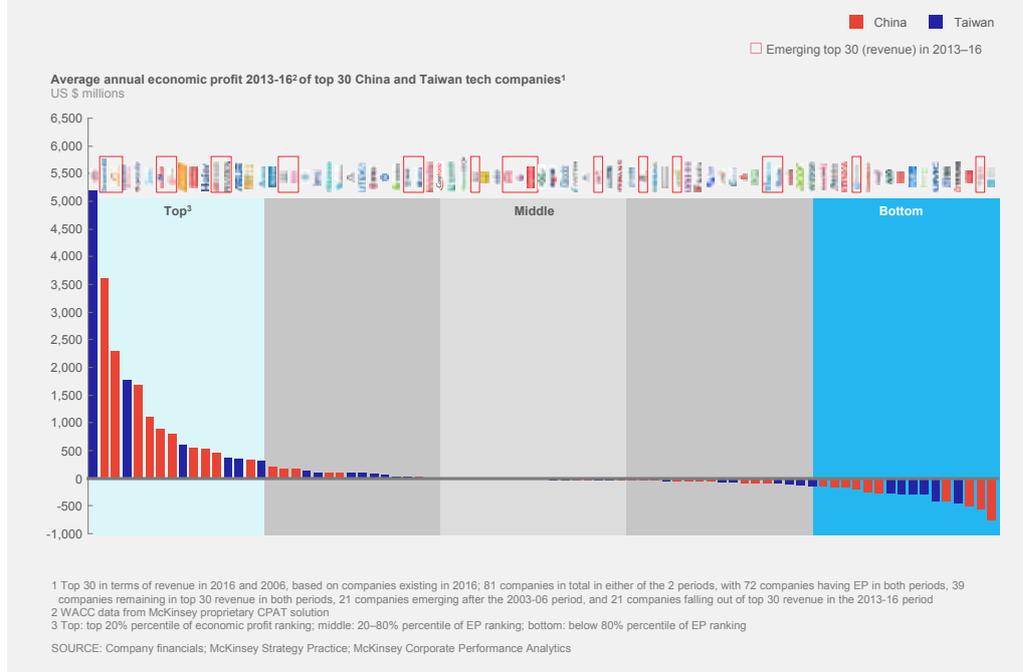
SOURCE: Company financials; McKinsey Strategy Practice; McKinsey Corporate Performance Analytics

The result? Today, Chinese companies are outperforming Taiwanese tech companies in revenue, profits, and growth. Ten years ago, Taiwanese companies comprised nearly 85 percent of the top quintile of companies as measured by economic profit (see Exhibit 13). Today, Chinese players are in the lead with 65 percent of companies in the top quintile (see Exhibit 14).

To probe deeper into the reasons for this shift, we identified 21 top-performing companies that were not in the first quintile ten years ago. Fifteen are Chinese, of which three are internet-focused (see Exhibit 14). By contrast, of the six Taiwanese companies new to the top quintile, none are internet companies. Taiwanese companies tend to focus on competing in the original device manufacturing space, despite the fact that this sector offers few high-growth opportunities.

Chinese high-tech companies are growing their share of the global profit pool by entering the upper end of the value chain and outperforming their Taiwanese counterparts at the lower end.

Exhibit 14 Today, Chinese companies dominate



How Taiwan's high tech sector can regain its competitiveness

As margins continue to erode and Chinese players continue to rise, how can Taiwan's companies regain their competitiveness? The answer is clear: Above all else, they need to digitize.

There are two ways Taiwan's companies can tap into the digital opportunity: by boosting efficiency and productivity by transforming their core business, or by developing entirely new and more profitable business models beyond their core business.

Digitizing core business processes

Taiwan's high tech manufacturers can generate higher growth, revenues, and profits by pursuing improvements across five key levers of performance in its core business processes. For each lever, there are a number of potential opportunities for improvement. The following is a list of potential improvement opportunities and examples of how companies have leveraged them to improve their performance.

1. Increase asset productivity and efficiency

Taiwan's high-tech companies, from semiconductors to ODMs and EMSs, are comprised mainly of asset-intensive hardware manufacturers. Increasing asset utilization and efficiency while reducing maintenance costs can help high-tech companies boost profits.

- High tech manufacturers can implement a digital maintenance system to actively maintain production equipment. The system can identify malfunctioning machines before they produce more deficient pieces and slow down the production line. In addition, management can proactively install back up machines and dispatch a repair team to limit damage and prolong machine life.

A global PC contract manufacturer used an integrated digital system that connects equipment sensors to an information hub to generate real-time root-cause analysis of machine operation problems. The digital maintenance system helped the company eliminate unscheduled and unexpected machine downtime and maximized the asset utilization rate.

- Automating the most complex steps in the production process, or those with the highest failure rate, can boost asset productivity. A leading Taiwanese maker of LCD panels used automated production lines to reduce ramp-up time from four months to just one month. They also improved their overall production yield rate by an additional 3-5 percentage points.
- Besides applying digital technologies to improve equipment utilization and efficiency, they can also help reduce equipment maintenance costs. Leveraging the massive quantities of performance data generated by equipment, manufacturers can deploy advanced analytics to predict potential failures and achieve optimal maintenance efficiency. For example, a global semiconductor foundry company developed machine-learning algorithms to process huge amounts of data collected from a set of the machines in its manufacturing facility. The algorithms helped identify machines with the highest likelihood of breaking down with an 87 percent accuracy rate. As a result, the machine-learning algorithms realized an 8 percent reduction in maintenance expense, which translated into nearly US\$2 million in savings⁴.

2. Increase labor productivity

For Taiwan's high-tech manufacturers, another main cost driver is labor costs, particularly for ODMs, OEMs, and EMSs, which are often very labor intensive. Over the past few decades, these companies have set up factories in China and Southeast Asia to tap into these countries' vast supply of low cost labor. However, rising labor costs is rapidly erasing this advantage. Going forward, to stay competitive, manufacturers will need to leverage automation technologies that are capable of replacing increasingly expensive human labor. The following are examples of high-tech companies that have applied digitization and smart automation to save labor costs.

- A leading ODM boosted direct labor productivity by 80 percent by utilizing "smart automation" along its assembly line.
- When applying robots to a production line, manufacturers have to ensure they strike the right balance between robots and human labor to optimize output. Optical component manufacturer Lite-On used inexpensive robots to reduce labor costs at its Dongguan site. To-date, the company has reduced labor by almost 80 percent for a single production line and has seen productivity triple. Those installed robots are expected to pay for themselves in about 1.5 years, according to experts. Another tool is to apply warehouse automation. Another ODM deployed sensors in its warehouse to automate its inventory management system. This initiative reduced labor costs by 75 percent.

⁴ "Predictive maintenance: Semi-conductor case study," McKinsey, 2016.

- In addition to applying automation to manufacturing operations to reduce labor costs, manufacturers can also apply automation technologies to back office activities. Back-office automation can lead to a 30 percent increase in efficiency with up to 65 percent of tasks capable of being automated. And in technical professions, the automation of knowledge work can lead to a 45–55 percent increase in productivity. Automated data analytics allows HR teams to more quickly and easily identify top performers and design the most effective talent-retention strategies and reduce hiring costs in the process.

3. Improve service level and effectiveness

Beyond the manufacturing process, high tech companies can reap substantial gains in value by applying digitization technologies to R&D, product development, and supply chain management. High-tech companies have to know what kind of product to be developed in what amount and how to deliver products to customers effectively. Digitization can help with demand planning, quality management, and product development feature planning.

- Digital systems to make demand planning more efficient. Taiwan’s high-tech companies tend to focus on the consumer electronics market, which is subject to volatile demand that is driven by rapidly changing consumer tastes. As a result, OEMs and EMS companies have to quickly adapt their manufacturing capacity to meet market expectations while not keeping lots of inventory. Companies that can quickly adapt to market demand and execute adjusting plan can win. They need a robust system to collect consumer and supplier feedback and make demand planning and supply chain agile. For example, through the use of digitized data analysis, a leading maker of display-panels was able to get a clearer picture of fast-changing consumer demand and adjust supplies, production lines, and inventory accordingly.

Supply chain planning example: A leading display panel maker invested in digitizing its supply chain system. It created an agile supply chain that can quickly adapt to the fast-changing pace of consumer demand. The system allows end-to-end transparency through digitized systems, quicker turnaround for the company’s manufacturing lines, and closer collaboration with its partners.

- Advanced analytics to reduce time-to-market. A Taiwanese ODM used digital R&D to improve the quality of its products. Instead of redesigning the entire product from scratch, the company identified and redesigned only the features that needed to be improved. By tracking and monitoring the implementation progress with an advanced analytics engine, the company reduced cycle time by 40 percent, which translated into a savings of \$15 million for just one business group.

4. Reduce materials cost

Taiwan’s ODMs, OEMs and EMS generate very low profit margins of 2-3 percent on average. Material and sourcing costs are a big chunk of total costs at Taiwan’s high tech firms. Better management of procurement can help them reduce material costs and boost profitability.

- Digitized procurement and supplier performance management tools to reduce sourcing costs. Upgrading every step along the procurement value chain can greatly enhance efficiency, reducing product costs by anywhere from 3 to 10 percent.

5. Boost revenues

By applying digital technologies, companies can increase the impact of their digital marketing and sales activities. Some analytics use cases that apply digital include sales analytics (insight-based selling and tendering), revenue growth management (pricing and promotion optimization), and marketing analytics (digital marketing & CLM and customer insight-based product innovation).

- Deploy big data to increase sales. Companies that are able to identify where customers are in their decision journey will be the most successful in understanding which products and solutions may be most relevant. Using data-driven customer prioritization and selling, a global high-tech company was able to boost sales by 20 percent.
- Digital sales and revenue growth management to improve sales. Digital pricing, insights-based selling, lead generation and management, and tendering have the potential to improve total annual sales growth by 2 to 4 percent.

Box 2

Smart factory manufacturing transformation for a Taiwan PC ODM

One of the largest original design manufacturers in the world, a Taiwan-based manufacturer of information and communication technology (ICT) products such as PCs, servers, and LCD TVs had already undergone a lean transformation program that significantly improved their manufacturing operations. Management, however, wanted to use Industry 4.0 to further improve productivity, with the eventual aim of building the “factory of the future.”

The Industry 4.0 transformation included three phases:

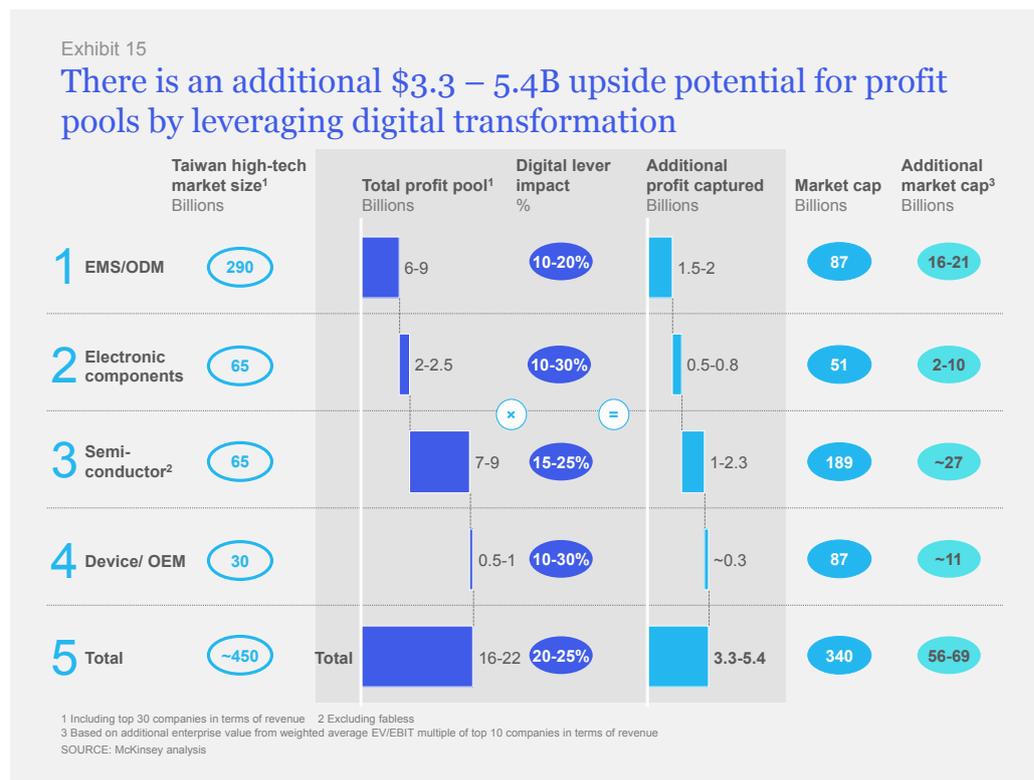
- **Diagnostics** – Conducted assessment via factory walk-throughs and workshops; defined 100+ use cases across five transformation themes (labor, asset, quality, warehousing, and enablers).
- **Design and planning** – developed a robust business model to identify priority initiatives; developed a three-year road map to implement Industry 4.0 across the network.
- **Implementation** – implemented five priority initiatives for the pilot plant; developed a “digital center of excellence;” trained change agents in key digital capabilities for rollout.

As a result of this initiative, the company identified more than 15 digital cost-reduction levers that are projected to improve EBIT (earnings before interest and taxes) by 35 percent, with the payback expected in approximately 3.3 years.

The digital opportunity for core businesses

By applying these levers, Taiwan's high tech firms could capture an additional US\$5 billion in additional annual profit:

- **Semiconductors:** Through improvements to yield, predictive maintenance, and digital procurement, Taiwan's semiconductor firms could generate an additional 11 to 17 percent, or approximately US\$2 billion, in annual profits.
- **Components:** Through advanced robotics-based manufacturing and digitizing the supply chain, Taiwan's components firms could generate an additional 5.5 to 15 percent, or US\$100 million to US\$500 million, in annual profits.
- **Devices/systems:** Taiwan's ODMs can generate an additional 14 to 24 percent, or US\$1.5 billion to \$2 billion, in annual profits. By implementing digital procurement, supply chain management, and advanced robotics, Taiwan's OEMs can generate an additional 11 to 32 percent, or \$300 million, in annual profits.



Building new businesses around digital

Once Taiwan's companies have used digital technologies to attain the next level of operating efficiency, they need to extend the boundaries by developing new high-value digital business models.

There are four kinds of business models that Taiwan's high tech companies can deploy:

- **Expand to new markets.** By matching supply and demand in new ways – for instance, through aggregation – companies can create entirely new markets. For example, Rockwell Automation is creating new markets in the industrial automation industry by

becoming a “connected enterprise.” It is developing a digital manufacturing ecosystem to standardize its manufacturing execution systems (MES) and associated operational management processes.

- **Create new value propositions.** The growing customer demand for solutions is pushing companies to provide, along with products, new information-sharing services that help customers make better decisions. For example, John Deere, the world’s largest manufacturer of tractors and combine harvesters, has moved from manufacturing tractors to offering sophisticated online services for farmers. These services include agriculture management solutions like Farmsight, a remote monitoring and control solution for precision farming, and MyJohnDeereOperations Center, an online platform where customers can log in and find tools to improve machine uptime and logistics management.
- **Re-imagine business systems digitally.** Digitizable products and services have the potential to unlock higher margins and streamline inefficient value chains. Recently, the world largest EMS provider, Taiwan’s Hon Hai, purchased a stake in SK Holdings, one of the largest conglomerates in South Korea. Together they will create digital businesses that provide supply-chain management solutions and business process outsourcing services for more than 200 B2B customers. JUSDA will also help convert customers’ existing processes into AI and robotic-technology processes based on data analytics. Already, it has created a new ICT technology-based logistics platform that utilizes the Internet of Things, AI, and big data. Their comprehensive logistics solution brand, Kerol, can track and monitor logistics flow in real-time in any region, while also suggesting the fastest route.
- **Hyper-scale platforms.** Combining new products with novel operating models can revolutionize entire industries – whole new value chains can be created and managed through digitization, and then become ecosystems. GE, for example, has transformed itself into a services and solutions provider by creating Predix, a cloud-based IoT platform that enables companies to drive digital transformation across multiple businesses. Drawing on asset modelling, big data processing, analytics, and applications, Predix allows companies to innovate, optimize asset performance, and make sound investments. Similarly, Taiwan’s ODMs can use their manufacturing advantage to become Industry 4.0 services and solutions providers to realize tremendous bottom-line growth.

Box 3

How to successfully transform a company into a “connected enterprise”

Global industrial automation companies typically sell a large number of products at low volumes, and customer demand is extremely hard to forecast. For example, in 2012, Rockwell Automation had almost 400,000 SKUs, but their IT systems and operations technology systems were not well connected. As a result, the company experienced subpar delivery performance, productivity, quality control, and inventory management. In addition, its global footprint did not adequately match demand, and the company was undertaking a consolidation of its nine existing enterprise resource planning (ERP) systems into one.

The company decided to standardize its manufacturing execution systems (MES) and associated operational management processes. Here is an overview of the key steps they followed as they undertook a digital transformation:

Identifying use cases to boost operational performance and design the target digital manufacturing ecosystem

Rockwell began by creating a high-level business case and road map with three streams – technology, process, and people – to drive impact that would be sustainable. Notably, the operations executives chosen to lead the effort had close ties to the IT organization, while the core team comprised experts from both.

Capturing value from digital manufacturing use cases

A plant in Mexico was chosen as the pilot site both to test the approach and create a showcase for other plant leaders to visit. Digitizing the factory led to substantial improvements in production capacity, productivity, product quality, and customer service. Central to this was a focus on change management to build an understanding across the campus of the new technology and processes.

Creating impact by transforming the entire organization and building institutional capabilities

A team of leading subject matter experts remotely led the rollout. They developed a standardized implementation playbook, facilitated the internal sharing and integration of lessons learned, led audit implementation, and managed and monitored the execution.

Scaling up the impact beyond the pilot plant required a staged rollout. Rockwell Automation thinks of its operations as approximately 450 manufacturing cells. In some cases the shift to digital encompassed the entire site; in others the focus was on specific processes where the need to upgrade was the greatest and the potential ROI the highest. To make the transformation more efficient, control of working capital was moved from individual plants to a central group.

To date, over 400 manufacturing cells have been transformed and more are slated for transformation where a clear business case exists.

Box 4

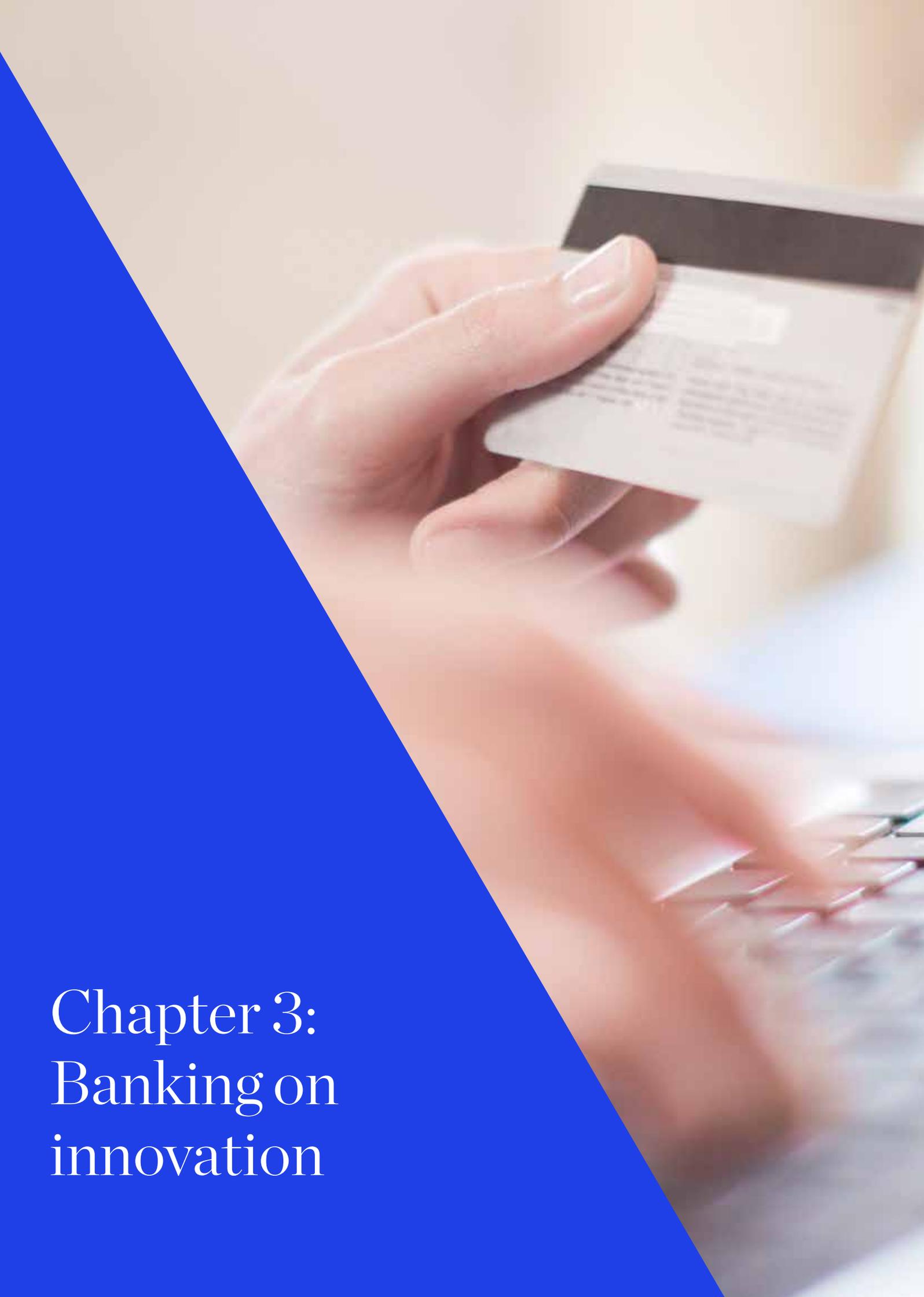
Industrial giant transforms into a software and analytics company

Realizing the urgent need “to disrupt or be disrupted,” GE identified that its previously disconnected technology efforts were not working as efficiently as possible.

GE has been investing heavily in digital technologies and businesses since 2011, with digital transformation a key priority in its corporate strategy. With attractive payback and revenue growth expected, the company invested up to US \$1.4 billion in digital in 2016. It has built IoT capabilities through in-house development, partnerships, and M&A. It has also aggregated software assets and introduced Predix, which has already generated more than US\$5 billion in revenue.

- **End-to-end solution for industrial applications with Predix.** A separate digital company was created with US\$1 billion-plus investments to put sensors on everything from jet engines to oil rigs. The sensors are then connected to cloud-based Predix, a first-of-its-kind platform for companies to digitally connect to industrial assets to improve performance. This drives a 20 percent increase in machine yield, 10 percent machine efficiency, 15 percent savings on parts, and 10 percent savings in tech support time for its leading client, Pitney Bowes.
- **“Digital Incubator” through partnerships and crowdsourcing.** GE has built a large partner program to increase the functionality that is included in its connected devices and ensure that it has access to cutting-edge applications. It has also engaged with crowdsourcing community Kaggle to organize and run multiple competitions in creating the best predictive model.

By creating an ecosystem for customers and third-party developers, GE aims to reach 20,000 third-party developers, 50-plus partners, and 10,000 customers. In addition, by unlocking new sources of revenue in operations and maintenance through advanced analytics, it is expecting to capture maximum value from the US\$200 billion-plus digital market opportunity.

A close-up photograph of a person's hand holding a credit card. The hand is positioned over a laptop keyboard, which is blurred in the background. The credit card is held between the thumb and index finger, with the rest of the hand supporting it from below. The card has a black magnetic strip at the top and some text on the front, though it is out of focus. The background is a soft, out-of-focus indoor setting. A large blue diagonal shape covers the bottom-left portion of the image, containing the chapter title.

Chapter 3: Banking on innovation

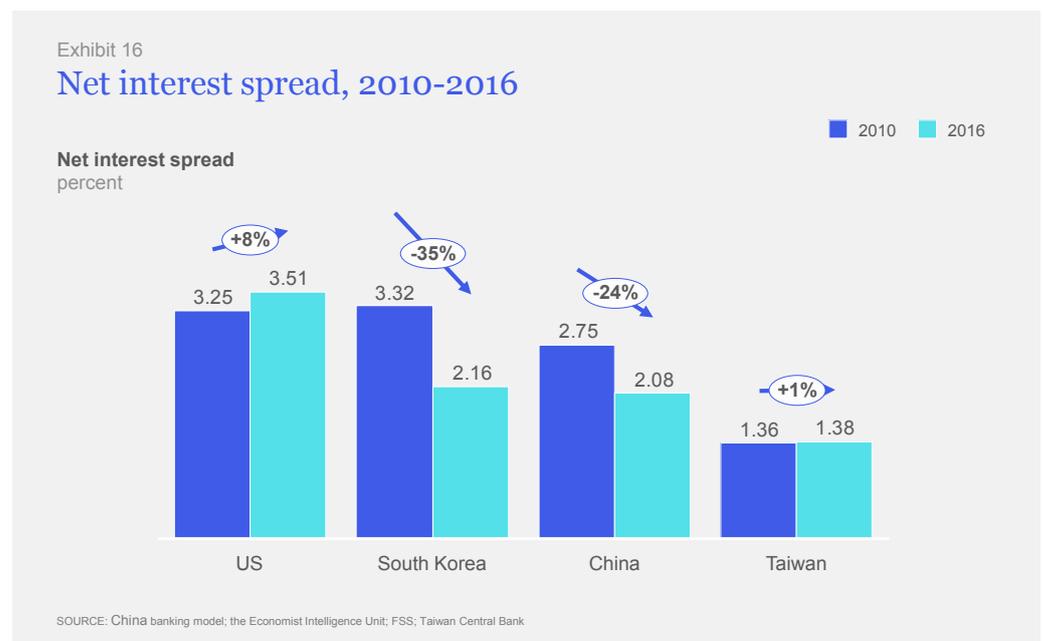
Financial services is one of Taiwan's most important sectors, contributing 6.8 percent of GDP and employing 4.8 percent of the workforce in 2016. Among Taiwan's top 200 companies, financial services firms represent 13.2 percent of revenues.

Despite its commanding position in the economy, Taiwan's financial services sector faces a series of challenges, such as lackluster revenue growth, thin profit margins, and an insufficient supply of qualified talent. In this chapter, we highlight some of these challenges and identify ways digitization can help overcome them.

Challenges faced by Taiwan's banks

Traditional banks have hardly been immune to the economic uncertainty that has gripped the world over the past decade. Bank profits in many countries have come under pressure as a result of declining net interest spreads.

In 2016, Taiwan's central bank cut the discount rate to 1.38 percent, the lowest it's been since mid-2010⁵. Consequently, Taiwan's interest rate spread, the difference between borrowing and lending rates, now ranks as the second lowest in Asia, severely limiting the profitability of Taiwan's banks (see Exhibit 16)⁶.



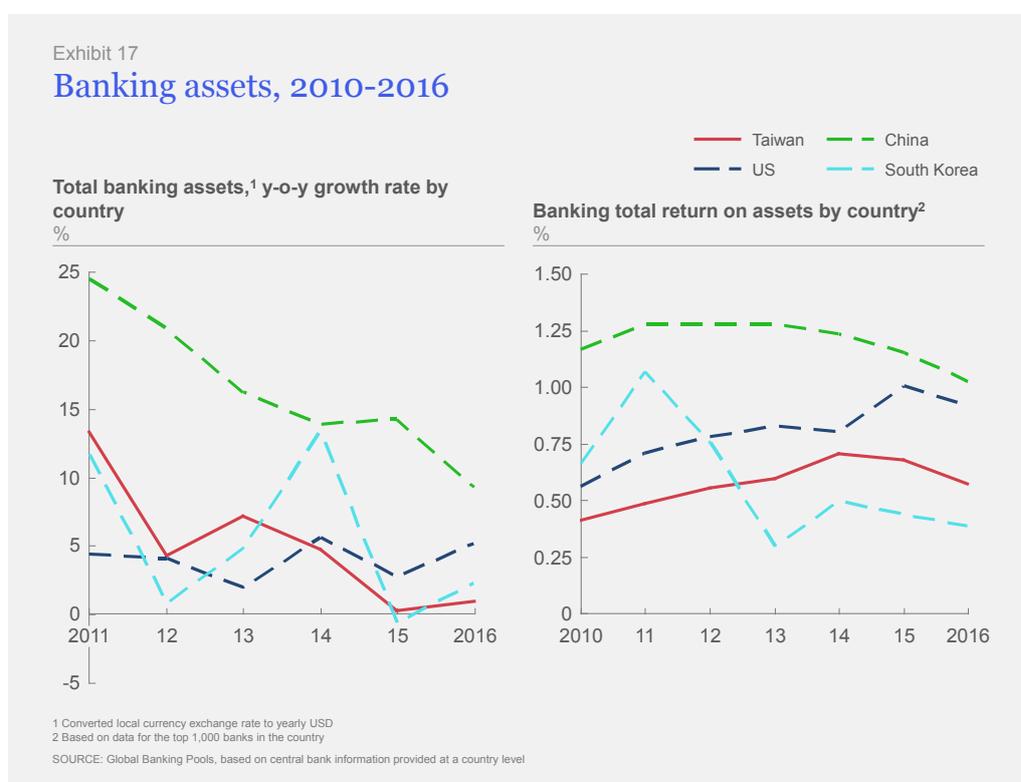
⁵ Central Bank of the Republic of China (Taiwan), press releases.

⁶ International Monetary Fund.

Low asset utilization and low growth potential

Over the past six years, growth in banking assets in the United States, China, Taiwan, and South Korea has slowed. Taiwan has slowed the most, with a decline in total asset growth rate from 13.3 in 2011 to 0.9 percent in 2016. Moreover, its return on assets stalled at 0.4 - 0.6 percent between 2011 and 2016, and is only slightly higher than South Korea's (see Exhibit 17).

The extremely low ROA of Taiwan's banks reflects the sector's limited growth potential. Taiwan's aging population and low birth rate translate into fewer young people available to fuel demand for banking products.



Bank branches and high fixed costs

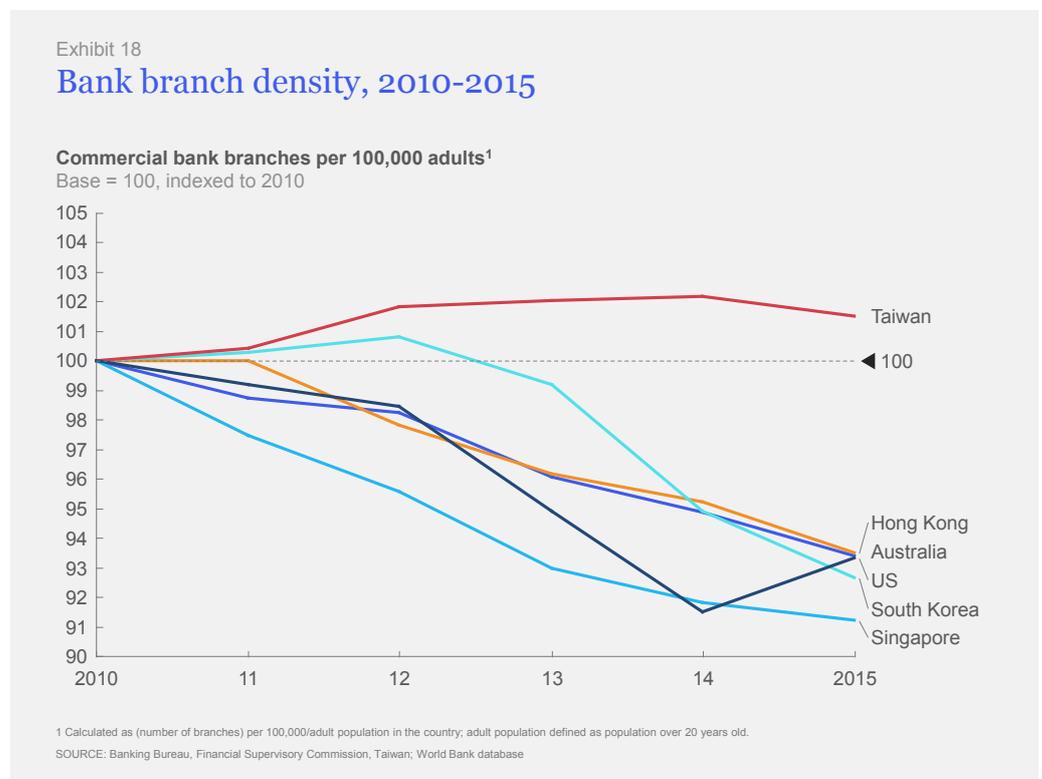
Traditionally, banks expanded their branch networks to increase customer awareness and boost market share. With the evolution of online and mobile banking services, however, this model has been shifting. Banks are now focusing on providing easy access via the internet and on ensuring good customer service. And they're using their physical branches to introduce more digital banking services.

Supporting evidence can be found in our analysis of the number of commercial bank branches in Taiwan, Hong Kong, Australia, the United States, South Korea, and Singapore between 2010 and 2015 (see Exhibit 18). Notably, every market except Taiwan gradually reduced the number of branches in its network during this period. By contrast, the number of branches in Taiwan grew slightly⁷.

⁷ Press released, Banking Bureau, Financial Supervisory Commission, Republic of China (Taiwan), <https://www.fsc.gov.tw/>

Moreover, Taiwan’s branches employed proportionately many more back-office staff than sales staff compared to branches in these countries. Back-office staff comprise approximately 40 percent of branch employees in Taiwan, but only 30 percent in the US, where branch operations are more automated and therefore more efficient.

As a result, Taiwan’s bank branches operate with higher fixed costs than branches in the other countries we examined. As online and mobile banking assume greater importance, Taiwan’s banks should consider reducing the number of branches in their networks and providing more digital banking services in the branches that remain. At the same time, they should also consider reducing the number of back-office employees while increasing the number of salespeople to provide better customer service.



Talent shortage

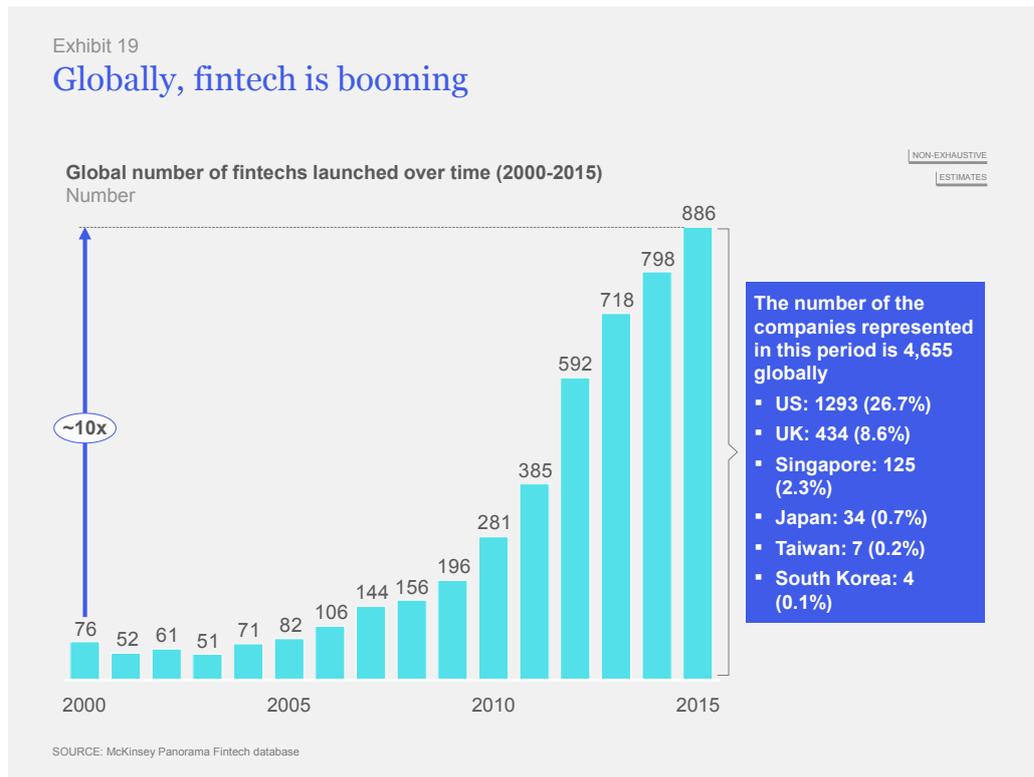
Taiwan’s banks also face a shortage of talent. There has been a significant increase in demand for information technology staff – especially for mobile application developers, data analysts, and business intelligence specialists. But the banking industry’s uncompetitive wage structure and conservative culture are strong disincentives for top talent. To compete for qualified IT and software talent in markets like the US, which are a magnet for such talent, salary levels need to be competitive with what US tech companies offer. Salaries for software engineers in the US are two to three times higher than average banking salaries in Taiwan.

Beyond offering competitive compensation, however, Taiwan’s banks also need to cultivate the type of entrepreneurial mindset and culture that are so crucial to driving innovation.

banking.gov.tw/en/index.jsp.

The fintech sector

Globally, the number of fintech firms is booming, with 886 in 2015, up from 281 in 2010. Asian fintech startups have a significant global presence, with more than 750 companies representing 20 percent of fintechs globally. Notably, only 1 percent of these 750 firms are based in Taiwan.



Fintech startups fall into four main subsectors: account management, loans and financing, payments, and savings and investment (see Exhibit 20). Their innovations, which range from retail value chain integration to robo-advisory wealth-management, have a common goal: to reduce operating and transaction costs for consumers and merchants.

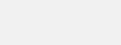
Most Asian fintech firms specialize in payments, savings, and investment. Taiwan is lagging in all four subsectors.

Loans and Financing

A number of fintech companies have developed lending platforms that cater to different corporate markets (see Exhibit 21). Fundbox, a US-based firm founded in 2014, uses a “credit-as-a-service” business model to help small and medium-sized businesses manage and optimize their cash flow. The company deploys advanced data analytics to make rapid assessments of customers and identify unpaid invoices.

Exhibit 20

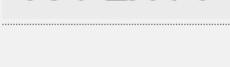
Four subsectors where fintechs are prominent

	Emerging disruptions	Value proposition	Global players	TW players
Account management	Next-generation money management	Providing aggregated overview of customers' financial health , helping them improve their financial situation by setting up saving goals and spending limits in a gamified way	 	
	Retail value-chain integration	Enhancing the traditional banking experience with personalized time- and location-based product and service offers through partnerships with merchants	 	
Loans and financing	Social data-enabled lending	Leveraging of data on social media platform to provide help with credit decision to customers	 	 
	P2P lending and investment	Matching lenders directly with borrowers and allowing investors to earn higher returns as well as borrowers to get access to financing at lower rates than banks would offer	 	
Payments	Digital for unbanked	Short-term loan and payment solution to those who have no access to mainstream financial services	 	 
	3rd-party payment	Providing a lower cost, easy, convenient payment method and bringing in social element to allow connection between users	 	
Savings & investment	Robo-advisory	Providing a low entry barrier and low-cost solution of asset allocation/investment portfolio , which can be adjusted automatically, supported by robotic algorithm and static model	 	 

SOURCE: McKinsey Panorama; McKinsey analysis

Exhibit 21

Online lending platforms

Platform lending model			
			
			
Hybrid model			
Direct lending model			
			
			
	Consumer finance ~US\$3.5 trillion ¹	Small business loan ~US\$2 trillion ¹	Student loan ~US\$1.3 trillion ¹

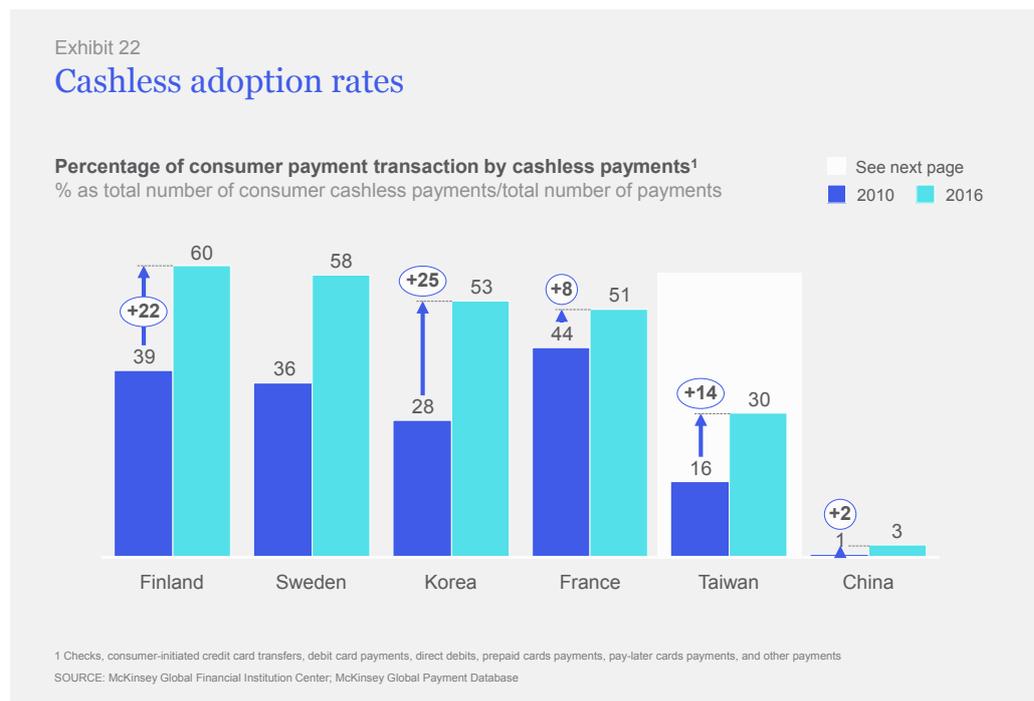
¹ Using US market size as example
SOURCE: US Treasury Department

While Taiwan firms are underrepresented in digital lending and financing, P2P lending could be one area that domestic fintech firms could explore since private lending, which is governed by the nation’s Civil Code, does not require regulatory approval. When Lend.com.tw, Taiwan’s first P2P lending service, launched in March 2016, CEO Tony Huang announced their mission of “democratizing finance” by offering more favorable returns for lenders and better terms for borrowers⁸.

Digital Payment Services

Many advanced economies are quickly moving toward becoming cashless. More than 50 percent of consumers have adopted cashless payment solutions in countries such as Finland, France, Sweden, and South Korea, where non-cash solutions are widely available for both consumers and merchants.

Consumers in Taiwan, however, still rely mostly on cash payments. Cashless payments as a percentage of total transactions in Taiwan lag leading global markets by 20 percent (see Exhibit 22). Although cashless payments are on the rise, low adoption by merchants and consumers continues to hinder growth.



Taiwan’s startups are, however, getting into the mobile payments game. Gangu Tech introduced OnePaid, a payment services platform for the Taiwan market. In 2015, OnePaid launched a partnership with PayEase, China’s largest electronic payment and solutions platform, to facilitate payment services for Chinese buyers and Taiwanese sellers. And in 2017, Installment, Inc launched INSTO, a mobile consumer-to-consumer (C2C) payment platform that allows individuals to schedule automatically recurring payments. The company is currently working with CTBC Bank to bring INSTO to Southeast Asia, with plans to introduce the app in the United States and France as well.

⁸ Matthew Fulco, “Taiwan opts for caution in developing fintech,” AmCham Taipei Taiwan Business Topics, April 12, 2017, <https://topics.amcham.com.tw/2017/04/taiwan-opts-caution-developing-fintech/>.

A number of new companies have offered cashless payment solutions for a particular purpose – for instance, travel cards. Some of these companies are now expanding into multi-purpose solutions. For example, Easy Card, which started as a cashless payment card for Taipei public transportation in 2000, can now be used for small-value purchases in convenience and drug stores as well as in taxis.

These developments pose a real threat to traditional banks. Once consumers have become accustomed to using these new services to make purchases, it may become very difficult to attract them.

The advent of robo-advisors

Wealth management and trading services have traditionally been a major source of banking revenue. These offerings, however, are under attack as fintech startups deploy innovative technologies and business models. A good example is the robo-advisor, an automated digital investment advisory program designed to collect information on a customer's financial goals, investment horizon, income and assets, and risk tolerance. The robo-advisor uses that information to develop and manage the customer's investment portfolio⁹.

Robo-advisors offer important advantages over traditional investment managers. Banks benefit from deeper penetration of the mass market and lower fixed costs. Meanwhile, customers enjoy greater and less-expensive access to financial advisors and one-stop service from advice to investment. Assets under management by robo-advisors are projected to be approximately US\$450 billion by 2020, assuming a compound annual growth rate (CAGR) of 86 percent since 2014¹⁰.

The United States is leading the robo-advisor space. Largely because of the high level of maturity and data transparency of its finance market, it has the largest number of start-ups and greatest volume of assets under management. Founded in 2010, Betterment is one of the key players. Positioned as an online investment advisor, it specializes in automated investing for passive investors, eliminating fees for brokerage sales representatives and advisers. Betterment targets less-than-wealthy individuals, investment beginners, and passive investors. By 2015, the firm had some US\$2.9 billion in assets under management for more than 75,000 customers¹¹.

Taiwan, by contrast, is a distant follower in the digital wealth management arena. It was only in June 2017 that the Securities and Futures Bureau published robo-advisor operations guidelines. Compared with leading nations, Taiwan has delayed adopting digital wealth management. While a few banks in Taiwan have started providing robo-advisory-like services to boost wealth management efficiency, there is still not much awareness or adoption from customers.

⁹ U.S. Securities and Exchange Commission, www.investor.gov.

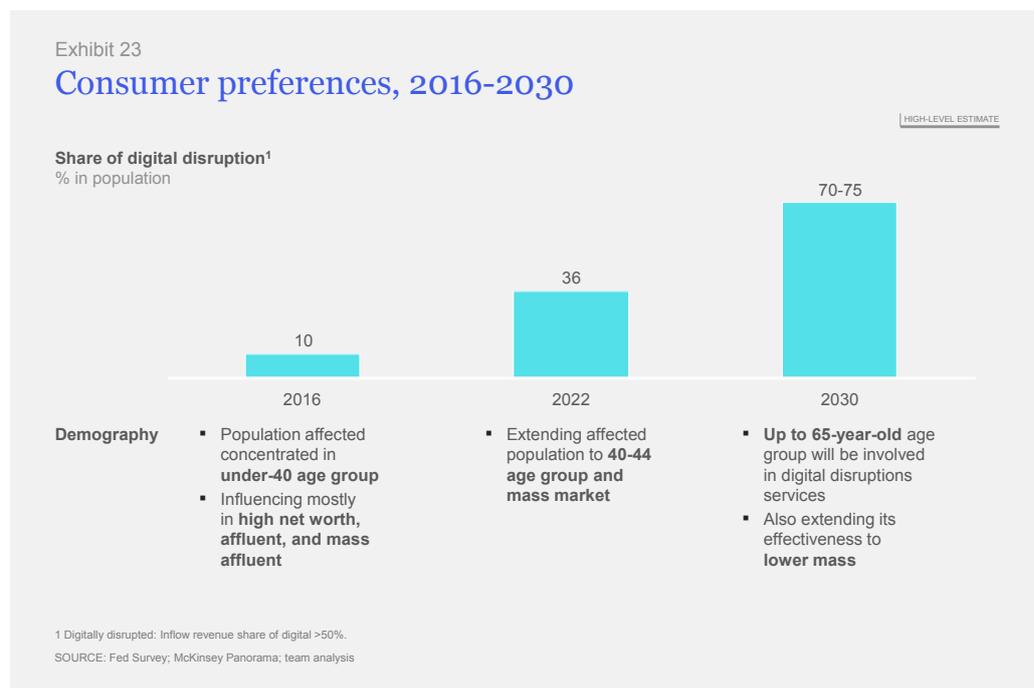
¹⁰ MyPrivateBanking Research: Who Will Win the Robo Game?, A.T. Kearney.

¹¹ Company website; SEC Investment Adviser Public Disclosure.

Growth challenges

Consumers late to the party

Where do consumers fit in this picture? To date, digital banking services are not well known to consumers around the world. According to McKinsey's research, only 10 percent of the population globally has used them. As people get older and wealthier, and as smartphones, tablets, and high-speed mobile internet become more widely used, it's estimated that some 75 percent of the population will make use of digital banking services (see Exhibit 23).



Consumer adoption of digital banking services in Taiwan is lower than in other Asia-Pacific countries (see Exhibit 24). Not coincidentally, the contribution from digital sales for most banking products in Taiwan trails countries in the Asia Pacific region as well as worldwide. Digital channels contribute only 18 percent of total core product sales, which includes current account and savings accounts (CASA), credit cards, certificates of deposit, unsecured personal loans, insurance, and mortgages. The digital channels of global digital leaders contribute twice that percentage. In three core product segments, personal bank accounts, credit cards, and personal loans, Taiwan lags global leaders considerably (see Exhibit 25), and has little to no presence in these emerging segments.

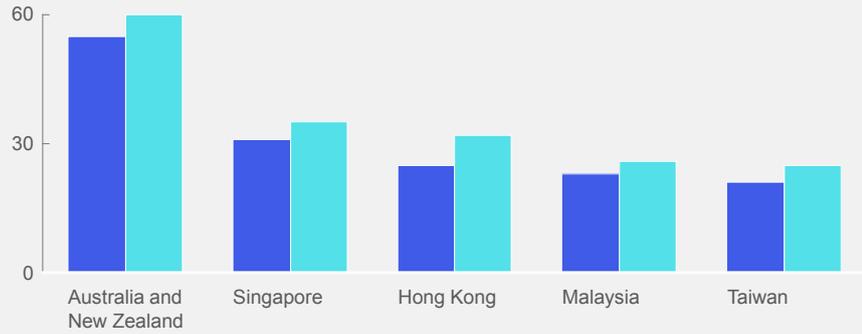
Exhibit 24

Consumer adoption of digital retail banking services

■ 2014 ■ 2016

Digital channel adoption

Active digital retail banking customers as % of total retail banking customers¹



¹ Total of retail banking customers excludes small-business customers and inactive customers
 SOURCE: Asia-Pacific Digital and Multichannel Banking Benchmark 2016; Finalta by McKinsey

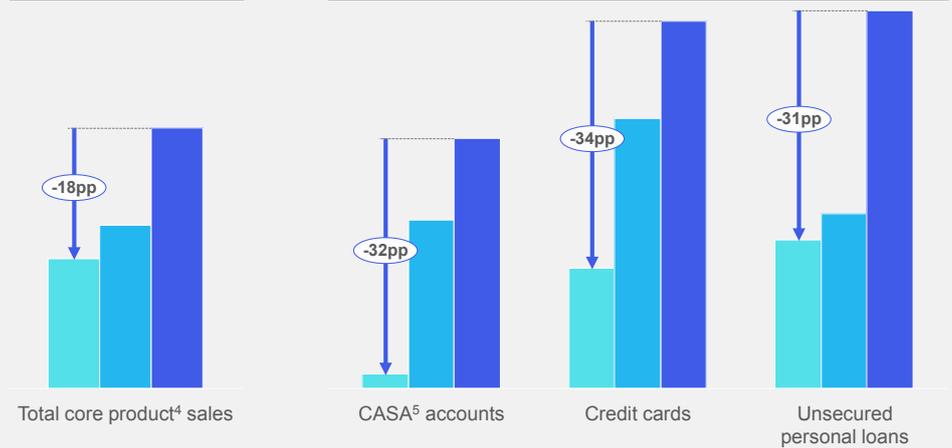
Exhibit 25

Digital banking product sales

■ TW
 ■ APAC¹ leaders
 ■ Global² leaders³

Digital sales contribution

Digital sales contribution of major products



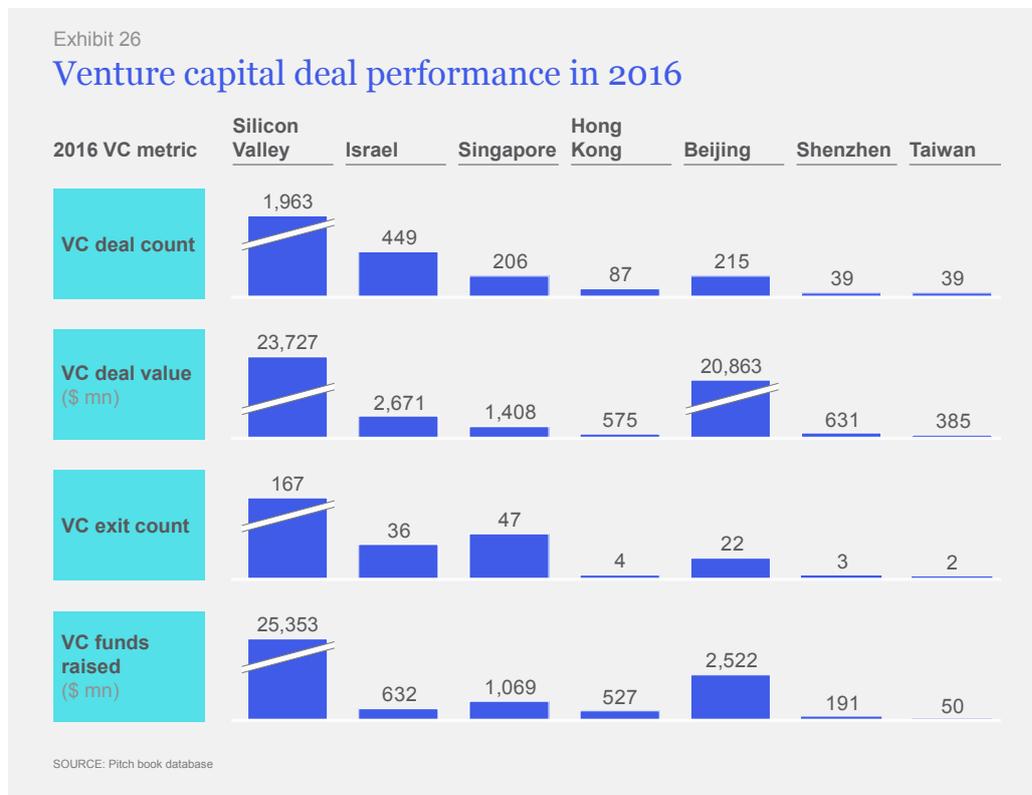
¹ APAC countries: Australia, Hong Kong, India, Japan, Malaysia, New Zealand, Singapore, Taiwan, Thailand
² Global: 50+ countries, including US, UK, Canada, etc.
³ Top quartile percentage
⁴ Including CASA, certificate of deposit, credit cards, unsecured personal loans, insurance, and mortgages
⁵ Current account and savings account
 SOURCE: Finalta by McKinsey; McKinsey analysis

Innovation challenges

Funding issues

Investment support from private equity (PE) and venture capital (VC) firms is the lifeblood of startup companies, and fintechs are no exception. According to our analysis of VC deals, the more tech savvy, capital abundant, and regulatory-friendly the location, the higher the level of VC investment (see Exhibit 26).

Silicon Valley is the most attractive place for VC because of its innovation ecosystem. Taiwan, by contrast, performed lowest against all VC metrics. We can infer that it is less attractive for investors because of its smaller market potential and more conservative regulatory environment.



The regulatory environment and innovation

The financial services industry has come under greater regulatory scrutiny in recent years. The reason: the sector is inherently connected to all others, so any shock to the financial system is likely to have a widespread impact on the global economy. There is reason to believe, however, that conservative regulations constrain innovation and adversely affect profits and growth potential, and that more-progressive regulations have the opposite impact.

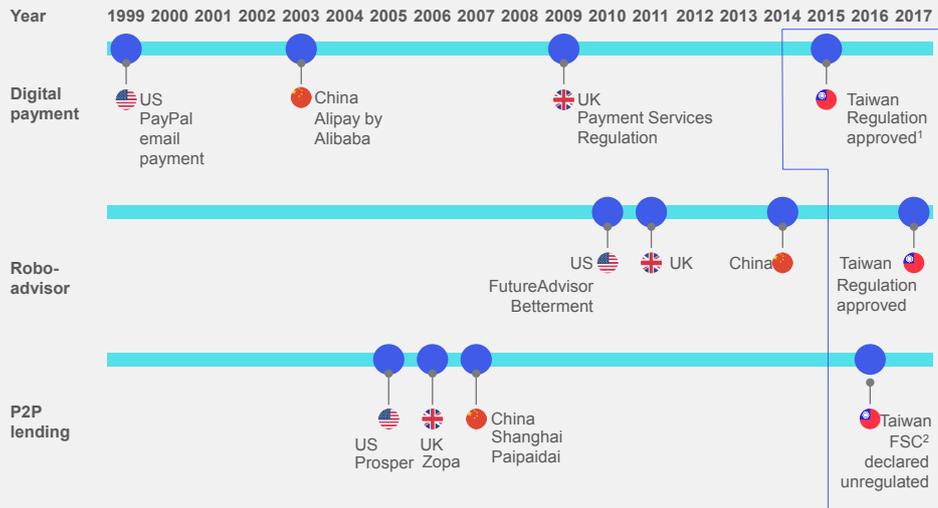
The United States is a case in point. According to our analysis, it is the leading country for fintech innovation, with 34 out of 50 of the top fintech companies, including PayPal, Lending Club, and Wealthfront, based there. At the same time, US regulations for both traditional banks and fintech startups are progressive (see Exhibit 27). These regulations keep pace with the emerging digital business model and encourage firms to develop innovative products.

Exhibit 27

Trends in fintech innovation and regulation

NON-EXHAUSTIVE

Fintech innovation adoption by countries



¹ Limited transfer amount NTD 50,000 per day
² Financial Supervisory Commission, Taiwan

SOURCE: Press releases; team analysis

In 2015 the UK became the first country to introduce the idea of a “regulatory sandbox,” a live environment where businesses can test financial services innovations without immediately being subject to the normal regulatory consequences.

In Taiwan, by contrast, financial regulation is more conservative. Banks are unable to engage in businesses where there is no regulatory supervision. Consequently, when it comes to developing innovative offerings and business models, Taiwanese banks and fintech start-ups have found it hard to compete.

There is reason to believe, however, that Taiwan could follow in the footsteps of countries with more progressive regulations. In early 2017, Taiwan’s Financial Supervisory Commission (FSC) unveiled its version of the regulatory sandbox¹². Expected to be made law by the end of the year, the Fintech Innovation Experiment Regulation calls for an experimentation period initially limited to six months and allowing for two six-month extensions.

We believe that Taiwan’s government should continue to use its regulatory powers to support financial services innovation. Taiwan’s financial regulator will need to strike the right balance between promoting new service offerings and business models and enacting regulations that curb practices that could be detrimental to the banking sector and the overall economy.

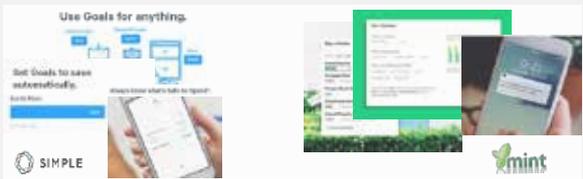
¹² Press releases, Financial Supervisory Commission, Republic of China (Taiwan): <http://www.fsc.gov.tw>.

Banking products on the digital horizon

The next generation of banking products will be interactive, social media or peer-to-peer (P2P) based, and personalized. They will exploit big data analytics and machine learning to provide the best solutions to customers (see Exhibit 28). Money management apps such as Mint or Simple will provide consumers with an aggregated overview of their financial health and use gamification to help them with budgeting and saving. Lending will be more flexible, based on social media or P2P platforms such as WeBank and LendingClub. And robotic algorithms from providers such as Betterment and Nutmeg will manage investment portfolios much faster than traditional account managers.

Exhibit 28

The next generation of banking products

	Key attributes	Examples
Account management	<ul style="list-style-type: none"> Aggregated overview of financial accounts Trackable spending and simple categorization Gamified style for budgeting and savings 	
Loans and financing	<ul style="list-style-type: none"> Social data-enabled lending P2P lending and investment 	
Savings and investment	<ul style="list-style-type: none"> Robo-advisory Easily accessible with online management Backed up with a team of licensed financial experts 	

SOURCE: Web search; McKinsey Panorama; McKinsey analysis

Capturing the digital opportunity

The digital landscape is full of possibilities for banks in pursuit of growth. Opportunities to develop innovative products are emerging in the areas of account management, lending, payments, and asset management. To compete in this environment, Taiwanese banks need to build out capabilities in digital operations, IT infrastructure, advanced analytics, and fintech partnerships.

- Digital operations:** Banks that go digital can improve their operations all the way from the front line to the back office, with benefits for customers and banks alike. Customers will no longer have to waste time queuing for tellers or waiting for loan approvals. There will be greater transparency around the status of loan requests, and fewer mistakes made that can hold up the process.

For banks, digitization will further automate straight-through processing (STP), which will reduce the number of manual interventions and therefore reduce handling time and error rates. Automation will also increase efficiency through direct processing of

structured data, thereby eliminating the need for validation steps. Take, for example, the account-opening process, which requires customers to sign several documents. Simply providing a signature on a tablet or other device will save time and so reduce the number of times the customer needs to sign their name.

Singapore-based Oversea-Chinese Banking Corporation (OCBC Bank), for example, has adopted a paperless process flow that makes its account opening process more simple and efficient. The new process has cut payment costs by 87 percent per transaction and reduced the time required to open a new account by 99 percent – from 2 to 6 days to just 16-64 minutes.

- **IT infrastructure:** Most traditional financial institutions remain bound to their legacy IT infrastructure. The operations of digital startups, by contrast, are based on modern greenfield platforms.

Traditional operations can use two-speed IT to enable rapid iterations that enhance innovation efforts. This involves implementing a comprehensive modernization program of legacy systems, with a customer-centric platform that allows the bank to offer simpler and more flexible products via a rapid product-iteration loop.

Several leading banks have adopted a two-speed architecture to increase their flexibility while avoiding the need to renew their entire application architecture from scratch. Some, for instance, are using a direct API (application programming interface) or access via middleware to support an agile front-end approach to rapidly building a single services layer. This API-built single services layer methodology helps banks to save the cost of redundant software development effort. At the same time, it also helps support innovation that enhances the customer experience via multiple banking channels (for example, with a single view of customer data, and workflows).

- **Advanced analytics:** Banks currently realize only 10 to 20 percent of their data's potential value, leaving many revenue and cost-saving opportunities on the table.
 - **Machine learning solutions** are able to work through large data sets, testing combinations of variables in order to yield insights not available through traditional statistical techniques. For example, whereas traditional statistical techniques attempt to map data to a predetermined “shape” (whether it be linear, quadratic, or logarithmic), machine learning applies a range of algorithmic approaches ranging from advanced regression analysis to neural networks to identify and record patterns. At one European bank, the shift from pure statistical regression to machine learning for credit analysis increased mortgage collections by over 30 percent.
 - **Data-empowered decisions** can improve the speed and quality of interactions. Analytics are critical to transforming customer experience. Take, for instance, the partnership with IBM Watson that helped the Development Bank of Singapore (DBS) improve its advisory services. Using Watson to analyze large volumes of complex data, relationship managers are better able to identify connections between customers' needs, and help advisors weigh the various financial options available to customers.

Data-empowered decisions also improve the operational efficiency of fraud protection services, call-centers, and ATM-networks. Equally important, they help drive efforts to grow revenue, such as cross-selling, upselling, and customer profiling. DBS uses data analytics to optimize the efficiency of its ATM network and improve customer satisfaction. By applying an ATM network analytics solution, DBS reduced ATM out-of-cash occurrences by more than 90 percent.

- **External investment and partnerships:** To have access to a diverse portfolio of fintech technology while mitigating risk, some incumbents are increasingly investing directly in fintech start-ups. Others are proactively exploring partnerships with PE and VC firms to build new capabilities, enhance customer value propositions, and shape their ecosystems.

Frequently, a bank will manage the investment process by setting up a separate innovation organization that includes an accelerator VC fund. The bank will then call upon Silicon Valley technologists to shape the product road map. DBS partnered with Nest, a start-up accelerator based in Hong Kong, to set up a DBS Accelerator that would play an active role in funding the fintech start-ups DBS needs to shape its fintech ecosystem. Since 2010, Citi Ventures, the VC arm of Citi Bank, has invested in at least 30 start-ups that specialize in areas ranging from big data analysis to digital payment to IT security.

As Taiwan's financial services sector continues its digitization journey, the Taiwanese government also has a crucial role to play. In particular, it needs to support the finance sector by accelerating the relaxation of finance regulations that constrain innovation. While the government acts as a gatekeeper to protect the impact of finance on the economy, it also plays a critical role in cultivating an environment that encourages innovation.

In general, regulation is regarded as a barrier to entry, particularly in the financial supervision and data protection areas. Although unlikely to change the general direction of any digitally fueled disruption, regulation can affect its speed and extent. The impact could also vary significantly by country, given different regulatory stances.

Consider the European Union, which plays an active role in the regulation of the banking and finance industry. The European Commission is working toward a Digital Single Market with the goal of harmonizing financial services regulation among the EU's various members and improve efficiency¹³. In 2013, the Revised Payment Service Directive (PSD2) was implemented to promote more transparent banking services, provide better protection for consumers, and level the playing field for payment service providers. As a consequence, third parties and non-banking players, including fintech firms, are allowed to provide pure banking services.

In addition, the 2014 Electronic Identification and Trust Services (eIDAS) regulations created a new system for securing electronic interactions across the European Union's internal market that eventually will provide a way to verify customer identities. This supervisory framework could prove critical to the launch of new products and services. For instance, with the approval of Spanish Anti-Money Laundering Supervisory Authority

¹³ European Commission: Digital Single Market <https://ec.europa.eu/digital-single-market/>.

(SEPBLAC), BBVA recently completed the first digitally facilitated online account opening in Spain, reducing the time needed to open the account from one hour to five minutes. How? By encouraging the supervisory framework to accept video conferencing as a new means of customer identification.

Although technology innovations will likely disrupt the financial services sector at an ever-increasing pace, a conservative approach to regulation will constrain the growth and development of fintech firms. To move forward, regulators in Taiwan need to proactively embrace innovative products and business models. For example, government could set up a dedicated department to cooperate with fintech companies, and introduce dedicated education and training programs to facilitate tech innovation in the banking sector.



The digital opportunity within Taiwan's finance sector is considerable. Despite banks' attempts to implement digital technologies, the industry faces disruption by some of the most digitally advanced tech companies. This makes it imperative for banks to develop a robust digital innovation strategy that will allow them to expand profits and market share.

As a result, banks will need to make fundamental changes to their business and operating models. They will need to redefine their branch functions and networks, redesign their back offices, and rethink their risk management strategies. To ensure these efforts succeed, banks will need to build out their IT infrastructure, recruit and develop new talent, and discover ways to work more agilely.

Box 5

BBVA's ten-year digital transformation initiative

BBVA, a multinational Spanish banking group, formed from the merger of Banco Bilbao Vizcaya and Argentaria in 1999, is the second largest bank in Spain. In 2007, it launched an initiative to "become the world's leading digital bank." Since 2015, BBVA has enjoyed more than 32 percent growth. In 2016, total revenue reached €24.7 billion, with net profit of €3.48 billion. BBVA has succeeded by possessing a clear strategic focus on digital that is led directly by its CEO and is centered around three strategic initiatives: digitizing traditional business lines and increasing mobile Internet channel sales; optimizing customer solutions to enhance customer-experience standards; and strategically planning for financial technology to explore new business models.

In the course of its transformation journey, BBVA implemented the following:

- **Digital operations:** The bank automated 1,500 existing operational flows, greatly improving efficiency and customer experience. After simplifying account-opening procedures, it focused on improving online registration, reducing account opening time by 10 to 15 minutes. The bank also simplified the consumer loan process; in Chile this improvement increased the volume of loans by 12 percent within six months.

- **Advanced analytics:** BBVA leveraged both machine learning and data analytics–based products to increase digital competitiveness.
 - Leveraging its vast amount of customer data, BBVA established a machine-learning model to segment customers and behaviors. With the ability to process six million customer portraits in five hours (compared with traditional processing, which requires two months), the machine-learning model has a cross-sales rate that is three times that of the traditional sales process.
 - The bank successfully embedded its digital products and services into consumers’ daily activities. For example, it launched Wibe, a car insurance app with functions like roadside assistance and parking assistance. BBVA also created a location-based app, Frances GO, which provides customers with information on nearby shopping discounts, sports games, and airplane tickets.
- **Investment and partnerships:** Partnerships with data analytics start-up Destacame, an alternative credit scoring platform, and FutureAdvisor, an intelligent financial services management company, are also part of BBVA’s plan to explore new business models and stake a position in the fintech industry.

With its number of digital customers reaching 20 million in 2016, a 20 percent increase from 2015, and a penetration rate of 38 percent, BBVA is well on its way to becoming a thoroughly digital company.

Box 6

CBA wins over customers through digitization

Commonwealth Bank of Australia (CBA) is one of the “big four” Australian Banks today. In 2016, CBA achieved revenue of AU\$24 billion (approximately US\$18 billion) with net profit margins reaching AU\$9.3 billion (approximately US\$7.3 billion). With 105 years of history as a technological innovator in Australia’s banking sector, CBA continues to be at the forefront of deploying technology to improve and streamline its customers’ banking experience, especially in relation to banking transactions and deposits.



- **Digital operations:** A customer-centric approach to technology – including digital initiatives such as Touch ID for mobile banking, apps for watches and tablets, digital payment services such as Tap & Pay, and innovations in the payments space – has enhanced CBA’s mobile banking capabilities. Since the introduction of Tap & Pay, more than 300,000 cards have been set up on the CommBank app, and one million transactions have been processed.
- **Branch design:** CBA has invested heavily in next-generation branch design to move toward a teller-less branch operation. A new generation of ATMs that accept both cash

and checks, and also update account balances in real time, has led to reduced queueing times for customers, higher transactional turnover, and increased overall satisfaction. CBA's success lies in personalizing the way customers and small businesses accept payments and manage their cash flow.

- **Agile IT:** To build a customer-centric bank where profitable growth is powered by simplified processes, CBA undertook a comprehensive program to modernize its legacy banking systems with a customer-centric platform. In particular, the bank:
 - Increased real-time transactions by immediate fulfillment of account opening and service transactions. This led to a 15 percent reduction in customer balance queries.
 - Streamlined and automated account opening and pricing, servicing, and transaction processing applied at the customer level. This resulted in a 10 percent increase in sales and converted referrals per full-time equivalent (FTE) employee.
 - Improved product development and maintenance efficiency. This led to a 75 percent reduction in time to market for new products.
 - Enhanced its ability to cross-sell – leading to a 36 percent increase in the product cross-sell rate from 2.2 products per customer to 3.0.
- **Advanced analytics-based products:** To provide top-quality risk assessment and improve fraud detection efficiency, CBA consolidated its IT operations from 23 data centers to just two over the past few years. As a result, check fraud detection efficiency increased by 95 percent; Internet banking fraud alerts went up by 60 percent; and check and Internet fraud loss-to-turnover ratios improved by 50 percent and 80 percent, respectively. Moreover, the bank launched apps such as MyWealth and DailyIQ that enable customers to invest, track, and manage their wealth across securities, high-interest cash accounts, and term deposits. CBA processes nine million transactions per day and handles 40 percent of card transactions in Australia to build loyalty to provide superior customer service.
- **Impact:** Underscoring CBA's large customer base and its technology investments, IAB Australia and Nielsen found that the lender had the nation's 13th most popular app, with a unique audience of 2.7 million monthly¹. As a result of CBA's mobile platform, assets operated through online accounts have risen to AU\$590 billion (approximately US\$465 billion).

¹ Press release: CBA leads way for digital-savvy customers, The Australian, October 12, 2015.



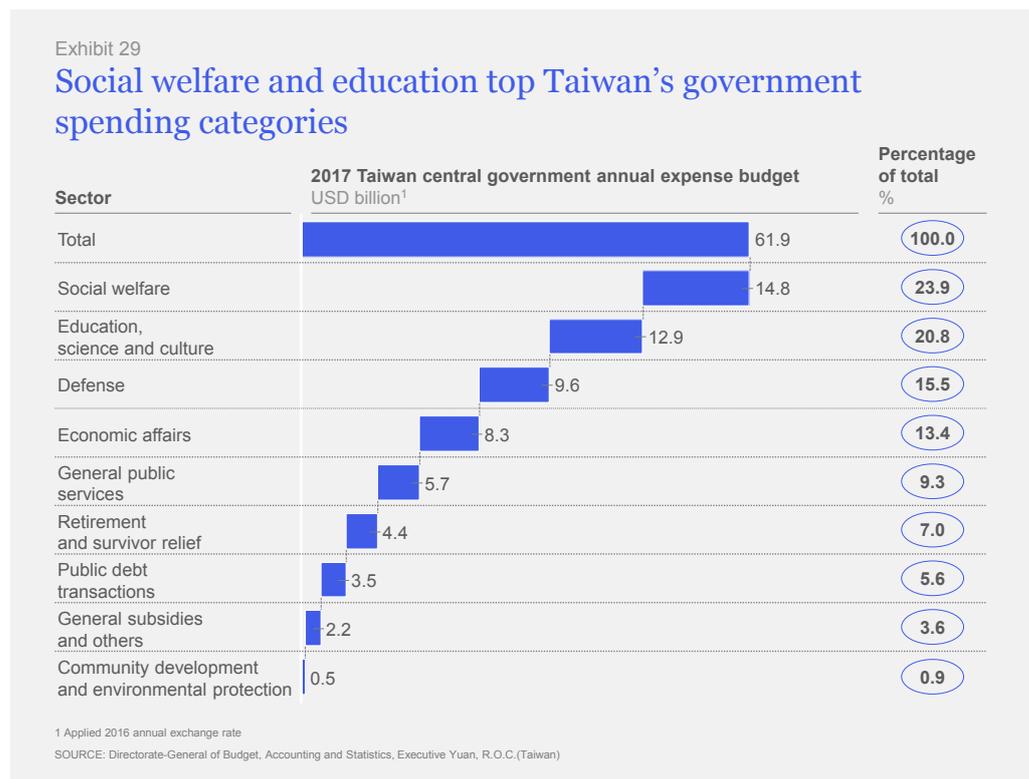
Chapter 4:
The next step for
e-government

In this chapter, we explore the challenges faced by the Taiwanese government through a financial lens. Then we apply a framework to analyze current levels of digitization, and go on to discuss how government can utilize digitization as a tool to become more efficient.

We also introduce some examples of successful government digitization initiatives from around the world as potential best practice-models for Taiwan's own government.

Taiwan central government budget spending

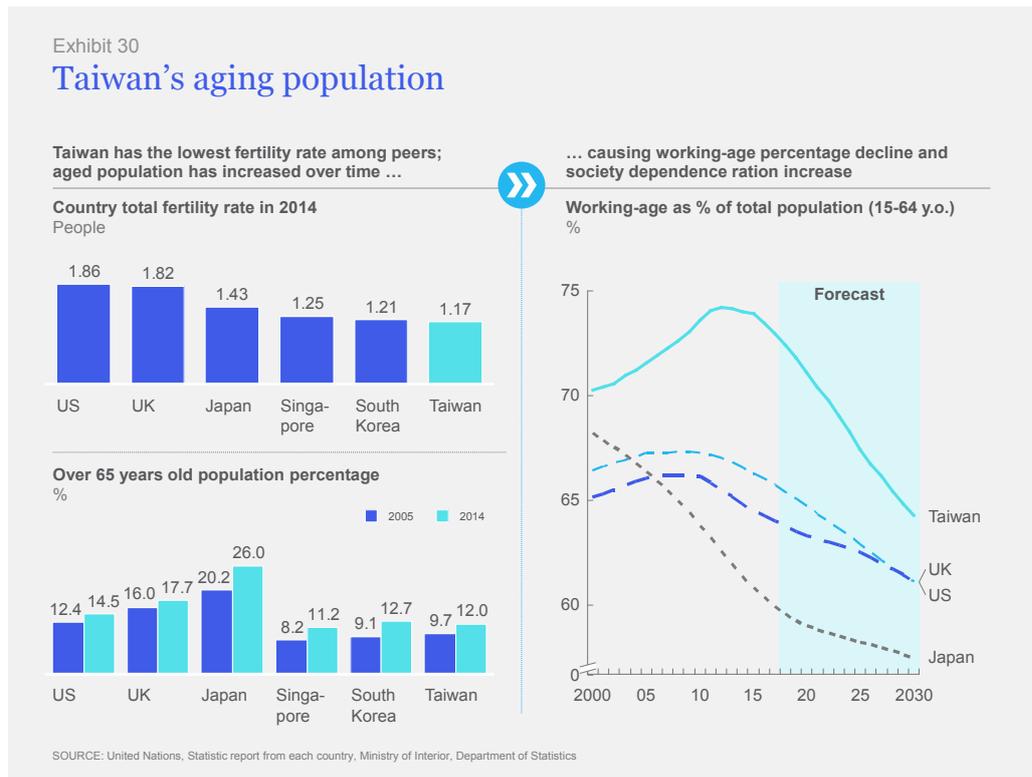
According to central government estimates, Taiwan's 2017 budgetary expenditures are projected to be about US\$62 billion (NT\$1,998 billion). The social welfare and education-related components account for almost half (see Exhibit 29).



Government finances will only become more challenging

- Aging population:** Taiwan's population is steadily aging. The Taiwan's fertility rate was the lowest of its peer countries in 2014. Meanwhile, the percentage of the population over 65 years old has also increased over the past dozen years because of better living conditions and a longer life expectancy (see Exhibit 30). As a result, the percentage of the total population who are of working age is set to decline by 8.7 percent, the sharpest drop among advanced economies, including the United States, United Kingdom, and Japan.

Taiwan's aging population, coupled with the decline in the working-age population, translates into an increased health care expense for the government. At the same time, the government needs to spend more on child-care to encourage people to have more children.



- **Difficulties of increasing government spending.** While the need for greater government spending is indisputable, it will be difficult to increase the budget because of Taiwan's high levels of debt and slowing GDP growth over the past 20 years.

Between 1996 and 2016, Taiwan's outstanding debt nearly quintupled while GDP stagnated. This caused Taiwan's debt-to-GDP ratio, a measure of the ability to pay back debts without incurring further debt, to nearly double. Given Taiwan's extraordinarily high level of debt, it will become increasingly difficult to increase government spending if GDP continues to stagnate.

Taiwan's government budget is not high to begin with. Among selected OECD countries (see Exhibit 32)¹⁴, Finland and France, countries with robust social programs, are on the high end when it comes to government spending, whereas Taiwan is on the low end.

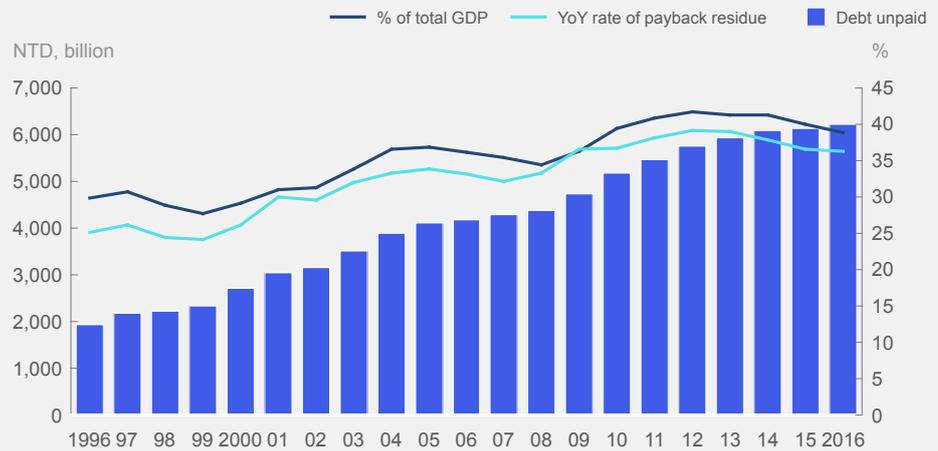
So even though Taiwan's government spending represents only 16 percent of total GDP, the high level of outstanding debt will make it more challenging to finance additional spending. Given its limited resources, Taiwan's government would be well advised to reduce the cost of the services it provides.

14 OECD 2015, accessed at <https://data.oecd.org/gga/general-government-spending.htm>.

Exhibit 31

Outstanding debt and GDP, 1996 to 2016

Taiwan government total outstanding debt at all level amount has increased almost 5x over the past 20 years; percentage of debt over total GDP has almost doubled from 18.9% to 33.3%

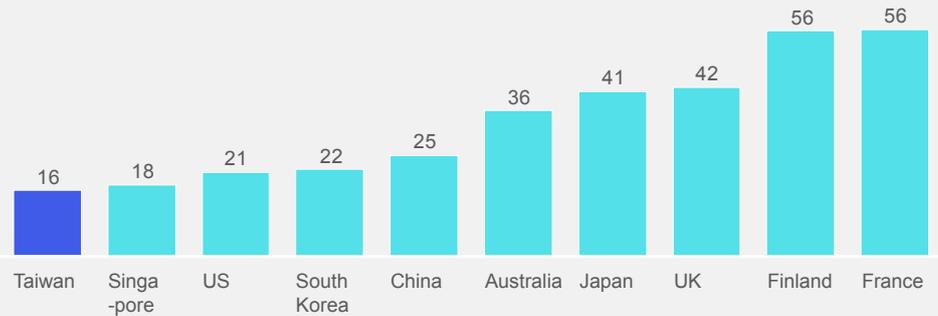


SOURCE: National Treasury Administration, Ministry of Finance and DGBAS (R.O.C.) Taiwan

Exhibit 32

Government spending as a percentage of GDP

Government budget expenditure in 2016¹
% of GDP



¹ Defined as general outlays (including loans), if not 2016 then the latest available year data
SOURCE: The Economist Intelligence Unit, derived from government data by country

The digital potential

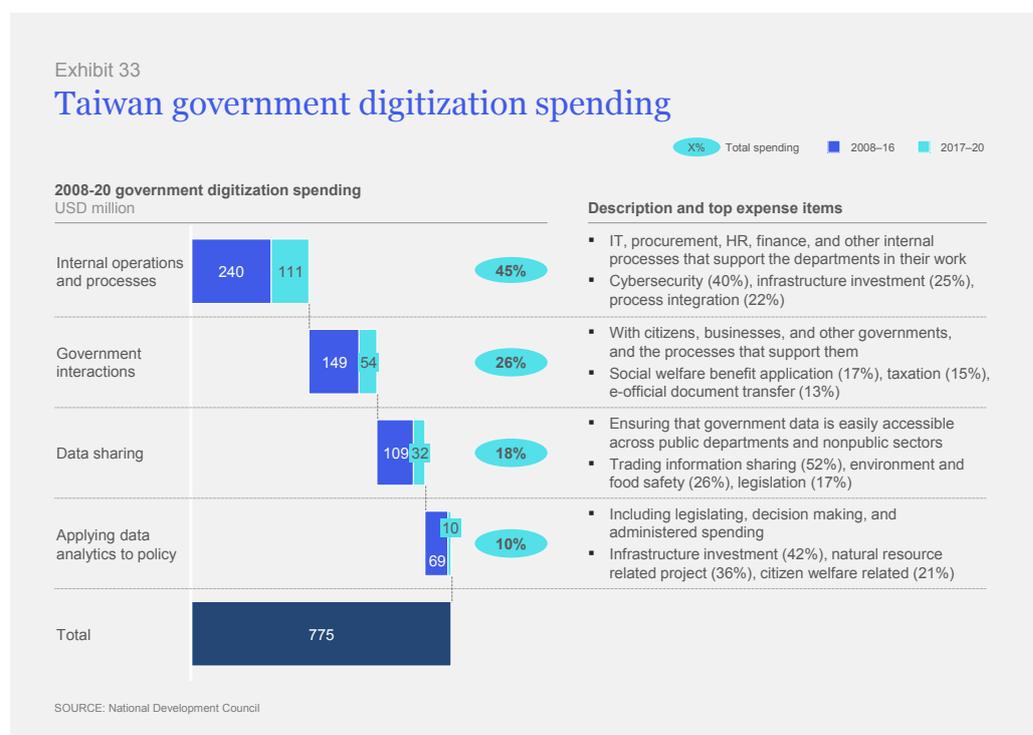
This is where digitization enters the picture. E-government initiatives, defined as the application of information technologies to public administration, offer four powerful benefits. They can streamline and integrate workflows and processes; help manage data and information; enhance public service delivery; and expand communication channels for the engagement and empowerment of citizens¹⁵.

¹⁵ UN E-Government Survey 2014, E-Government for the future we want, (UNDESA, 2014), https://publicadministration.un.org/egovkb/portals/egovkb/documents/un/2014-survey/e-gov_complete_survey-2014.pdf.

The government is the most digitized sector in Taiwan’s economy. Public-sector digital transformation efforts have simplified the online user experience, improved efficiency and staff productivity, and made government data more accessible. Yet Taiwan’s e-government offering does not consistently reach the level of international best practice.

1. Internal operations and processes: automating tasks

The government has allocated some 45 percent of its budget over the next few years to improving internal operations and processes (see Exhibit 33). One of its best-known projects is the electronic official document exchange system. By September 2015, more than 5,000 government agencies and public schools had implemented this online system, saving an estimated NT\$1.1 billion (approximately US\$36 million) in mailing costs¹⁶. There are several other digitization initiatives aimed at streamlining internal processes, such as the webHR system, iDesk, and the online procurement website.



While document exchange systems are useful for streamlining internal processes, automating the labor-intensive elements of these processes can prove even more effective. For example, numerous government agencies still print out official electronic documents for review before approving them online. Eliminating the need to print out documents can reduce time as well as paper costs.

Moreover, while the official document exchange system is now automated, the number of steps to process official documents has not been reduced. There is also a gap in the digital adoption levels of central and local government agencies. Streamlining digital efforts across departments and overcoming technical barriers can produce additional efficiencies.

¹⁶ Digital Plan: “第五階段電子化政府計畫(106年-109年)-數位政府”, National Development Council, January 2016.

As an example, the State Shared Service Centre of Estonia adopted a shared service and procurement model that allows it to identify and engage firms that can provide most Estonian public-sector agencies with financial, HR, and payroll accounting services. This approach has reduced state costs by US\$2 million per year and has increased efficiency by 20 percent. The center aims to conduct all public procurement in Estonia this way in the future.

Taiwan should seek to implement an end-to-end electronic document system not only at the central government level, but across every government agency. The United Kingdom provides an apt example. As part of its mission to provide “simpler, clearer, faster” service for users, the UK has applied a “digital by default” principle to its GOV.UK website. The strong back-end automation processing system allows for 90 percent of cases – even cases that span more than one agency – to be completely automated. Automating data sharing has allowed the UK social insurance and tax agencies to share data seamlessly. Hospitals, for example, report new births to the tax authority, which then automatically forwards the information to the citizen registry, the social insurance agency, and local authorities. A side-benefit of this automation has been reminders about mandatory medical checkups and other proactive notifications.

The government made it a priority to automate services that are costly to provide because they involve many interactions with customers. For example, the Department for Work and Pensions focused on automating five social insurance offerings, which eliminated 60 percent of the department’s manual processing work and more than 80 percent of its incoming call center volume.

2. Data sharing: engaging citizens to co-create solutions

Taiwan’s government prides itself on the transparency and accountability of its institutions. According to the Global Open Data Index, the global benchmark for the publication of open government data, Taiwan ranks first of 95 markets in the index¹⁷.

This ranking takes into account things like Taiwan’s open data website (data.gov.tw), a single portal for sharing government information with the public launched in 2012. The open data covers 18 categories, such as education, house purchases, elections and voting, traffic and communication, and public information. By 2017, there were almost 30,000 dataset entries available on the site. In addition to searching the dataset by keyword, citizens can also make data requests.

Nonetheless, when it comes to data sharing among government organizations, there is still room for improvement. The central government, rather than government agencies, conducts most of the information collection because government agencies do not have processes or incentives in place that encourage them to share data.

Estonia’s X-Roads platform demonstrates how a government can overcome the technical barriers to seamless data sharing across agencies. A data exchange layer enables secure internet-based data exchange between the state’s information systems, while further functionality allows both public and private-sector enterprises to interface their IT systems with X-Road, generating additional resource efficiencies.

Open data sharing can also lead to better relationships between government and its citizens. The South Korean government used open data to build a healthcare app for patients to use in

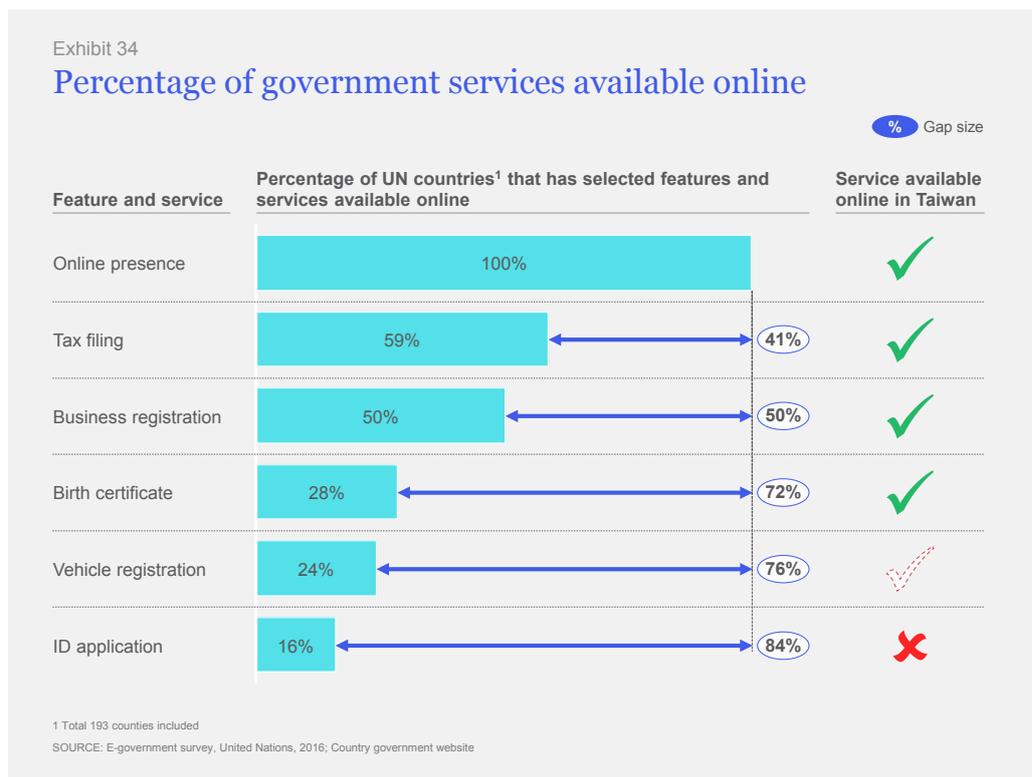
¹⁷ Open Knowledge Network Global Open Data Index: <https://index.okfn.org/>.

their interactions with healthcare providers. The app combs 58 databases with over 670,000 health data items to answer a wide range of health-related questions. It allows patients to identify providers on the basis of location, medical facilities, and the type of care needed. The app also provides fee estimates and quality ratings. Feedback in the form of satisfaction surveys and reviews is used to refine the dataset.

3. Services: building digital interfaces to improve user experience

The Taiwan government has increasingly been using digital tools to innovate the delivery of public services through electronic, web, and mobile channels since 2008.

Nonetheless, the digital revolution that is sweeping the world is raising expectations. Accustomed to the choice, convenience, and speed of digital apps, people are becoming increasingly impatient and dissatisfied with traditional government services that are cumbersome, time consuming, and inflexible. No matter how well-designed a website might be, it won't improve people's experience with government services if they must stand in long lines, deal with cumbersome paperwork, or make endless calls just to apply for an identity card, register a new vehicle, file taxes, or set up a business (see Exhibit 34)¹⁸.



At present, Taiwan's government, unlike most other countries, can provide all of these services online except for ID applications and vehicle registrations. In addition, the government has partnered with convenience stores to provide an additional channel for the delivery of e-government services. As a result of this public-private partnership, people can pay their taxes or renew their driver's license while doing their grocery shopping¹⁹.

18 Government productivity: Unlocking the \$3.5 trillion opportunity, McKinsey Global Institute, April 2017, mckinsey.com.

19 National Development Council 2016 Individual/Household Digital Opportunity Survey in Taiwan.

To further improve the user experience, Taiwan’s central government should share its best practices for fostering digital interactions across individual government agencies. While tax and healthcare transactions have been sufficiently digitized, there are additional opportunities to streamline transactions among other agencies. For example, although the MyeGov portal has made information accessible, information could be categorized, organized, and communicated more effectively (see Exhibit 35). Complex terminology needs to be simplified, especially when the application lacks descriptive information. Enhancements are needed so that people can more easily navigate the category of services they need information on (for example, real-estate transactions) and then apply for such services directly on the website. This would be far preferable to downloading and printing documents for subsequent processing at the relevant government agency.



Following international best practices, the Taiwan government could collate all of the already-developed e-government mobile applications on a single platform. For example, in China, “Shanghai Publish” is an app built on the popular WeChat platform that provides bus schedules, visa applications, traffic monitoring updates, weather reports, and air-quality indices.

Another example, Denmark’s “NemID” applies the same secure login across banking and government platforms to increase convenience – and maximize transaction flows – for individuals and businesses. NemID, which has a 90 percent user satisfaction rating, saves millions of euros annually for the tax agency alone. In Sweden, the tax agency provides personalized services such as proactive notifications to remind people of important upcoming appointments (for instance, infant health check-ups). Letters from the agency often provide the name and direct telephone number of the official dealing with a case, which allows for smoother transactions and more personalized service.

The New South Wales (NSW) government in Australia developed a unified, single point of contact for residents and businesses across more than 800 services, from birth certificates

to senior citizens' cards. Three critical components make this possible: A customer-friendly website and an app where individuals and businesses can perform transactions digitally; service centers with extended opening hours and digital service stores located at shopping centers and other major customer hubs; and a 24/7 telephone service, which is manned by a customer-service representative based in NSW.

4. Decision making: applying advanced data analytics to policy

Data analytics is critical for effective government decision making. Done right, it allows the government to assess policy and program effectiveness, measure progress, and debate matters of policy more rationally. The deployment of data analytics can improve legislation and the management of administered spending.

Taiwan's government has been able to exploit data analytics in policy decisions thanks to its well-established IT infrastructure and early shift to electronic information documentation. Take, for example, the eTag system, which was installed on vehicles in 2006. Since then, the system has tracked vehicle information and analyzed traffic conditions, enabling proactive decisions that help manage traffic²⁰.

In the public transit sector, traffic flow is measured by analyzing data collected from swiping electronic passes on buses, the MRT (subway system), and high-speed rail. The Ministry of Transportation and Communication also collects data on passenger traffic during peak hours from EasyCards in Taipei's MRT system²¹ to improve scheduling and minimize wait times.

Taiwan's comprehensive National Health Insurance Research Database (NHIRD) serves the National Health Insurance program, in which nearly 100 percent of Taiwan's population is enrolled. The database contains registration files and original claims for reimbursements, and serves as a useful resource for tracking health trends in Taiwan's population²².

Taiwan's government, however, is still some distance away from using data to design and improve policy initiatives. The UK government's Behavioural Insights Team was formed explicitly to use data about people's behavior to make government interventions more effective. The team set up randomized control trials (long used in the medical field but only now gaining favor in the public sector) to test the impact of small changes, such as adjustments to the language and tone of a letter that the tax authorities sends to delinquent taxpayers. In its first two years, the team paid for itself 22 times over in cost savings. It has identified interventions expected to save the UK government at least £300 million over the next five years²³. Now the unit has also started advising other governments on how to use data and randomized control trials to improve performance.

In addition, the Taiwan government should think about using digital technologies to better understand how to reduce future unemployment and increase job opportunities. German job platform JOBBÖRSE, for example, uses data analytics to segment candidates and make personalized recommendations to candidates on potential jobs and employers. In New

20 Institute of Transportation, <http://www.iot.gov.tw/>.

21 "Analysis on the Traffic of Passenger in Taipei's MRT System," Department of Statistics, Ministry of Transportation and Communication.

22 National Health Insurance Research Database, <https://nhird.nhri.org.tw/>.

23 Annual Update 2011-2012, Behavioural Insights Team, September 20, 2012.

Zealand, economists use the data from an actuarial appraisal welfare system to compare the total life-cycle cost of unemployment with the annual budgetary cost.

Enhanced decision making through the use of data can only be achieved if there is advanced data analytical skills and talent. Accordingly, the UK's Government Digital Service has developed a comprehensive talent-management strategy for digital skills. Its recruitment hub helps all departments recruit digital talent and organizes rotational programs.

While recruitment is critical, digital skills should also be developed internally. The United States is building the capabilities of its employees through its DigitalGov University, which each year trains 10,000 federal civil servants in digital and data analysis skills.

Substantial opportunities to deploy digitization to increase government efficiency

To support the four core areas of automation, data sharing, digital interfaces, and advanced data analytics, the Taiwan government needs to do the following:

Improve the efficiency of operations. By digitizing back-office processes, government can realize savings of time and resources, while also reducing errors and fraud. However, the process design is challenging. Moreover, like most governments, Taiwan's has legacy IT systems that can be risky to replace. A large-scale IT system upgrade will require effective project management to ensure the right functionality for users and avoid significant cost overruns.

Consider the example of an electronic procurement system: a digitized, automated procurement process will allow government to significantly reduce the time devoted to procurement both for government agencies and vendors, while online status updates will improve the transparency of the process.

To ensure effective digitization of a process, government organizations should digitize all the constituent activities that make up the entire process chain, which may mean reengineering a process that cuts across multiple departments. In addition, they should design new processes to be digital from the outset. To address the issue of legacy systems, organizations can adopt a two-speed IT model: a reliable and low-risk foundation of familiar systems, plus a more flexible digital layer that accommodates the rapid creation and deployment of new services²⁴.

It should also be noted that a far-reaching automation effort can profoundly change the nature of the work that agencies and employees are asked to perform. To smooth the transition, it is vital to provide public employees with appropriate training in new skills, as well as assistance navigating what could be a disruptive career transition.

Open data sharing for individual and business applications. The Taiwanese government is already a leader in data openness and sharing; the next step is to harness this resource to create value in the economy. Individuals and business can begin to use Taiwan's open data resources to build businesses and monetize the data. Many governments have released transit, weather, address, and geospatial data. Using these datasets, developers have generated numerous mobile apps to support business decision making.

²⁴ Digital by default: A guide to transforming government, MCG, November 2016; and Digitizing the delivery of government services, McKinsey & Company, March 2016.

The potential upside of open data sharing is sizable: McKinsey Global Institute research estimates that the annual value of open data across seven different public and private domains exceeds \$3 trillion worldwide²⁵.

In Taiwan, the challenge stems not so much from the availability of open data, but from low awareness of what data is available or of how to exploit it. As a start, government should raise awareness by actively marketing what it has done so far to open up data. Then government agencies should consider cooperating with appropriate businesses or adapting app ideas from other countries to meet local needs.

BrightScope, a US startup, mined US Department of Labor data on the management fees charged on employee retirement plans. It discovered that small businesses were paying in excess of \$4 billion more than larger companies. Based on those data, as well as data from various public sources such as the US Securities and Exchange Commission and the US Census Bureau, BrightScope now provides an online tool that allows users to rate employer-financed retirement plans quantitatively²⁶.



Taiwan's established digital infrastructure serves as a strong foundation for the government's digital agenda. Although the journey from automation to comprehensive digitization is still in progress, Taiwan can continue to draw on its open data source and data analytics capabilities to improve engagement, service delivery, and policy making.

25 Open data: Unlocking innovation and performance with liquid information, MGI, October 2013.

26 Big data: The next frontier for innovation, competition, and productivity, MGI, June 2011.

Box 7

Singapore: leading digital government in Asia

Singapore has become a world leader in the e-government arena through its sustained efforts in digitization. Its government initiated the first e-Government Action Plan in 2000. Since then, many of its e-government initiatives have resulted in high satisfaction ratings among its citizens and garnered worldwide recognition. According to a 2016 United Nations eGovernment survey, Singapore ranks fourth on the E-Government Development Index and eighth on the E-Participation Index among UN members¹.

1 United Nations E-Government Survey 2016, E-Government in Support of Sustainable Development, <https://publicadministration.un.org/egovkb/en-us/reports/un-e-government-survey-2016>.

How has Singapore achieved this digital transformation? Here are some of the initiatives that it has taken:

- **Efficient government processes to save time and cost:** Singapore has effectively captured efficiencies and costs savings by digitizing the government’s back-end processes (for example, GeBIZ). This forced other businesses to go digital, for example, accepting only e-payments and e-invoicing.

Using this back-end automation system, the Accounting and Corporate Regulatory Authority (ACRA) takes only 15 minutes to process a company registration. ACRA’s system will automatically and proactively issue a notice of incorporation to the professional firm engaged for the purposes of incorporation, removing the need for the business owner to complete this step.

- **Publishing and leveraging data for decision making:** The Singaporean government is deploying data analytics to make better, “smarter,” and quicker decisions. For example, the Land Transport Authority (LTA) used advanced data analytics to map out commuter travel patterns across Singapore and to gain a better understanding of usage and demand. In 2011, the government started promoting open data through data.gov.sg, a one-stop portal to publicly available datasets from 70 public agencies. Four years later, it added interactive dashboards, a data blog, and datasets organized according to their relevance to different services.
- **Government leads in prioritizing digitization:** Prime Minister Lee Hsien Loong supports digitization in a way rarely seen in other countries. When a government leader is such an enthusiastic champion, it demonstrates that going digital is one of the government’s highest priorities.
- **Multiple group involvement:** When the Singapore Committee on the Future Economy – a Singapore initiative for shaping digital-government strategy – solicited recommendations, it consulted multiple parties, including citizens, residents, and the private sector. This approach helped the government ensure that its e-Government initiative incorporated the perspectives of different kinds of users.
- **Recruiting digital talent:** Singapore’s government has invested in cultivating citizens’ IT and software skills. For example, it has launched multiple teaching programs such as the SkillsFuture Program to help citizens and workers learn and maintain programming capabilities.

Looking forward, there are still some challenges that the Singapore government has to overcome to reach the next level of digitization. Nonetheless, Singapore is still considered a leading example of government digitization, from leadership mind-set to implementation.

A photograph of a business meeting. In the foreground, a person's hand is pointing at a tablet displaying a 3D pie chart and a bar chart. In the background, other people in business attire are visible, some holding documents. The image is partially obscured by a large blue diagonal shape on the left side.

Conclusion:
How business and
government can
seize Taiwan's
digital opportunity



During the late 20th century, the “Taiwan miracle” transformed Taiwan into one of world’s economic powerhouses. In recent years, however, economic growth has stagnated, and labor productivity has fallen behind that of other leading economies.

Digitization offers a crucial opportunity for Taiwan to jumpstart its economy and restore its position of economic leadership, but only if business and government leaders fully embrace digital transformation. This final chapter offers a few additional areas that business and government should consider pursuing as they launch their digital transformation.

Building a digital capability: recommendations for business

Taiwan’s high-tech and financial services sectors currently face many challenges. The issues that industries face, and the methods for dealing with them, differ widely.

Develop a robust digital strategy

The first step in developing a strong digital capability is to develop a digital strategy that supports the overall business strategy. Companies need to understand how digital technology can be used to expand the value proposition of the current business model or to develop a new model altogether. They also need to take into account digital’s potential to impact or disrupt the industry.

At the same time, the digital strategy should tie digitization to specific customer or business outcomes. Companies need to determine how they can use digital to redefine the customer decision journey, so they can influence the customer at every point of interaction²⁷. By applying data analytics to this process, firms can deliver a streamlined and personalized customer experience across multiple channels.

Leadership and organization

Successful digital transformation requires the organization to make difficult trade-offs. So it is critical to have leaders who not only are willing to commit to the transformation but also know how to make the tough decisions. Moreover, individual executives must take responsibility for driving the digital imperative in the areas within their remit. Equally, they need to be comfortable with the nitty-gritty details of automation, advanced analytics, and other digital levers²⁸.

Successful digital transformation requires more than sound leadership from the top; most organizations will also need to develop their talent throughout the business. One of the most common problems for companies undergoing digital transformation is that they are unable to alter ways of working at scale to take advantage of the speedy pace that digitally enabled innovation allows. Therefore, it is critical to allow digital teams to work autonomously so that they can drive impact.

27 David Edelman and Marc Singer, “Competing on Customer Journeys,” Harvard Business Review, November 2015.

28 Simon Blackburn, Michaela Freeland, and Dorian Gärtner, Digital Australia: Seizing the opportunity from the Fourth Industrial Revolution, McKinsey Global Institute, May 2017.

Attract and retain digital talent

Recruiting and retaining the right digital talent is key. Competition for top talent is bound to intensify as digitization becomes more pervasive. According to projections by the McKinsey Global Institute, by 2018, demand for deep analytical talent in the United States could outpace supply by 50 to 60 percent²⁹. The shortage of digital skills in Taiwan will likely be as acute, if not worse, because the salary levels are lower and working hours are longer than many other countries.

Some Taiwanese businesses, however, are already finding ways to build strong talent pipelines. Hackathons, events where coders collaborate on computer programming projects, offer a way to tap non-traditional talent pools. Digital and analytics tools can help as well. For instance, candidate screening tools powered by sophisticated algorithms can help reduce unconscious biases during the hiring process³⁰. And generous perks like extra vacation days and a flexible career path can also prove effective.

Design a digital-friendly culture

As companies digitize their operations, they should also be thinking about their culture. A forward-looking culture that encourages employees to embrace digital change can significantly enhance growth and momentum. A company undergoing digital transformation should seek out people with an entrepreneurial and collaborative mindset.

Entrepreneurial types are best suited for identifying and trying out new business ideas with potential. They have a strong appetite for risk, so they're willing to make an informed bet on technology, but they're also able to learn from the failure if the bet proves misguided.

Collaborative instincts are equally important. The greater the reciprocity and the degree to which colleagues help one another, the more effective the culture. Not surprisingly, at higher levels of digitization, companies experience more collaboration between IT and other parts of the operations. So it is essential for companies undergoing digital transformation to create processes and teams that can work across functions, while simultaneously promoting the digital vision at every level of the organization.

Recommendations for government

There are several reasons why the Taiwanese government needs to heed the digital imperative. Digital technologies offer an opportunity to capture considerable efficiencies and productivity gains. Second, the government plays a vital role in encouraging Taiwanese businesses to participate in the digital economy, so that Taiwan does not fall behind as global digitization continues. Third, government needs to manage the regulatory environment to encourage fintech and other sectors to develop digitally enabled business models.

1. Capture the digital opportunities in the government sector

The Taiwan government's digitization efforts compare well with those of its international counterparts today. With the government's focus on continuing its digital transformation agenda, we are already seeing certain aspects coming to maturity: for instance, its "data sharing" offerings rank first in the world in The Global Open Data Index.

²⁹ James Manyika, Michael Chui, Brad Brown, Jacques Bughin, Richard Dobbs, Charles Roxburgh, and Angela Hung Byers, *Big data: The next frontier for innovation, competition, and productivity*, McKinsey Global Institute, June 2011.

³⁰ James Manyika, Susan Lund, Kelsey Robinson, John Valentino, and Richard Dobbs, *Connecting talent with opportunity in the digital age*, McKinsey Global Institute, June 2015.

The ultimate goal is to achieve an end-to-end digital infrastructure that captures the full potential of digitally enabled innovation and productivity. We see four primary areas of opportunity:

- **Internal operations and processes.** The government's opportunity is much broader than simply digitizing paper-based systems. It includes the consolidation and automation of back-office processes and goes even further, to supporting the flow of citizen information and application processes across agencies.
- **Data sharing.** The government needs to continue removing barriers between agencies so that they can share a broader range of datasets than simply the data gathered by the central government.
- **Interactions with citizens.** While MyeGov and some other government interactions are already digitized, the government has the opportunity to improve interactions with citizens by digitally upgrading the user-interface, interactivity, information search function, and individual transactions. Governments of other countries provide some examples to learn from.
- **Data analytics-based decision making.** The Taiwanese government has a significant opportunity to shape policy priorities through the use of advanced analytics. To name a few examples, the government can use analytics to look at educational, occupational, or public service restructuring initiatives.

2. Encourage participation in the digital economy

Increased digital participation can improve the quality of life, support more effective delivery of public services, and boost economic growth. It can help with day-to-day activities such as online shopping and bill payment, facilitate job searches, or help people stay connected with friends and relatives. But the all-pervasive change digital affords cannot be achieved unless government provides the necessary support and protections.

The Taiwanese government has made significant progress on the access and infrastructure front, most visibly with the development of automated e-government services and digital information delivery platforms.

But that is only the first step. The key to capturing the full opportunity is to engage citizens to make use of, and provide feedback on their e-government service experience. A 2016 survey conducted by Taiwan's National Development Council found that with regard to civic participation, only 34 percent of internet users had searched online for public government information, down from almost 50 percent in 2012. Meanwhile, 32 percent of internet users had made use of online application services, but only 14 percent had downloaded data from the government's Open Data Platform since its establishment in 2013³¹. The government should make an effort to capture continuous user feedback and satisfaction data with a view to making its service more user-friendly.

The challenges of providing government services online are complex: too often citizens overcome one obstacle only to face another as they seek to access Internet-based services. For this reason, citizen trust is an important catalyst of e-government adoption.

³¹ National Development Council 2016 Individual/Household Digital Opportunity Survey in Taiwan.

Research findings indicate that the high adoption rate of Taiwan's e-filing tax system is due in part to recommendations from acquaintances. Similarly, a recent study of a Singapore e-government website found that citizens' trust in the government is positively correlated to trust in e-government web sites.

To build trust with individuals, the government should seek to extol the benefits of using digital services and provide guidance on how to do so. Sweden, for example, has developed an online education platform for students to use when navigating the school selection process. The comprehensive website, which includes a step-by-step description of the application process, information about the school itself, and feedback from parents and students, has significantly improved user adoption (see Exhibit 36). The Swedish government has also started providing free Internet training to middle-aged citizens, the elderly, and recent immigrants at digital opportunity centers, mobile service vans, and libraries across the country.

3. Take a new approach to setting the regulatory framework and encourage innovation

Digitization is taking the global economy into uncharted territory. Entirely new business models can rapidly emerge. Uber and Airbnb, for example, built substantial user bases before regulators could address some of the concerns sparked by the success of these innovative business models. But governments with a conservative approach to regulation can constrain such innovative companies from developing in the first place.

To promote digital innovation, the Taiwan government needs to approach regulatory issues in a way that places the interests of the people first.

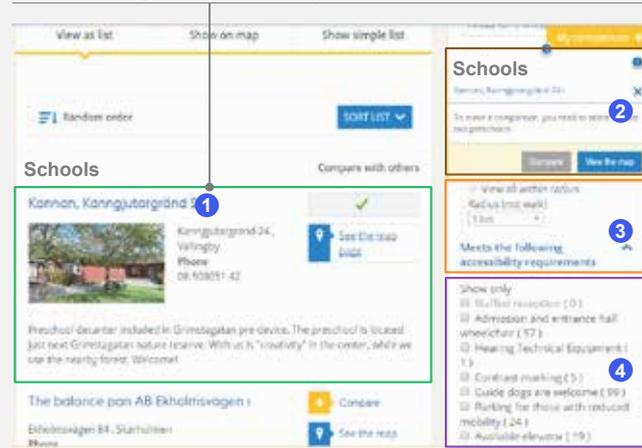
Lastly, government has a critical role to play in developing regulations for workers as they adapt to the digital world. As burgeoning on-demand services cause more and more people to engage in freelance work and participate in the so-called "gig economy", policy makers will need to update regulatory frameworks to take these new working models into account. It is important to clarify how project-based workers are treated under the law, both to protect employee rights and to preserve government's tax revenues.

Taiwan's recent revisions of the Labor Standards Law addressed permissible working hours, overtime pay, and other working conditions. At the same time, however, it limited the flexibility of both employees and employers in an era when many millennials and white-collar professionals want to be evaluated on the basis of their performance rather than the number of hours worked. Accordingly, the government should consider designing a regulatory framework that recognizes these sentiments and that can meet the needs of different working models as the economy evolves.

Exhibit 36

Sweden's comprehensive online schooling information search and application platform

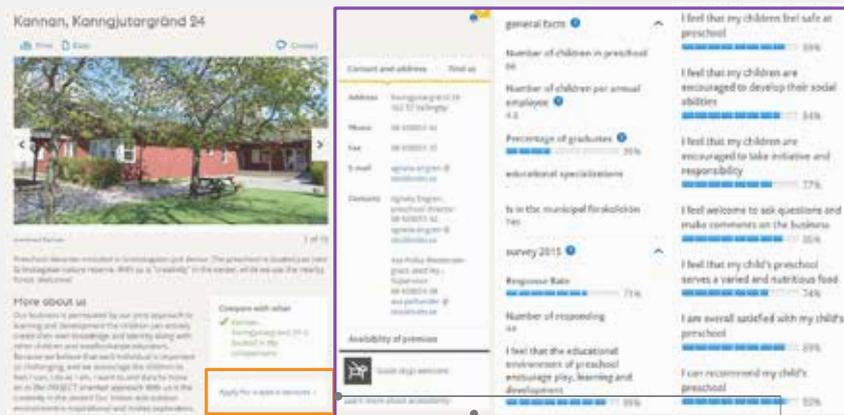
Upon signing in, the student is greeted with a school search page that provides an overview of schools with a **summary of each**, along with an **advanced mapping function** to help students estimate **travel time**



An online school **comparison function** compares **general facts** (e.g., facilities, courses) and **survey feedback** from parents and students

As students use their ID to sign in, the system **knows the location of the student's home** and is able to **filter schools by location**

Lastly, the system also provides **advanced filter functions** such as grade requirements, course information, and even **school facilities for students with disabilities**



5 Upon clicking on a school link, students are brought to a more **detailed page** that provides **comprehensive information on the school**, including contact details, reviews based on **survey results**, and **feedback from parents and students**

6 If this is the school of their choice, students can **immediately apply** directly from this webpage

SOURCE: McKinsey analysis



In the course of just 50 years, Taiwan transformed itself from a primarily agrarian economy to a manufacturing powerhouse. In recent years, however, as productivity and profits have slackened, Taiwan has begun to lose its competitive edge. And, as digital technologies accelerate the pace of change, keeping up will become only harder.

To regain its competitiveness, Taiwan needs to undertake a digital transformation. This will require industry and government to take the lead in developing a robust digital strategy, foster wider adoption of new technologies, and encourage changes in mindset and culture. Only when businesses and government embrace the digital imperative, can Taiwan generate the economic growth it needs to regain its position on the world stage.

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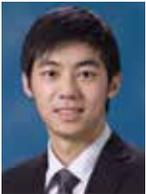
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