罗汉堂
LUOHAN ACADEMY

Digital Technology and Inclusive Growth

Luohan Academy Report 2019
Executive Summary

Mission Statement of Luohan Academy

Digital technology is fundamentally changing our global economy with the potential to advance human welfare in many ways. It not only reduces costs and market frictions, but also enables the development of new services and processes. Consumers may benefit in numerous ways, from lower costs to improved services, and from greater social connectivity to better health outcomes. Entrepreneurs and firms (especially small firms) may benefit from having low-friction access to marketplaces, cheaper computing and back-office services, as well as earlier and cheaper, more efficient sources of financing. Governments may be able to lower the costs of administering their welfare systems, better anticipate and serve the needs of their citizens, and deliver services more efficiently and inclusively. Moreover, by building a valuable network for producers and consumers, digital platforms can generate new opportunities for resource and risk allocation, and provide a stage for efficient and resilient routines, processes restructuring, as well as market relationships.

At the same time, our society is not yet well-prepared for this unprecedented structural transformation brought by big data, machine learning, artificial intelligence, robotics, and other digital technologies. Thus, it is imperative that we study and manage the coming digital revolution to benefit society and protect individuals as consumers, workers, and citizens, both domestically and internationally.

Citizens in all countries are confronted with numerous questions about the optimal and balanced use of these new technologies. How can societies harness the power of technology to promote growth, enhance societal welfare and at the same time preserve individual rights and social inclusion? What is the future of work and leisure? How must education change to address the needs of the changing nature of work, the rise of digital assistance, the rapid change of technology and new methods enabled by the digital revolution? How to avoid a "digital illiteracy" that results in "digital knowledge gap" across citizens? How can we ensure that the new social environments will be fair and inclusive? Which appropriate regulation and competition policies foster competition and technological progress without slowing innovation? What are the contours of a privacy policy that will allow legitimate use of data to create socially beneficial and inclusive services, while protecting citizens against abuses by unauthorized agents and institutions? How can digital technology contribute to a greener planet?

Social scientists in general, including economists, must therefore collaborate to help societies adapt smoothly and fairly to the digital revolution. Two important objectives of the academic community are first, to understand business models and market structures that enable growth and progress, and second, to identify the impact of digitization on individual and social welfare. So far the rapidly increasing scale of digitization has not been followed by a corresponding increase in theoretically grounded empirical research on the rationales, consequences, and policies of digitization. A well-organized research community could greatly facilitate and speed up such research efforts.

This is an opportune time to bring the best research minds in the world together with first hand practical insights into the digital economy to advance the research frontiers of digitization and shape constructive consensus for the public good. The Luohan Academy thus has a two-fold mission. The first is to understand how digital technology can help achieve the common good. The second is to help build a broad research community for systematic and in-depth research leading to new paradigms for solving first-order problems in the digital society. In this endeavor, the academy will abide by the spirit of open science, operating independently under the principles of integrity, inclusion and diversity.

It is an exciting new beginning. We sincerely invite you to join.

Foreword

If there is one finding in this report that stands out above all others, I believe it is this: data is becoming a new and critical resource that will drive human progress.

Put simply, data is a resource as essential to development as oil, indeed much more so. We all know that oil will one day run out; data, on the other hand, will never be used up, and the more people use it, the more valuable it becomes.

The uncharted territory that lies before us throws up many unanswered questions. How is data to be used appropriately? How should privacy be protected? How can data be harnessed so that it delivers maximum benefits and minimum drawbacks to mankind? With so many unanswered questions it is easy to succumb to feelings of dread and foreboding. But anxiety solves no problems. Instead we must work hard to look for answers and solutions. Rather than fleeing the challenge, we choose to look at matters soberly and explore the potential impact of data, and to do so in a holistic way.

I would like to thank the scholars whose excellent research forms the basis of this report. Their findings and analysis will not necessarily provide instant and immediately applicable answers that all will agree with, but I am convinced they will help shed light on the path that lies ahead for mankind.

Among all the swirling questions about data and the future, to me one thing is crystal clear: machines cannot and never will replace humans, because it is ultimately human love and human wisdom that carry us all forward.

Jack Ma
Executive Chairman
Alibaba Group

Foreword

China's digital technology companies have become leaders in developing e-commerce, mobile payments and digitally based financial services. In 2018 Jack Ma, the founder and executive chairman of Alibaba group, created Luohan Academy in Hangzhou to promote research on the development and impact of the digital economy. At a time when almost all economies are increasingly being built on digital foundations, this is timely indeed.

We sit on the Academic Committee of Luohan Academy and see great potential in this initiative. As a rapidly digitizing economy, China has accumulated rich experience that can be used to study key issues, opportunities and challenges related to digital technology. By a wide margin, mobile payments in China are the most highly developed and deployed in the world.

China is still a developing country, albeit a rapidly growing one. This first report, a joint work by the academy's internal research team and many of its academic committee members, focuses on the crucial issue of the contribution that e-commerce has made to China's growth and to the inclusiveness of the growth patterns associated with ecommerce, mobile payments and digital financial services.

The data support a number of important insights and conclusions.

Open e-commerce platforms have spawned digitally enabled ecosystems that have helped produce vast numbers of new businesses, many small and medium sized, which have been able to thrive by accessing much larger potential markets than the gravity model for trade in the physical world would imply.

The platform centered and designed ecosystems have low entry barriers for several reasons. Among these are that both capital requirements and digital skill requirements are low. This is no accident, the platforms being structured precisely so as to minimize skill requirements. This is consistent with experience in other developing countries where mobile payments and banking services have developed. Another reason is that over time the digital ecosystem has developed a host of complementary resources that reduce the complexity of the process of creating and scaling a new business or of testing a new business idea or model. This again is by design. Taobao, the main e-commerce platform, has built private and public sector training programs to support entrepreneurs and public officials who need to work with the private sector.

E-commerce has grown more rapidly in the less developed regions of the country, areas with lower incomes and much less retail infrastructure, and where people buy proportionally no less than more developed regions, and buy a greater variety of products online to offset the disadvantages of their local markets. Here a highly plausible case can be made that e-commerce and mobile payments have materially accelerated the pace of modernization in the less developed regions: rural areas, villages and third- and fourth-tier cities.

There are other aspects of inclusiveness, too, among them being that of Taobao's about 10 million companies and startups, half of the entrepreneurs are women.

Mobile payments are a key piece of the digital economy. Interestingly, Alipay developed before the mobile internet was widely available to solve a common trust problem in ecommerce: buyers worried about not receiving the product and sellers about not receiving the payment. Much has changed. The mobile payment system dominates e-commerce transactions and has spread to the rest of the consumer economy. This has enabled the extension of credit at reasonable rates to individuals and businesses that were formerly essentially isolated and blocked out of the credit system: no collateral, no easily accessible track record. Now reliable mobile payments, credit, insurance, asset management and more seem reachable for the vast majority of citizens. They are key elements in the platform ecosystem and highly inclusive in terms of impact.

In summary, one of the most important conclusions of the report is that the growth patterns associated with the adoption of ecommerce, mobile payments and related financial services in China are strikingly inclusive in multiple dimensions.

For many decades the Coase theory of the "division of labor" between business organizations and markets has been the framework for thinking about the institutional arrangements that efficiently allocate resources. In that theory, among other things, firms solve coordination problems that are a challenge for markets. This report argues that open two-sided platforms are a new institutional form that "solves" certain kinds of coordination problems. Hence it shifts the boundaries in the direction of markets. This is not an invalidation of the Coase theory, but rather a significant shift in the parameters.

Digital market places, powered by data and artificial intelligence algorithms, significantly reduce search costs and improve the efficiency of buyers' preferences and interests with sellers' differentiated products and services.

The report argues that another key lesson is that the fast-developing digital economy requires an effective partnership between the public and private sectors. Experiments, not all of which are successful, play a key role in this dynamic. Government needs to be watchful in the regulatory function, but not excessively risk averse to the point that experiment and innovation are stifled. The experience in China suggests that this partnership has worked and that the public sector has struck a reasonable balance between encouraging innovation while keeping a sharp eye out for abuses and vulnerabilities.

The report acknowledges that there are a host of issues that have received a great deal of attention recently and that need to be addressed as digital economies develop: data privacy and security, market power of platforms, jobs and skill requirements in relation to automation and artificial intelligence, cyber security and the role of digital technology in national security and defense. Societies have become increasingly aware of these vulnerabilities and challenges, and a start has been made in addressing them. But there is a long way to go. Progress is critical in preserving the very substantial benefits in terms of growth and inclusion that the report documents of the Chinese experience of the past two decades.

Finally, we believe – and the report suggests – that the highly inclusive, digitally enabled growth patterns that are visible in China are important and relevant for developing countries more broadly. Of course there will be differences and required adaptation appropriate to local conditions and constraints. But the upside potential is enormous and deserving of further research.

We hope that this first report will contribute to research on the digital economy and to balancing the debate that has shifted in a negative direction in the recent past, at least in some countries. We also especially hope that the China experience as laid out here helps other developing countries integrate digital elements into overall growth and development strategies.

Bengt Holmström
Paul A. Samuelson Professor of Economics, Massachusetts Institute of Technology
2016 Nobel Prize Laureate in Economics

Sir Christopher Pissarides
Reguis Professor of Economics, London School of Economic
2010 Nobel Prize Laureate in Economics

Michael Spence
William R. Berkley Professor of Economics and Business, New York University
2001 Nobel Prize Laureate in Economics

Acknowledgment

This report is a joint work by the internal research team and many academic committee members of Luohan Academy. The internal research team is led by Long Chen, Director of the Academy, Ted Haoquan Chu and Tao Sun, and researchers include Daixi Chen, Yong Li, Xinyu Liu, Jingyi Shi, and Yuan Tian. Coauthors from the academic committee include Patrick Bolton, Markus Brunnermeier, Bengt Holmström, Sir Christopher Pissarides, Michael Spence, Steve Tadelis, Neng Wang, and Wei Xiong. Luohan Academy interns, Lina Han, Yadong Huang, Shumiao Ouyang, Zhengyun Sun, and Dayin Zhang, provided excellent research assistance.

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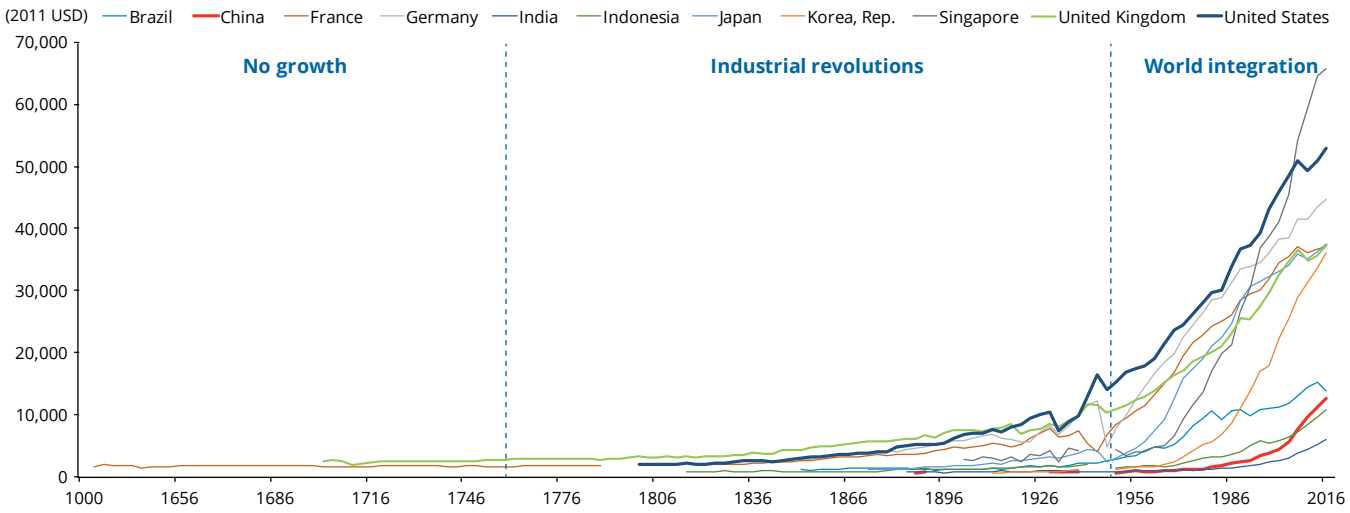
1. Technology presents both opportunities and challenges

Technology has been the primary driver of unprecedented prosperity over the past two centuries (Figure O.1). Yet, technological change poses adaptation challenges on individuals, companies and governments, leading to long periods of structural change. How to embrace and harness technology, so as to take advantage of its potential to benefit all, the so-called inclusive growth, presents one of humanity's greatest challenges but also limitless opportunities (Romer, 1990).

Achieving inclusive growth is essential for the Sustainable Development Goals of the United Nations. However, how to turn technological change into inclusive growth is far from being fully understood. Views differ sharply even among well-informed academics and policy makers. Some believe the technological tide will eventually "lift all boats" if markets are simply allowed to operate freely. Others think the speed and scope of today's digital revolution require policy interventions to ensure that the new technologies create equal opportunities for all and provide safety nets for the severely disadvantaged.

To better understand how digital technologies have spread, how they affect business operations, and how they serve workers, consumers, and households, we have taken a closer look at China. China is an interesting case, because of the exceptional growth it has achieved, and its rapid adoption of digital technologies. In this overview we highlight the main lessons we draw from our study, the most important one being the positive impact digitization has had on inclusive growth.

Figure O.1 Real gross domestic product (GDP) per capita across countries and regions, 1000 - 2016



Note: Three stages of economic growth: (i) no growth, (ii) industrial revolutions, and (iii) world integration (Spence, 2011).
Source: Maddison project database 2018; Luohan Academy.

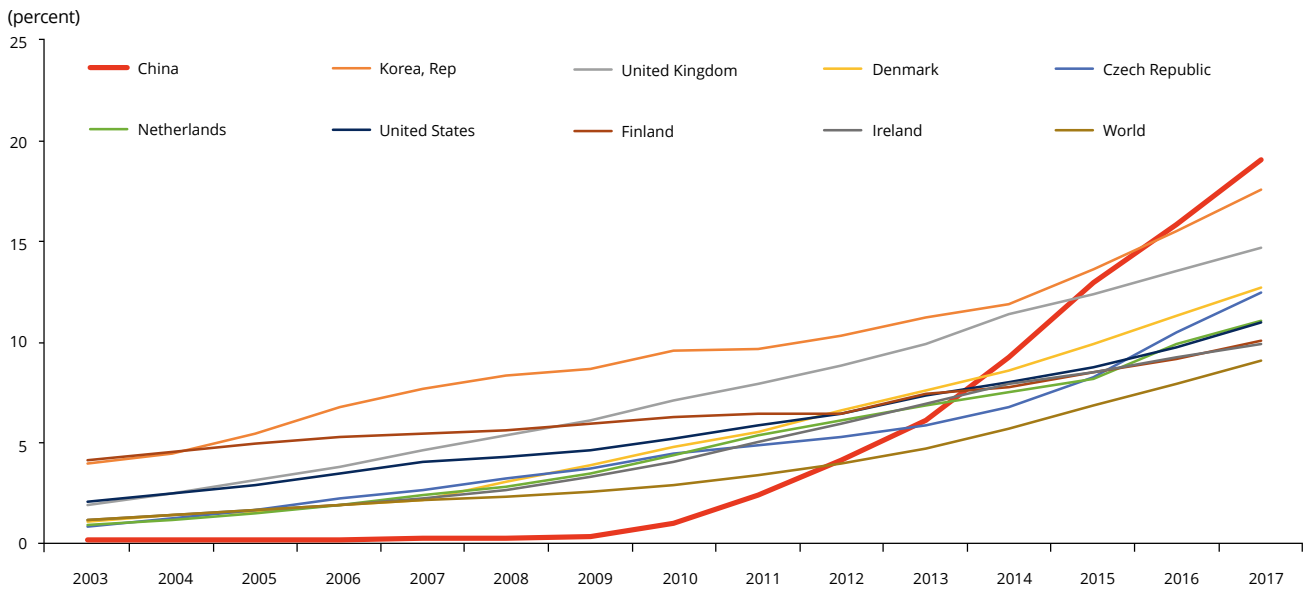
2. What makes digital technology so special?

The digital revolution stands out from previous technological revolutions for two reasons: 1) the low threshold of digital technology adoption and penetration, and 2) the low use cost and non-rivalry of digitized information.

The exponential reduction in the cost of computer processing power, along with the internet, has made possible instant sharing of large amounts of digitized information. Mobile devices, which have long surpassed the number of computers, have been especially important in expanding the reach of the internet. In 2018, the number of active internet users worldwide exceeded four billion, with more than 60 percent of the population in low-income countries having access to mobile phones. Digitized information can be replicated and used at near-zero cost. Unlike physical goods, information is a non-rival good, meaning that it allows consumption or possession to multiple users (Arrow, 1962).

These two features have profound implications for inclusive growth. The level of economic development is no longer decisive in determining the speed of technological penetration, or how fast applications of a certain technology develop once it is adopted. Many developing countries with GDP per capita of less than $5,000 have achieved roughly the same penetration rates as developed countries (World Bank, 2016). In less than 10 years, China's e-commerce market has become the largest in the world, accounting for 23 percent of the country's total retail sales in 2017 (Figure O.2). In 2011, mobile payments in China and the United States were $15 billion and $8.3 billion, respectively. By 2017, the value of China's mobile payments had grown to $22 trillion, more than 100 times that of the United States.

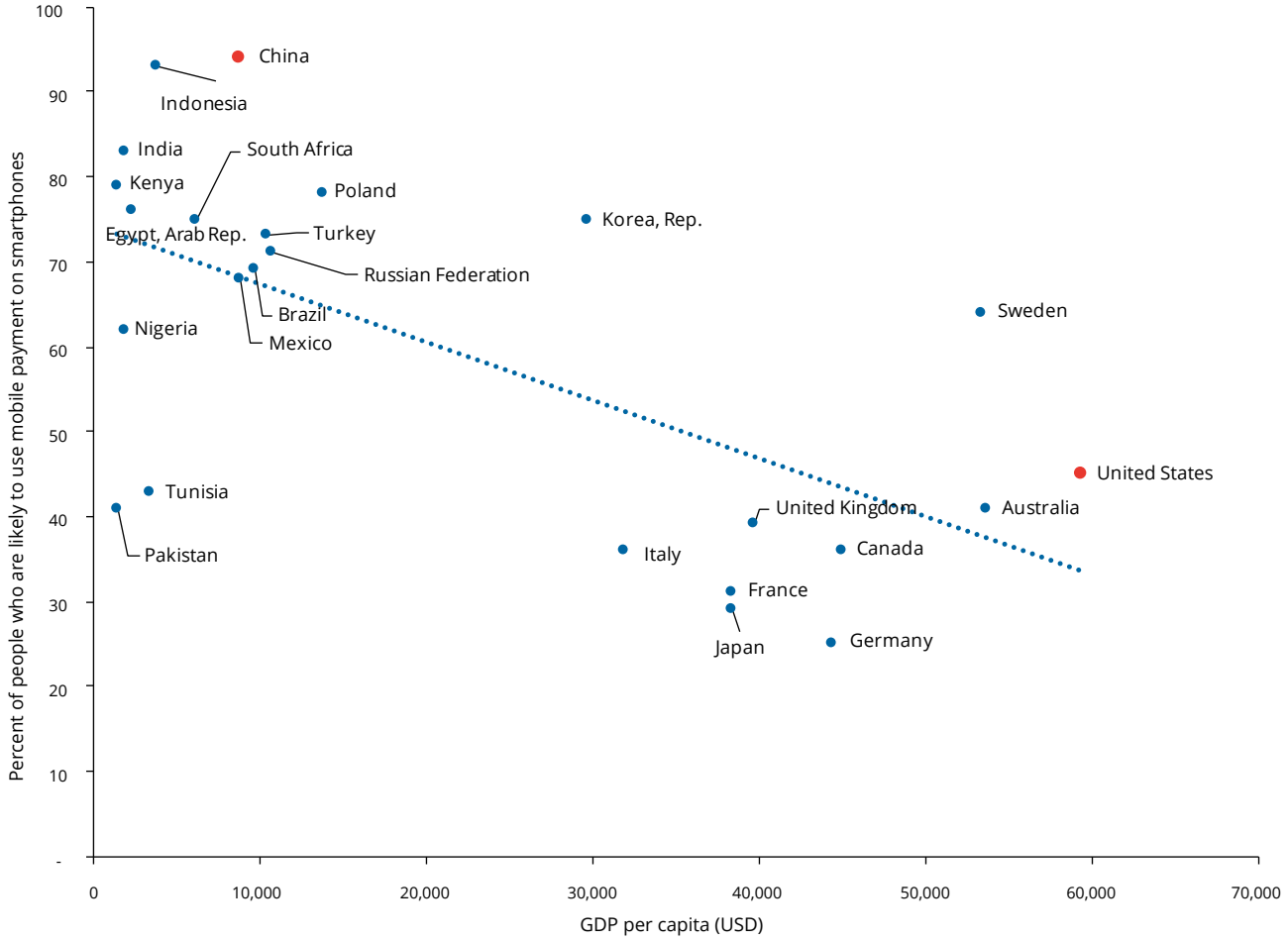
Figure O.2 E-commerce share of total retail sales, 2003-17



Source: Euromonitor 2018.

A crucial factor driving the rapid adoption of advanced digital technologies in China and many other emerging economies is necessity, as consumers had few or no other alternatives to digitalized services before. Take mobile payment for example. China was a cash economy until the mobile payment revolution, leapfrogging paper checks and plastic credit cards, still widely used for payments in advanced economies. Most Africans had no computer. Simple mobile phones were their first digital device, enabling them to be among the first to use mobile payments with M-Pesa and other creative applications of text messaging. Figure O.3 illustrates the negative relationship between economic development and attitudes toward mobile payments.

Figure O.3 Relationship between attitudes toward mobile payments and GDP per capita, 2017



Source: Centre for International Governance Innovation (CIGI) survey; United Nations Conference on Trade and Development (UNCTAD); World Bank; Luohan Academy.

3. What have we learned by studying the adoption of digital technology in China?

Message #1:
Digital technology can be an important driver of inclusive growth

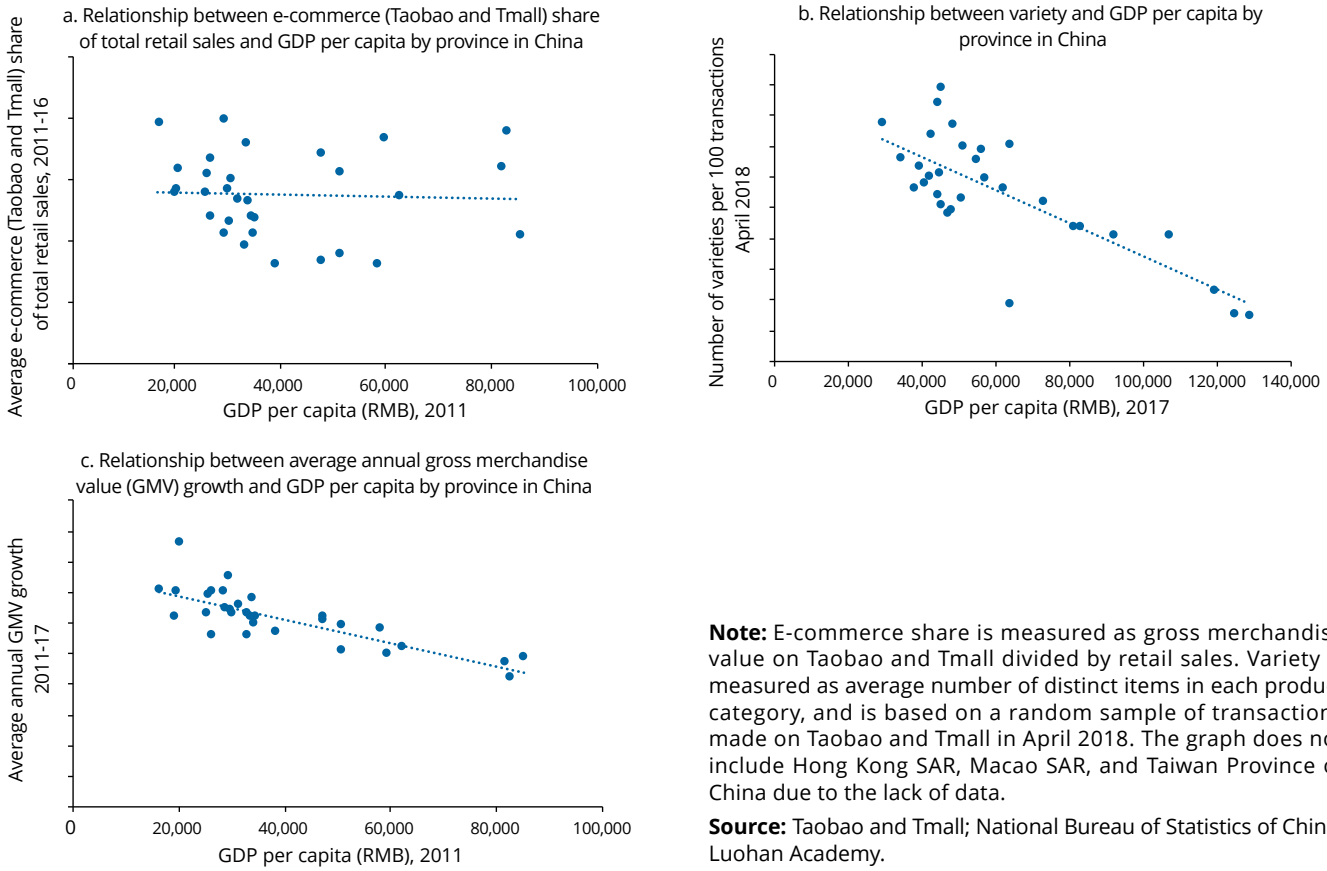
Consumers in remote and less developed regions enjoy equal access to a variety of products and services.

In pre-digital commerce, proximity to a well-developed commercial area was an important factor in determining an area's inclusiveness—only residents who lived near commercial areas could enjoy a rich variety of products and competitive prices. Digital technology has changed all that as evidenced by shopping patterns on Alibaba's Taobao and Tmall e-platforms. First, the average shopping distance on these platforms is close to 1,000 kilometers, compared with a few kilometers in traditional markets. Second, in less developed regions people spend proportionally no less than more developed regions online, and buy a bigger variety of goods on e-platforms, offsetting the disadvantages of their local markets. Third, people living in poorer regions with limited access to good retail services experience proportionally faster growth of spending on e-platforms than people in richer regions (Figure O.4).

Entrepreneurship disparities between regions, gender, income, and age have decreased.

Inclusiveness is also enhanced by helping small and medium enterprises (SMEs) to grow, especially those in less developed regions. There are 10 million SMEs and startups on Taobao, China's largest e-commerce platform. More new SMEs are emerging from more remote and less developed regions (Figure O.5). About half of online entrepreneurs are women, a larger share than their offline counterparts. E-commerce has enabled female entrepreneurs to start businesses at home and work flexible hours.

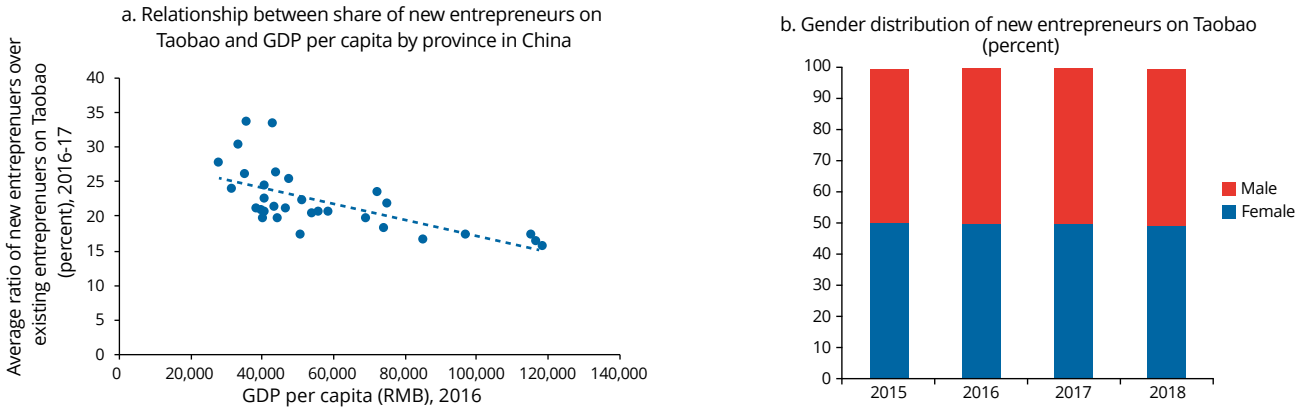
Figure O.4 E-commerce development across most regions in China



Note: E-commerce share is measured as gross merchandise value on Taobao and Tmall divided by retail sales. Variety is measured as average number of distinct items in each product category, and is based on a random sample of transactions made on Taobao and Tmall in April 2018. The graph does not include Hong Kong SAR, Macao SAR, and Taiwan Province of China due to the lack of data.

Source: Taobao and Tmall; National Bureau of Statistics of China; Luohan Academy.

Figure O.5 Inclusiveness of entrepreneurship by region and gender in China



Note: The graph does not include Hong Kong SAR, Macao SAR, and Taiwan Province of China due to the lack of data.
Source: Taobao; National Bureau of Statistics of China; Luohan Academy.

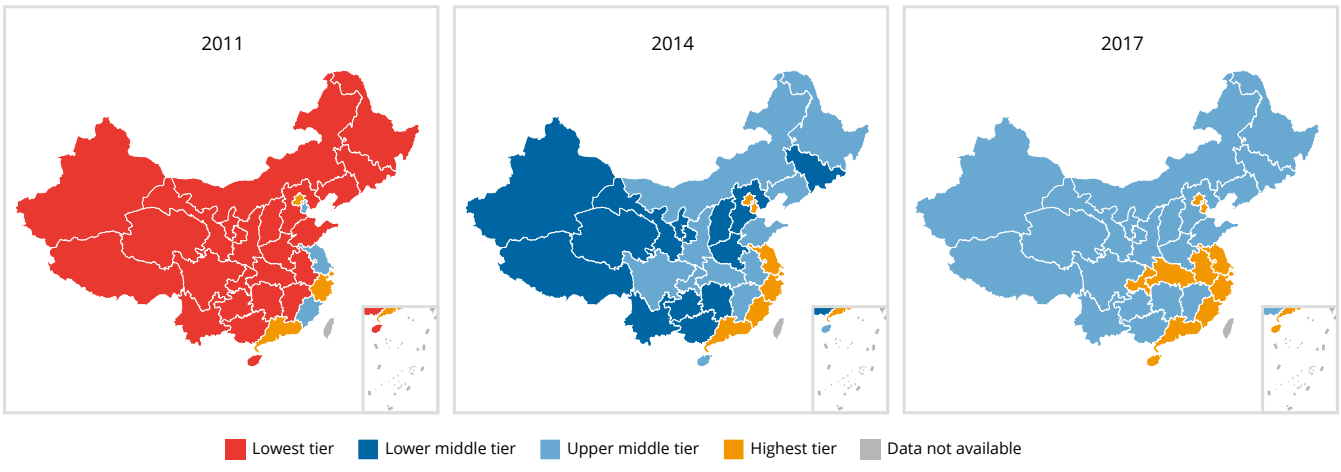
E-commerce has also benefited people with disabilities. In 2016, 160,000 online stores on Taobao were operated by people with disabilities, creating RMB 12.4 billion in sales. More than 90 percent of the sales came from such sellers with no more than a high school education. With technical support, 16,000 visually impaired people opened their own online stores on Taobao in 2016.

Financial services become much more accessible, affordable, and sustainable.

China now leads the world in mobile payments, with most of its 1.25 billion internet users using mobile payments and enjoying free money transfers. Shops pay a processing fee of 0.6 percent, among the lowest in the world. With rich contextual information and artificial intelligence (AI) algorithms, risk can be assessed accurately in real time, reducing the incidence of fraud to a fraction of what it is with traditional bankcards. Millions of Chinese startups have enjoyed access to credit without collateral. Over the past three years, Ant Financial Services has provided non-collateral micro-lending to more than eight million SMEs via the innovative "310" credit model: 3 minutes to apply for a loan, 1 second to get it approved, with 0 manual interference.

Digital financial services, covering payment, lending, wealth management, and insurance, have developed quickly across China. In 2011, substantial gap remained between the most developed regions and the rest of the country (colored in red in Figure O.6). In 2014, many regions have caught up as digital finance developed (in dark blue and light blue). By 2017, the difference between leaders and the rest (now in light blue) continues to shrink, indicating higher level of inclusion.

Figure O.6 China digital inclusive finance index, 2011 - 17



Note: For each year, regions are separated into four colored tiers covering 80-100%, 70-80%, 60-70%, and below 60%, respectively, of the maximum index value. The convergence of colors represents a reduction of digital finance inequality.
Source: Institute of Digital Finance, Peking University.

Message #2:

To promote digital penetration, lowering the skill threshold is as important as raising the level of skills.

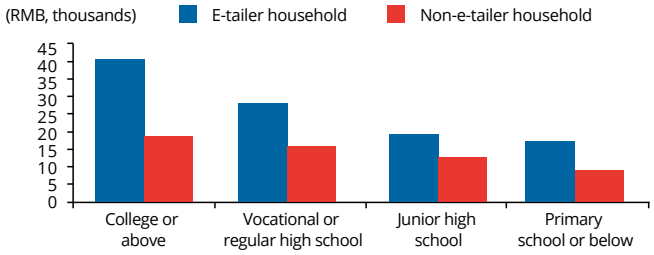
Technology penetration can be propelled in two ways once it is adopted. The first is to raise the level of education and skills of the population. The World Bank (2018) identifies many skill-related obstacles that can hamper inclusive growth, including poor early childhood nutrition, limited access to education, lack of a basic social safety nets, and weak institutions.

The second is to lower the threshold of education and skills needed to take advantage of new technology. Mobile phone and internet use enjoy unprecedented speeds of penetration across the world (World Bank, 2016). Directly and indirectly, the mobile internet has increased literacy, both traditional and digital, showing that digital adoption can be a major lever for education and should be encouraged early and inclusively.

The emergence of clusters of offline e-commerce providers in rural China, known as "Taobao villages," illustrates the power of low skill thresholds. Shaji, a Taobao village, was stuck in poverty ten years ago, relying on farming and recycling waste plastics. Han Sun, a local college dropout, succeeded by selling self-designed furniture online, quickly inspiring others. Many young villagers who had moved to urban areas seeking work returned to start producing furniture or open their own online furniture stores. The elderly, who could not move, also became involved. Even those who had never learned pinyin, the Romanized system for Chinese characters, ventured to run brisk online businesses with the aid of handwriting recognition software. Entrepreneurs such as Han Sun gained management skills and trained their staff as well. E-commerce developed logistics, component supplies, and expanded professional services such as photography and product design. China's largest e-commerce furniture cluster was created in less than ten years.

For entrepreneurs with rural "Hukou" (rural household registration), the average income of those in e-commerce business is much higher than the income of those not in e-commerce (Figure O.7). This is true for every education level. Remarkably, those in e-commerce and with junior high school or primary school degrees earn close to those not in e-commerce and with college degrees do. We find very similar patterns for Taobao villages.

Figure O.7 Median personal income by education among business owners, 2016



Source: China Household Finance Survey.

Digital technology has made learning more accessible and cost effective. For example, Taobao launched online classes in 2006 to develop the skills of small businesses. There are now 3,000 different pre-recorded classes and more than 20,000 live classes a year available in 99 percent of China's poorest counties. Taobao's public sector training has been custom designed for public servants in poor and remote areas. From 2015 to 2017, more than one million public sector participants from 765 poor counties took courses. These activities were one of the key drivers for the rapid growth of Taobao villages and towns.

One of the most well-known examples of the virtues of a low skill threshold is M-Pesa, which made mobile money ubiquitous within a decade in many developing countries. Launched in 2007 in Kenya, M-Pesa spread to ten countries in Africa and Eastern Europe, eventually processing more than six billion transactions a year for a customer base of 30 million people. To overcome information and communication technology (ICT) limitations (specifically slow or non-existent mobile internet), M-Pesa innovated on the back of existing infrastructure to provide cheap accessibility. It relied on SIM cards rather than apps, allowing basic phones to offer financial and other essential services. M-Pesa uses a dense branch network, with 40,000 branches in Kenya alone, including remote villages, that makes account registration easy.

Lee and Teo (2015) attribute the success of M-Pesa and services such as Alipay in China to the "LASIC" principle: these services have low profit margins (L), they are asset

light (A), and their design is scalable (S), innovative (I), and compliance friendly (C). In essence, scalable accessibility and affordability to take advantage of a low skill threshold are the key.

Message #3:
Digital platforms represent a new form of exchange and coordination that facilitates economic and social integration.

Digital technology has radically transformed the classic firm versus market tradeoff (Coase, 1937), facilitating the emergence of a third institutional form, the two-sided digital platform (Tirole, 2014). A successful platform allows any interested party to participate, coordinate, and contribute —increasing the value of the network by creating large numbers of interactions among participants. Buyers and sellers can rely on each other's feedback and digital footprints to find better matches for their needs. Importantly, digital platforms offer inclusive forms of coordination that facilitates economic and social integration.

Digital platforms also expand beyond e-commerce and financial services to revolutionize business operations and supply chains. For example, Alibaba's QianNiu (meaning "a thousand ox") business tool platform, used by millions of SMEs every month, incorporates thousands of third- party business tools to help SMEs with marketing, product management, online operations, customer service, cash management, logistics, business advisory and data analysis, covering essentially every aspect of running a business. The Tao Factory platform on Alibaba connects 40,000 factories from more than 30 industries with Taobao sellers to form an integrated supply chain market. Taobao sellers can sell their own brands and designs, usually starting with small and ad hoc orders, without owning manufacturing facilities. This has led to an explosive growth in product variety.

A digital platform is not a firm, but rather an economically and socially integrated ecosystem, created and overseen by a firm, and open to all interested parties. Its economic value derives from the seemingly unlimited possibility of exchange and coordination, and high efficiency, all owing to the special features of digital technology. For example, mobile payments thrived in China not as a standalone financial service, but as an essential part of trading or social interaction on the platforms. The real-time, digitized information, in turn, fundamentally changed the ease and efficiency of assessing credit risk. In this digital ecosystem, consumers and SMEs are users, producers and beneficiaries of digitized information, all at the same time.

Of course, not all digital platforms are two-sided, and they can differ in terms of inclusiveness. The experience in China and elsewhere shows that digital ecosystems, properly designed, can become powerful drivers of inclusive digital penetration.

Macroeconomists and trade theorists have long emphasized that trade and matching frictions, be it distance from market or absence of information about products and jobs, can play a significant role in explaining market failures, such as the existence of idle resources and sparse trade (Diamond, 2010; Mortensen, 2010; Pissarides, 2010; Isard, 1954). Following the intuition of Pissarides (2010), digital platforms can improve the matching technology in decentralized markets, resulting in better market outcomes for all.

The new digital information technology sheds fresh light on Hayek's seminal argument (1945) about the informational efficiencies of the decentralized market mechanism. He argued that decentralized markets process information better than a centrally planned economy and thus allocate resources more efficiently. However, we know that information imperfections often lead to market failures, qualifying Hayek's argument. By improving the information technology, the digital economy reinforces Hayek's argument—the market benefits from a new type of "wheel," the digital platform, which facilitates frictionless decentralization and deeper coordination.

Message #4:

Effective digital penetration requires an effective partnership between the public and private sectors.

The development of digital technologies and e-commerce, even more than other innovations, hinges on a clear understanding of the roles of the public and private sectors. As the World Bank's Growth Commission Report (2008) points out, the public sector has an important contribution to make in facilitating development and growth. It needs to maintain political and macroeconomic stability, implement a coherent development strategy, build infrastructure and a friendly regulatory environment and, in a best-case scenario, correctly anticipate what the private sector will need.

The Chinese government has played a very active role in shaping the country's digital development path. The new digital economy is pioneered and powered by the private sector, but also relies on the support of the public sector, ranging from a benign regulatory environment to efficient infrastructure development and local support.

Because digital technologies are so new and evolving so rapidly, the government needs to encourage experimentation, which means willingness to bear risk and accept failure. The Chinese government has been particularly successful in allowing entrepreneurs to experiment and grow. It has made digitization a priority and encouraged local governments to work closely with the private sector.

Since digital technology and economic and social integration are critical elements of inclusive growth, an active push to dismantle regional and global trade barriers and develop special economic zones with good digital business infrastructure are important priorities. This is true for both large and small economies, even in the absence of sizeable domestic markets.

Message #5:

Managing unanticipated effects brought by digital technology is challenging, but we must first separate facts from speculation and anxiety.

Against the strong evidence that digital technologies promote inclusive growth, many concerns about adverse consequences of digital technology have been raised and deserve serious attention: technological unemployment caused by changes in skill requirements, abuse of private information, lagging competition policy, and increased inequality, to name the major concerns. Hard evidence about these adverse consequences is still sparse. The academic literature is still limited, and most of the discussion has been carried out in the press and social media. We briefly examine some of the claims made about the risks that digital technologies pose.

Are machines making humans unemployable? There is no conclusive evidence that the number of jobs lost is outpacing the number of jobs created, which would lead to "technological unemployment." Global unemployment rates have remained relatively stable at least since 1991, when comparable statistics become available, even though nearly 1.6 billion people have been added to the working age population since 1991, an increase of 50 percent. Robots and artificial intelligence are still in the early stages of development and their ability to replicate sophisticated reasoning remains a matter of conjecture. Previous waves of technological change have been accompanied by fears that they would cause mass unemployment, fears that ultimately proved to be unfounded.

That said, the digital revolution will create greater "churn" in the labor market. Those who do not manage to adapt may feel excluded from progress. The obsolescence of human capital can be devastating to families and destabilizing for society if it is not accompanied by mitigating policies. The changing nature of work calls for stronger public-private commitment and collaboration to retrain current workforce and to reinvent the education system with the help of digital technology.

Are technology companies, especially those that run digital platforms, becoming too powerful? The real issue is not the size of "super platforms," but whether their dominant positions remain contestable. Our research shows that they mostly are, at least in China.

There are at least two reasons why even the largest digital platforms are not immune to competitive pressure. The first is that competing companies typically offer differentiated products. The second, and more critical, is that customers on one or more sides of the platform can "multihome" by patronizing more than one platform.

Is privacy under increasing threat? The challenge is to understand the risks and returns from data sharing from all perspectives. Since data sharing is so critical for the logic of the digital economy, it is not a matter of choosing in an absolute sense either complete privacy protection or nothing. The trade-off depends on the context. Choosing what to protect and what to reveal is made much more difficult in this context because privacy is associated with both human dignity and economic property, and inevitably different social groups have different views about the trade-offs.

There is an incipient literature addressing privacy issues. For example, privacy regulation that puts a "tax" on information tracking yields ambiguous welfare effects (Goldfarb and Tucker, 2011). Individuals rarely have a clear knowledge of what information other people, institutions, and governments have about them. They may not have a good idea of how that information is used and with what consequences. These challenges result in the classic privacy paradox (Barnes, 2006; Athey et al., 2017), that people always claim to be very concerned about their own privacy, but their online behavior tends to ignore the risks. There is certainly much the public and private sectors can do to inform and to protect consumers.

While digital technology could be the cause of privacy invasion, it could also be part of the solution. By combining techniques such as desensitization, encryption, and secure multi-party computation with user permission procedures, it is possible to alleviate a lot of the privacy-related concerns.

The relationship between technology and inequality remains unclear. Studies over the past thirty years have documented a rise in wage inequality and pointed to technological change as a potential explanation, yet the empirical evidence remains mixed. Krueger (1993) finds that workers who use computers on the job earn 15 to 20 percent more than non-users, while DiNardo and Pischke (1997) suggest that computer users possess unobserved skills that were rewarded when computers were introduced in higher paying jobs.

Clearly, the impact of technology on society is uneven. It varies with different technologies and applications. It creates winners and losers, while also generating significant inclusive impact. The benefits of new market access and opportunities are more pronounced in less developed countries, as the Chinese evidence shows. The goal should not be maintaining status quo for the sake of protecting the losers, but rather to find pathways that can drive productivity growth while sustaining equal economic opportunities for all.

We recognize that digital technology has raised complex and important social and economic issues that deserve further investigation, which will surely be a central part of our future research agenda.

4. A call for a new development paradigm

This report identifies where digital technologies have made a material difference for inclusive growth in China, and offers some insights on how to make China's experience global, especially where inclusive growth is most needed.

In our call for a new digital development paradigm, the key takeaways are:

1. Much of the debate on the impact of digital technology has focused on the costs and potential risks, but we should also pay attention to the fact that digital technology has made an invaluable contribution to inclusive growth. This has happened at both micro and macro levels. The social and economic groups lagging behind, such as women, the poor, minority ethnic groups, and the disabled have been served and empowered as never before. Some of China's remote and least developed regions have received a boost with the introduction and spread of digital technologies, with the potential to rapidly narrow the gap in market access with more developed regions. But much remains to be done in China and worldwide.

2. The positive impact of digital technology is made possible by its ability to break down critical information barriers in traditional marketplaces and to lower the skill threshold of use. The unique characteristics of digitalized markets help overcome matching, trust, and enforcement challenges. Digital platforms make markets more efficient, draw in more participants, and offer more product varieties. They play a critical role in creating integrative digital ecosystems that spur innovations and enable new forms of coordination.

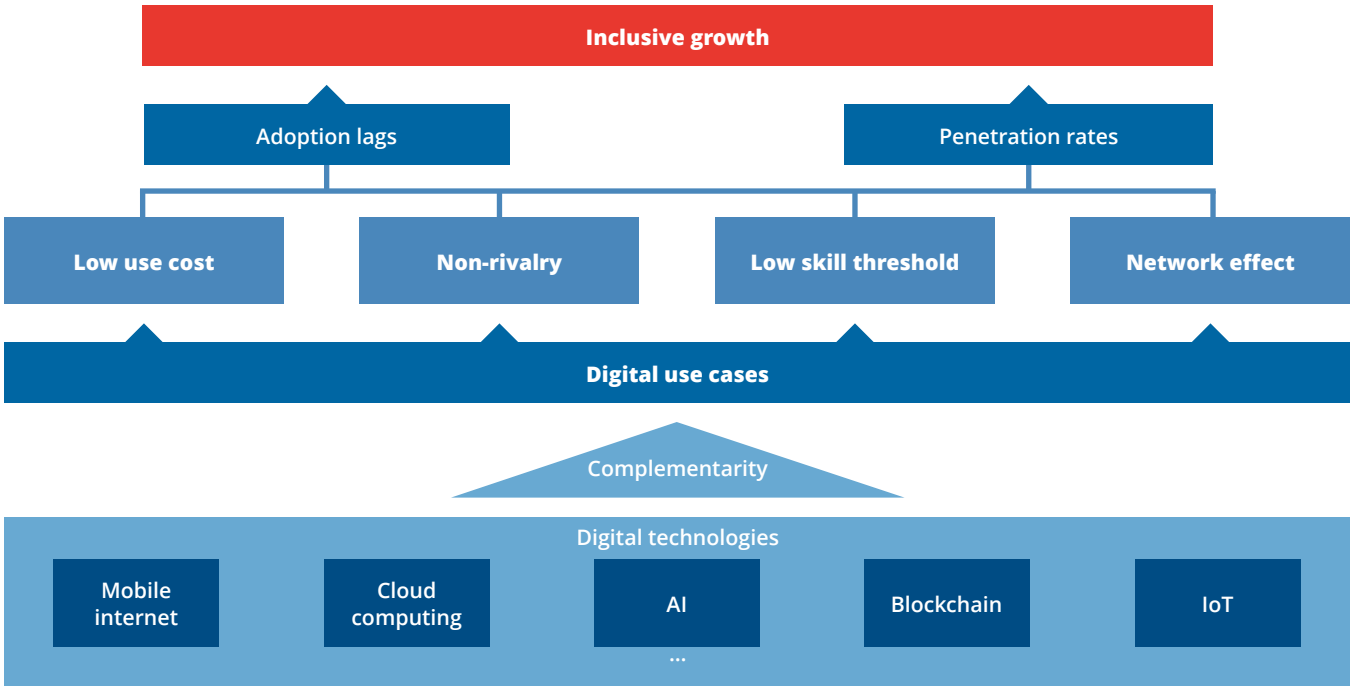
3. Infrastructure such as mobile internet and broadband access, and supportive regulatory environment, are critical. Once disadvantaged groups and regions can participate in the modern digital economy, powerful positive feedback effects on skills, training, and infrastructure development will follow in a sustainable way. To be sure, this will not happen automatically. Effective private-public sector collaboration, market integration, and leveraging the power of digital platforms are key ingredients for a successful digital growth strategy.

4. Finally, unanticipated challenges in this dynamic process must be addressed, such as the impact on employment, competition, data privacy, and inequality. Separating facts from fiction and speculation is the first step in dealing with these issues. A holistic assessment of technology's impact and specific policies to handle transitional issues will go a long way to garner support for embracing digital technology and realizing its inclusive growth potential.

Emerging markets today are confronting multiple technological revolutions simultaneously: electricity, computer, and digital technology. This means they are likely to develop along a digitization path different from that of advanced economies (Gerschenkron, 1962). For example, much of retail services in emerging markets used to be provided by local small businesses and the informal sector. With the aid of digital technology and e-commerce platforms, a great number of small and micro enterprises have emerged to serve customers even if they are thousands of kilometers away.

A new paradigm is appearing that involves widespread diffusion of smaller-scale, less capital-intensive, and more environmentally benign digital technologies that facilitate distributed and inclusive patterns of production, and produce products more appropriate to the needs of the global poor. They represent an increasingly large part of untapped human capital and consumer demand. Digital technologies are complementary to each other and create new kinds of building blocks of key markets. With the features of low skill adoption thresholds, low use costs and non-rivalry of digitized information, and network effects supported by platforms, digital technologies greatly reduce the adoption lags and lift penetration rates, thus enlarging the opportunities to promote inclusive growth (Figure O.8).

Figure O.8 A new path to inclusive growth powered by digital technologies



Source: Luohan Academy.

The more we understand the possibilities and relevant tradeoffs, the better we can implement strategies to promote inclusive growth using digital technology. In this way, creative destruction can be shifted towards creative construction.

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LuohanAcademy@service.alibaba.com

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