A Study of Employment and Talent in the Digital Economy (Part I)

Year 2035: 400 Million Job Opportunities in the Digital Age

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1. The Digital Economy’s Impact on Employment

1.1 The Impact of Previous Industrial Revolutions

The digital economy will continue the trends of previous industrial revolutions in bringing about giant leaps in human cognition and productivity. Those jumps in turn have transformed the industrial structure and greatly developed the economy. The general results on employment are as follows (For more detail, see the sidebar “Previous Industrial Revolutions and Changes in Employment”):

- **Workforce**: Physical strength matters less while mental skills gain importance. With less need for brute force, employers put greater emphasis on knowledge, skills, experience and competencies. As machines and other digital technologies such as artificial intelligence improve, more and more people are able to join the workforce, but those who do work need additional and even new capabilities.

- **Workplaces**: Industrial upgrading becomes normalized and the employment landscape is continually shifting. While machines liberate people from certain labors, they also cause the decline and disappearance of obsolete industries and jobs. New industries emerge to extend the content and boundaries of employment.

- **Work patterns**: Employment is freed from the constraints of time and space while personal values are more broadly shared. Production moved from individual family workshops to large, regimented factories, but now is returning toward individual effort tied into virtual network organizations. Employment evolved from well-defined positions and responsibilities to project teams, partnership, and freelancing, thus mobilizing and sharing individual effort more widely and freely.
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Previous Industrial Revolutions and Changes in Employment

The First Industrial Revolution, featuring the invention of steam engine and technological breakthroughs in metallurgy and steelmaking, changed employment as follows:

- **Workforce**: Machines replaced hand tools, greatly reducing the demand for manual labor and techniques, while increasing the overall working population, such as by enabling children to participate more extensively.

- **Workplaces**: Automation created a multitude of job opportunities. Less time was spent on producing basic goods, and the savings fueled demands for new goods and industries. With urbanization came expanded employment in services.

- **Work patterns**: Factories created a fixed employment pattern with an eight-hour working day. Standardization and mass production broke down the workflow into a series of specialized tasks on a line carried out by workers under central management.

The Second Industrial Revolution, featuring the invention of electricity and the internal combustion, as well as expanded railways and the automobile, made further changes:

- **Workforce**: With the demands on physical labor further diminishing, women joined the workforce in all areas and “knowledge workers” became a substantial segment.

- **Workplaces**: Large-scale job opportunities emerged as light industry became mechanized into factories. Unified national markets of goods and services created new jobs as well; Managerial structures also developed.

- **Work patterns**: As industry became increasingly capital-intensive, individual workers were more “locked” in the industrial chain. Companies fostered a long-term and stable employment relationship, and organizations developed a clear division of functions according to a definite hierarchy.

The Third Industrial Revolution, featuring the early achievements in nuclear energy and information technology, transformed the landscape further:

- **Workforce**: Knowledge and skills became an increasingly important employment threshold. With the generational gap in capabilities, the economy went through multiple waves of layoffs even as companies faced shortages of some skilled groups.

- **Workplaces**: Computers replaced some manufacturing and management functions and boosted the demand for engineers. World trade became an important source of employment...
1.2 The Impact of Digital Technology: Business Logic, Organizational Structure, and Worker’s Capabilities and Values

We are now in the Fourth Industrial Revolution, as advanced by new digital technologies such as cloud computing, big data, artificial intelligence, and the “Internet of Things”. While further driving global economy, these technologies are bringing revolutionary changes to employment. We see the disruption in these three areas:

- **Business logic**: Digital technologies are remaking the business logic and operations of traditional industries. For example, e-commerce challenges retailers’ traditional idea of “channel dominance”. It is prompting retailers to shift toward a “customer-centered” philosophy that focuses on building integrated user scenarios combining the online flow platform with the offline retail network, and employs big data to predict consumer behavior and sharpen business insight. Alibaba has invested in Intime Department Stores, while Yonghui joined hands with jd.com and Suning has initiated its online-to-offline transformation. Manufacturers are targeting a fully automated production line integrated with suppliers’ systems in order to achieve responsive, flexible production in small quantities and diversified types under the “Consumer to Business” model. The financial industry has used internet connectivity to better meet the needs of individuals and small enterprises, and to rebuild the social credit system.

- **Organizational structure**: Digital technologies promote collaboration inside and outside organizations and tie it closely to business demands. The costs of communication and coordination fall significantly. Flat organizations and lean management further increase efficiency by removing redundancy. The boundaries among organizations blur as companies adopt more open platforms that support internal and
external individuals in quickly responding to market demands and customer needs, and even establish an ecosystem around itself. These platforms work to maximize the overall interests of the ecosystem through the integration of resources.

• **Capabilities and values:** Digital technologies have enhanced workers’ labor capabilities and fostered a new work ethic in the youth. While these technologies continue to replace human labor, they have also instilled new values in “digital natives” who have grown up with them. Comfortable with an open, liberal, equal, sharing, transparent, and diversified environment, they readily accept a work culture that is crowd-sourced, collaborative, trial-and-error based, iterative, non-hierarchical, miniaturized, and modularized. They also are more likely than their elders to pursue self-realization and work-life balance.

2. **Profile of the New Employment Landscape in the Digital Economy**

2.1 **Differences Between Employment in the Digital Age and Traditional Employment**

Building on the previous industrial revolutions, we believe that the increasingly digital economy will strengthen some areas while diminishing others:

• **Changing workforce:**
  ◦ **Strengthening:** Both professional skills – especially in applying digital technologies, and intangible competencies such as sociability and creativity that machines mostly cannot imitate, will drive employment, especially for senior level jobs.

Recent studies suggest that 55 to 77 percent of current jobs in China are susceptible to automation because they require fewer skills. (See Exhibit 1.) As digital technologies are integrated into all industries, most jobs will need to make use of them. Marketing, for example, is shifting to digital marketing and business analysis is transitioning to big data analytics. People with integrated skill sets and competencies that are not easily replaced by technology will enjoy a wider career path and advantages in reaching the top, and will gain the most attention in the war for talent. (See “A Study of Employment and Talent in the Digital Economy, Part II”.) The World Bank has a similar conclusion: “Workers with
technology savvy will have higher productivity and pay; those who fail to upskill will have to compete for low-level jobs.”

- **Diminishing: Physical abilities and even location will matter much less.**

Smart robots are reducing the physical demands on autoworkers, freeing them from lifting heavy objects or maintaining an uncomfortable posture. (See Exhibit 2, and “Man and Machine in Industry 4.0,” BCG Focus, April 2016). Meanwhile individuals or small organizations in remote locations will have access to work opportunities throughout the world. The Alibaba retail platform brought together 15,000 “Tao Factories”, formed a number of processing industry groups, and gave birth to 1,311 “Taobao Villages” – 18 of which are in China’s poverty-stricken counties.¹ Upwork, zbj.com, and other employment platforms for freelancers make remote employment possible and help low-cost skilled labor in developing countries to obtain jobs from developed countries. Upwork ranks India and the Philippines after the United States as the second and third largest sources of its workers.
• **Changing employment fields:**

  ◦ **Strengthening:** Employment will grow in digitized basic services as well as in the digitization of legacy industries. Jobs will also emerge from the new business models created by digital technologies.

  Of the top ten Chinese industries with the strongest demand for talent, three are directly related to the digital economy: Internet commerce, computer software, and IT services (system/data/maintenance). Yet the digital transformation of many traditional industries also creates a high demand for people with both business acumen and technology proficiency – further fueling the growth of functions such as software development, system integration and product/operations management. (See Exhibit 3.) Finally, the new business models created by digital companies are boosting employment both directly, in e-commerce platforms and supporting services, as well as indirectly, as improved transaction efficiency stimulates greater demand for sellers’ goods and services. Alibaba e-commerce retail platform alone has created an estimated 31 million job opportunities.²

  ◦ **Diminishing:** Digital technologies are reducing employment in some indus-
tries and functions. Some standardized, procedural, non-mental work will be replaced by low-cost technologies. We believe, however, that overall, digital technology will stimulate more employment than it will reduce.

Take Germany’s Industry 4.0 as an example. Robot-aided production and unmanned distribution tools are expected to cut about 610,000 jobs by 2025 in such areas as assembly, packaging and production. But 960,000 jobs will likely be created in information technology, which is still a net increase of 350,000 jobs for the manufacturing sector.\(^3\) In order to make this happen, however, assembly line workers whose jobs are partially replaced by technology, will need to upgrade their abilities to better work with machines, especially around flexibility and problem solving. In China’s retail industry, for example, the demand for assistants in physical stores is still growing even as e-commerce has disrupted offline channels. (See Exhibit 4.) Online and offline channels are becoming integrated and jointly promoting rising consumer demand – but only because store assistants are upgrading their skills. They are giving personalized recommendations rather than general information that customers can already obtain on their own. They can also offer social interaction with fans, and even the chance for customers to design personalized products.

### Exhibit 3. Digital-related Industries and Functions Generate Huge Job Opportunities

<table>
<thead>
<tr>
<th>Rank</th>
<th>Industry</th>
<th>Rank</th>
<th>Profession</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Internet/E-commerce</td>
<td>1</td>
<td>Sales</td>
</tr>
<tr>
<td>2</td>
<td>Fund/Securities/Futures/Investments</td>
<td>2</td>
<td>Administrative/Logistics/Secretarial</td>
</tr>
<tr>
<td>3</td>
<td>Real Estate/Construction/Building materials/Engineering</td>
<td>3</td>
<td>Software/Internet development/System Integration</td>
</tr>
<tr>
<td>4</td>
<td>Education/Training/Universities and research institutes</td>
<td>4</td>
<td>Sales management</td>
</tr>
<tr>
<td>5</td>
<td>Computer software</td>
<td>5</td>
<td>Finance/Audit/Tax</td>
</tr>
<tr>
<td>6</td>
<td>Professional services/Consulting</td>
<td>6</td>
<td>Customer service/Pre-sale/After-sale technical support</td>
</tr>
<tr>
<td>7</td>
<td>Trading/Import &amp; export</td>
<td>7</td>
<td>Education/Training</td>
</tr>
<tr>
<td>8</td>
<td>FMCG</td>
<td>8</td>
<td>Human resources</td>
</tr>
<tr>
<td>9</td>
<td>Media/Publishing/Television/Culture communication</td>
<td>9</td>
<td>Marketing</td>
</tr>
<tr>
<td>10</td>
<td>IT services (System/Data/Maintenance)</td>
<td>10</td>
<td>Internet product/Operations management</td>
</tr>
</tbody>
</table>

Changing work patterns:

- **Strengthening**: Digital technologies are creating a new engagement model where people collaborate freely by gathering on demand. “Slash” workers can hold multiple positions in order to better demonstrate their personal value.

Cloud computing, location-based services, and mobile payment technologies, fueled by the popular interest in sharing, are facilitating employment and entrepreneurship. A skilled independent person or entrepreneurial team with skills can access a digital platform at any time to obtain “on-demand” contracts and generate value. People are shifting from a stable “company + employee” relationship to a flexible “platform + contractor” structure, as they no longer need employment to gain labor qualifications or social recognition. The Didi transportation platform, for example, now has 13.3 million drivers.⁴

These platforms will create a great deal of entrepreneurial employment. Alibaba’s cloud ecosystem, for example, has generated 1.2 million job opportunities⁵ at start-ups. The platforms will also boost employment among supporting ser-
services and functions, including many positions in management, coordination, and operation, in order to maintain those temporary contracts and cooperative relations. Here as well, the relationship between the platform and the individual will evolve from management control to individual empowerment, enabling workers to fulfill contracts on the platform. Organizations will shed unnecessary hierarchy and provide maximum equality and freedom, all to fully mobilize individuals’ self-driven power and efficiently integrate the massive amount of fragmented, underused resources.

- **Diminishing: Older employment relationships will be challenged as digital natives with their new work culture become the dominant workforce.**

Digital natives are used to performing multiple tasks simultaneously and using technology to socialize and to exchange information at all times. They are less dedicated to organizations than their elders, and they see employment less in order to make a living and more as an important path for self-achievement. They like to pursue changes and new stimuli, they favor an open, free, and relaxed corporate culture, and they are eager to challenge themselves with the emerging digital professions such as Internet host and web celebrity. All of these challenge the traditional employment culture with a given responsibility scope, emphasizing rank or hierarchy and a long-term relationship. A growing number of these new entrants to the workforce choose to become “Slash”. Currently, over 70% of freelancers in China were born after 1985. (See Exhibit 5.)

We expect the two employment ecosystems to keep a positive dynamic that maintains mutual development and fosters integration. (See Exhibit 6.) While people with digital skills will work with machine intelligence to form the backbone of the new workforce, many will still prefer a traditional relationship with employers. But those traditional organizations will also create flexible internal job markets similar to that of the external platform. And in response to the increasingly complex, diverse, and strong demands of their customers, they will eventually expand their talent pool with competitive task outsourcing platforms and external expert networks.

### 2.2 China’s Overall Job Opportunities for the Digital Economy in 2035

With the largest number of Internet users in the world, China’s digital economy has developed rapidly and driven great social progress in its short history.

To estimate the impact of the digital economy on future employment in China, we use
the e-GDP indicator that quantifies the digital economy by expenditure. (See the sidebar “E-GDP Methodology”.) We assume that each component of e-GDP generates job opportunities at approximately the same rate. We also assume this job generation rate will decline by 6% annually, from one job per US$12 in 2015 to one job per $39 in 2035. At that later point China’s digital economy will comprise 48% of the overall economy, account for $16 trillion in spending, and offer total job opportunities of 415 million. (See Exhibit 7.)

E-GDP Methodology

BCG first put forward the e-GDP concept at the G20 meeting in 2011 and has continually revised it since. E-GDP tracks expenditures to assess all activities associated with the production, service delivery and applications of digital devices, as well as e-commerce itself, in these areas:

Consumer: Personal purchases of goods and services through the Internet; and also spending for Internet access, and for devices that allow Internet access including hardware, software, broadband,
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**E-GDP Methodology (Continued)**

- **mobile Internet access and smartphones.**

**Investment:** Private capital expenditure of all telecommunications companies as well as investment in Internet-related information and communication technologies (ICT).

**Government:** Spending on ICT infrastructure construction, including software, support services and government subsidies.

**Net exports:** The difference between import and export values of all goods, equipment and services related to ICT.

**Other:** The main other element of China’s digital economy involves Internet-based transactions between individual sellers and individual consumers, especially C2C, much of which takes place on Taobao.

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**Exhibit 6. Digital and Traditional Employment Will Coexist and Develop in an Integrated Way**

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**Source:** BCG analysis.
If Alibaba-generated employment has the same share of China’s digital economy in 2035 as in 2015, the platform will create 112 million jobs. If Alibaba’s emerging businesses, such as cloud computing and digital entertainment, play a strong future role as well, we can expect another ten million jobs by 2035 – for a total of 122 million jobs. (See Exhibit 8.)

3. In-depth Studies of Four Major Employment Sectors

To better understand the employment dynamics of the digital economy, we studied four major economic sectors in depth: new retail, pan-entertainment, new finance and new manufacturing. We chose these because of their large workforces, their broad inclusion of sub-sectors, their high digital penetration, and their broad prospects for future development.

3.1 New Retail

China’s total retail sales of consumer goods exceeded 30 trillion RMB in 2015, of which 4
As online shopping continues to expand, it also provides tens of millions of new jobs for specialists, such as “Tao Ladies”, store designers, and shop operators. Taobao Village and other networks are boosting employment in remote rural areas.

Digitization will penetrate retail even further with the emergence of the “new retail” concept in 2016. This new approach relies on modern logistics and digital management of people, data, supply chains, goods and services to seamlessly integrate online and offline transactions. It differs markedly from both traditional retail and e-commerce:

- **The best of both worlds:** Online operation offers 24-hour display of goods at low cost, tied closely to actual orders regardless of distance. Offline shops give customers real experiences with personal service and an emotional bond, as well as convenient distribution within a small range. The new retail turns online and offline into a two-way channel for real-time sharing of scenarios, data, and resources.
• **From passive response to active allocation:** Companies will increasingly use data to predict consumer behavior and regain the initiative in the value chain. They can forecast demand, allocate product and service resources in advance, and even transmit data to the back-end of the supply chain to achieve flexible production and non-stock sales.

These trends will deeply affect employment. (See Exhibit 9.)

• **Upgrading offline jobs to create personalized experience.** The new retail shifts physical stores from displaying merchandise to providing consumer experiences with personalized service. Unskilled store clerks will be gradually replaced by large touchscreens, mobile apps, and shopping guide robots that can provide a better experience at lower cost. The U.S. company Lowe’s uses “Hololens” augmented reality glasses to show consumers how various household products would appear in their homes. Adidas stores include large screens for shoppers that display recommended products (including product details, inventory details, sales promotion videos, and reviews from social media), adjusted according to the automatic gender-detection system and any available big data. Blue Nile, an online jewelry retailer, has set up physical stores for

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**Exhibit 9. Changing Employment in New Retail**

<table>
<thead>
<tr>
<th>Online e-commerce</th>
<th>Offline retail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brought tens of millions of job opportunities over the past few years</td>
<td>Upgrading offline jobs to create personalized experience</td>
</tr>
<tr>
<td>14.89 million Upstream and downstream industries</td>
<td>• Standardized services are replaced by big touch screens, mobile apps, and automatic shopping guides</td>
</tr>
<tr>
<td>4.18 million Express + e-commerce third-party services</td>
<td></td>
</tr>
<tr>
<td>11.76 million Shopkeepers taobao.com</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Catalyzing cross-field opportunities and a two-way workforce flow</td>
<td>• Omni-channel operation</td>
</tr>
<tr>
<td>• Digital marketing</td>
<td>• ...</td>
</tr>
<tr>
<td>• Digital customer experience</td>
<td>• Store operations</td>
</tr>
<tr>
<td>• ...</td>
<td>• Business attraction and expansion</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Overhauling warehousing and distribution jobs</td>
<td></td>
</tr>
</tbody>
</table>

Sources: “A Study on the Employment Acquired and Driven by Alibaba Online Retail Platform”, September 2016, Labor and Human Resources College, Renmin University of China; BCG analysis.
do-it-yourself products, with in-store assistants guiding consumers on jewelry design, crafting and accessories.

- **Catalyzing cross-channel opportunities and a two-way workforce flow.** As offline stores take on digital capabilities, they’ll create strong demand for digital talent. Traditional retail functions will require digital skills. Now point-to-point digital marketing channels are replacing the traditional one-way advertising-based communications, so marketers will need to be familiar with the new promotional models. Some e-commerce companies will offer independent, non-integrated offline channels, and will create traditional retail job opportunities there. But most of the job growth will go to people with the digital skills to support all-channel operations.

- **Overhauling warehousing and distribution jobs:** The back end of new retail will also look quite different. Sophisticated automation technology for picking and sorting, as seen in Amazon’s robots, Cainiao Network’s logistics data infrastructure, and jd.com’s “Asia One” intelligent warehouse, will take over much of this function. Delivery over the “last mile” may still rely mainly on human workers for some time to come due to the geographical constraints, but even here, drones will take on some of the work. More importantly, as security and quality improve, the sharing economy will integrate scattered human labor and transport resources to create work opportunities in personalized express delivery on open logistics platforms. Meanwhile big data analytics, artificial intelligence and GPS will substantially reduce the employment of people to provide logistics information and support for these deliveries. In all of these activities, machines will replace repetitive human labor for the physical movement of packages, but will create jobs in research and development, manufacturing, and maintenance of this intelligent distribution system.

### 3.2 Pan-entertainment

Since “cultural development and prosperity” was promoted as a national strategy in 2011, China has seen accelerated development in this area. In 2015, 6.5% of GDP growth was contributed by cultural, entertainment, and related industries. The digital economy, represented by the (mobile) Internet, certainly plays an important role here. China presently has 307 million online readers, 391 million online gamers, 514 million online video viewers, and 502 million online music listeners. Digital technologies are transforming these industries:

- **From separate industries to a self-circulating ecosystem around substantial intellectual property:** To expand their returns on IP investments, the major enter-
tainment companies are building pan-entertainment spheres covering literature, animation, film and television, games, derivatives, and theme parks. These encompass digital high-quality content production through to final presentation and realization – with unified high-quality IP that reaches consumers in diverse formats in different settings and stimulates the “fan economy”.

- **From the elite culture to the celebrity economy:** Also feeding the “fan economy” is the democratization of production. Digital natives are comfortable with collaborative creation, and they are expanding cultural and entertainment production beyond corporate labels. Any individual or small group with skills and distinctive personalities can create fan circles and stand on the mainstream cultural stage, and generate real revenue. The output value of the Chinese celebrity industry may reach as high as 58 billion RMB in 2016. This trend will intensify with more digital natives coming of age.

- **Expanding the application of data to drive business decisions:** Industry leaders such as Netflix and Spotify have long applied analytics, but now the web of data application is much broader. Taopiaopiao is integrating the consumer, social, and entertainment data derived from the Alibaba ecosystem (including Alipay and Taobao) to predict movie sales and optimize the order of movie listings. Data capture in the future may expand to the Internet of Things. Refrigerators and dining tables may display media content. Augmented reality and virtual reality may create new industrial chains to supplement those for the PC and the Internet.

These trends will affect employment as follows. (See Exhibit 10.)

- **From professional workers to industrial innovators:** “Content is king” in era of big IP, so companies will focus on developing high-quality IP and applying it to diversified businesses. Jobs in traditional media operations, game production and other area will need to add interdisciplinary knowledge, skills and experience. Workers will also need to enlarge their vision, broaden their thinking, and take initiatives to cross traditional boundaries. They may even seek cooperation with erstwhile industry competitors.

- **Expanding the supply of content contributors:** Meanwhile the digital age is lowering the entry barrier for producing and sharing creative content. The business model that translates the web traffic into economic value is more sophisticated; and the demand for original content is more robust from the new generation of digital entertainment consumers. Online platforms are generating series of new professions, such as Internet host, individual media operator, online novelist, online video maker and
online celebrity. These positions offer a flexible working model in line with the expectations of workers in creative industries, yet also can bring in substantial income. So they are attracting many workers currently working at conventional cultural and entertainment institutions.

- **Eliminating some positions while creating others that require high-level technological expertise.** Filmmakers can now use big data to predict customer demands for a particular scenario, which will replace conventional market research and improve the efficiency and quality of production. They can focus their energy and judgment on areas that require a human touch, such as maintaining and expanding the relationship with stakeholders or parties of interest. Companies also need to recruit digital experts to build the basic models of big data. In VR animation and game art, as well as in computer vision, computer-generated artists and interactive engineers, will see growing demand.

### 3.3 New Finance

Digital technology is reducing information asymmetry, so customers can better promote
their specific financial needs. It also boosts companies’ internal operational efficiency. When combined with e-commerce and consumer payment platforms, the new financial models play an increasingly important role in addressing the pain points of small-and medium-sized enterprises. Internet-based finance is booming in China, with revenues exceeding 10 trillion RMB already in 2014. Its rapid expansion is playing out in several ways:

- **Users: Stimulating a deeper level of demand.** More and more industry players are breaking from traditional value chain thinking and focusing on user needs. By combining finance with daily life and work settings, they aim to dominate the field with new products and services. They are better connecting users with the cloud (cloud computing, credit platform, data services and other infrastructure), and the end scenario and product. Alibaba’s Alipay, for example, has gradually evolved from a payment tool to a platform that covers routine tasks, social life and services for 450 million users.

- **Technologies: Tapping new financial opportunities.** As an industry with rich data resources, finance has become a demonstration field for big data applications. These include personal and corporate credit systems and precision marketing for segmentation and cross-selling, as well as improved product models and operating efficiency. With improvements in data processing technology and information security, these innovations will spread widely.

- **Channels: Shifting simple transactions online.** Already over 80% of transactions in four largest state-owned banks of China run through electronic channels. In the future even more low-value and standardized services will be transferred to virtual counter systems (VTS), electronic channels and the third-party Internet financial platforms. These changes will drive several changes in the job market, particularly around the digital transformation of traditional financial institutions. (See Exhibit 11.)

- **Reducing labor and upgrading workers on value-added services.** Companies are streamlining operations by removing internal processes such as multi-level credit approval and paper form verification. One well-known bank employed cloud technology and standardized tools to achieve synchronized transfer of business data from branch offices to the back-office approval departments, thereby eliminating repetitive approvals at the branch level. Commerzbank expects by 2020 to digitize 80% and remove 9,600 jobs. ING is looking to close 600 branches by the end of 2021, and use the savings to develop e-banking platforms.
Similar to offline retail, some branches will remain to provide specialized, experiential, differentiated value-added and customer-centered services, especially in integration with other channels. Their service personnel will focus on capturing new demand, providing professional services, and building emotional bonds with customers. Umpqua Bank in the U.S., which won the Retail Design Institute’s 2013 Store of the Year Award, re-designed its branch layout around the store-and community-centered concept. It offers free coffee, ice cream, iPad product information, and even a late-night movie or yoga sessions. It feels like walking into a neighborhood retail store where customers can freely chat and interact with the staff knowledgeable about all kinds of banking products. Through this emotional connection, the branch can discover potential business opportunities.

Again as with retail, digital transformation in traditional finance will generate new jobs with new tasks, such as digital insights, digital channels, digital marketing, digital risk control, digital security, digital innovation, and digital infrastructure. Some of these will completely change existing job functions, while the others will require only upskilling the existing staff.

- **Catalyzing cross-field opportunities and a two-way workforce flow.** Traditional
financial institutions are strong in risk control and management as well as product design, while digital infrastructure, new channels, and new scenario construction are areas of improvement. Internet-based financial players, by contrast, have better digital platforms, access points for Internet users, and practical experience in integrating platforms with financial instruments. These two types of players will carry forward their existing advantages, but will also have to recruit talent from each other in their respective areas of improvement. This recruiting will increase the demand for people skilled in both areas, a combination that will especially boost opportunities for product design to meet more refined requirements from customers and platforms.

- **Cashier positions are decreasing.** As people move from physical cash to credit cards and now Internet payments and NFC payments, they are eliminating a great deal of cumbersome, repetitive human labor. The unmanned supermarket model, such as Tesco’s “Scan as you shop” (the consumer scans goods and pays at the checkout counter) and Amazon’s “Amazon Go” (consumer’s identity and product information complete the automatic identification and billing in the virtual shopping cart), will become increasingly popular.

### 3.4 New Manufacturing

Digital technologies are driving new manufacturing practices in China. The Made in China 2025 Blue Book (2016), a national programmatic document for Chinese Industry 4.0, describes the next round of large-scale transformation with the following characteristics and trends:

- **Production Facilities: Continually improved smart factories and machinery.** The Industrial Internet and simulation technology will further drive the intelligence of manufacturing plants and machines, especially in collecting information independently, predicting errors, and adapting to changes.

- **Production Chain: Flexible manufacturing will meet customer needs with high precision.** Many leading Chinese companies, such as www.homekoo.com, Qingdao Rcollar Group and Haier Group Interconnection Factory, are customizing product design and then producing on a large scale according to individual demand, with rapidly iterated innovations. As costs fall, this consumer-to-business (C2B) effect will gradually extend to the upper industrial chain, such as cotton-growing in textiles.

- **Production Network: Aggregating firms toward real-time matching and collaborative production.** Network is a key force in the new manufacturing. Traditionally
independent factories will be integrated through system sensors, machines and IT systems. People, machines, and components will interoperate through data in the cloud, forming connections. The European Aerospace & Defence Industries Association, for example, use the AirDesign platform on a private cloud to enable all manufacturing and design partners to interact with complex product and production data.

• **Products: Prospects for intelligent products.** Smart home appliances have become a transformative path for many traditional manufacturing enterprises, and drawn close attention from Internet giants.

We believe that the new manufacturing will not substantially reduce overall employment in the short term. Instead, it will create more diverse and valuable opportunities, and upskill the workforce. And by upgrading industry, stimulating competition, and lowering prices, it will expand the market and indirectly create jobs. Here are some specific impacts on employment. (See Exhibit 12.)

• **Upgraded job functions and partial job replacement.** Smart factories will reduce the need for low-skilled workers, but they cannot completely replace the human

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**Exhibit 12. Changing Employment in New Manufacturing**

<table>
<thead>
<tr>
<th>Upgraded job functions and partial job replacement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workers:</td>
</tr>
<tr>
<td>- From physical to mental labor</td>
</tr>
<tr>
<td>- From routine to agility</td>
</tr>
<tr>
<td>- From simple operation to solving diverse problems and applying simple digital technology</td>
</tr>
<tr>
<td>Replacing:</td>
</tr>
<tr>
<td>- Quality controller (by big data analysis)</td>
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<td>- Logistics personnel (by auto-drive technology)</td>
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<td>- Supply chain planning and operation coordinator (by intelligent supply network technology)</td>
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<th>New technology-based positions</th>
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<td>A broader range of workers enabled by collaborative production</td>
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Source: BCG analysis.
workforce. Jobs that are not replaced by machines will inevitably require strong skills in technology and problem solving, as well as higher-level of flexibility. They will generate value where intelligent machines are not yet available or capable. A machine operator may no longer need to know the operating manual – machines can automatically display the operating steps – but will need to use the new digital software or system. He or she may also need to handle watching over a variety of intelligent machines and production lines simultaneously, so multitasking will also be stressed. Digital technology will also replace some quality control workers with big data analytics, and replace some logistics personnel with unmanned technologies. Intelligent supply network technology will reduce the number of jobs in the planning, operation and coordination of supply chain.

- **New technology-based positions.** Meanwhile some sophisticated and high-tech jobs will be created in hardware, software, data science, digital engineering, and human-computer interaction. Industrial robots require R&D, design, testing, management, and maintenance personnel (such as automation coordinators, image recognition engineers, network security scientists, and speech synthesis engineers). Production line simulation will require industrial engineers and simulation experts, while big data will increase industrial data scientists and self-organizing production will drive positions in data modeling and analysis. These jobs require not only strong digital skills but also manufacturing expertise such as knowledge of process and equipment.

- **Positions in smart machine manufacturing and smart home sectors.** The making of intelligent machinery will thrive and bring large-scale employment, while intelligent home appliances will create opportunities in the hardware, super application, cloud platform, and data fields.

- **A broader range of workers enabled by collaborative production:** Manufacturing network platforms such as “Tao Factories” will expand industrial employment to a wider range of people. Digital skill, not physical abilities, will determine who does the work.

### 4. Implications for Stakeholders

#### 4.1 Individuals

With machine intelligence taking over ever more human labor, people will need a higher level of technical skill (especially digital skill), social skill, creativity, flexibility, and learn-
Cross-sectoral professional skills and expertise will also become more desirable. The digital age also requires an all-embracing mindset that seeks common ground in diversity and actively participates in virtual, cross-team, cross-organizational, and even cross-platform collaboration. Diversified working patterns give individuals more choice but also demand self-reliance, self-governance, and the taking of initiative. Only people bearing the traits above can achieve an independent and fun life style as a “Slash”, while realizing personal values and giving meaning to life in the digital age.

4.2 Organizations

The strong demand for emerging digital talents, diversified employment patterns and individualistic work cultures will challenge corporate talent management. First, companies need to assess their digital talent gap, improve the capacity and capability of the human resource by helping employees adapt to digital transformation – especially executives and digital staff. For example, they can provide immersion-training programs to inspire new thinking styles, and design accelerated promotion paths for young talented recruits. Second, they need to reshape their relationship with talented employees, redefine the employer value proposition, and strive to be more appealing to current employees and external candidates. For example, they can establish a “sub-ecosystem” for digital talents’ further development, and adapt management styles based on the traits and preferences of Millennials. Third, companies need to actively integrate the diverse talent acquisition channels to build human capital more effectively, as with open employment and entrepreneurship platforms that cut across company boundaries. They can actively empower the flexible workforce within their ecosystem.

4.3 Government

Based on these trends, we recommend that the Chinese government formulate initiatives in the following areas. First, a fundamental reform in the existing university and vocational education curriculum should be carried out to boost digital and related application skills of both professional and blue-collar workforces. For example, the government can encourage cooperation between universities and enterprises to increase the proportion of digital technology courses in general education courses, and give priority to the training of advanced technical personnel. Second, in response to the booming innovation and entrepreneurship in the digital era, the government can develop a better support system, especially in financing and qualification. Specific measures may include low-interest business loans and tax relief for entrepreneurship incubators and small and micro enterprises, as well as a taxation system compatible to the digital economy. Third, to minimize fraud and
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deception in current employment platforms, the government can promote a digital social governance system, complete with a digital credit system to create a simple, transparent, safe and credible platform for job seekers and clients. Fourth, in view of the rise of the emerging mobile workforce, a corresponding social welfare and taxation system needs to be developed so people in this community can enjoy social benefits and protection while creating value for the society.

Notes:
1. Alibaba Research Institute data.
2. A Study on the Employment Acquired and Driven by Alibaba Online Retail Platform (September 2016), Labor and Human Resources College, Renmin University of China.
3. BCG Focus “Man and Machine in Industry 4.0 (April 2016)”.
5. Alibaba Research Institute data.
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