



Digital Revolution, Financial Infrastructure and Entrepreneurship: The Case of India

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Digital Revolution has been sweeping across the world over the last three decades. This revolution has spread far more rapidly, especially in developing countries, than was the case with either the Industrial or Agricultural Revolution. Indeed, the spread has been so rapid that China has become its major driver with India emerging as one as well.

This paper is devoted to two aspects of the Digital Revolution as it impacts India: financial technology or fintech, and innovation and entrepreneurship. As in other countries, the spread of digital technologies has led to a dramatic transformation of financial infrastructure in India. On the one hand, this has improved efficiency and on the other it has led to increased financial inclusion. The government's payments system has evolved to a point that it can make payments directly to individuals and firms through bank accounts. Individuals are seamlessly able to transfer funds from their bank accounts to those of others. Businesses and customers can transact digitally in real time.

Digital technologies have also helped democratize innovation and entrepreneurship. Unlike conventional technologies, digital innovations are less costly to commercialize on average. Scaling up of conventional innovations requires a large volume of investment. In contrast, many digital innovations lend themselves to scaling up at low costs. As a result, in the digital space, innovators themselves are often seen as turning into entrepreneurs. The sharp division between innovators and entrepreneurs that existed in the past has greatly diminished.

I divide the paper into three parts. Part 1 focuses on the spread of financial technologies in India. Part 2 considers how the digital revolution has helped spawn and transform the nature of entrepreneurship in the country. Part 3 offers some concluding remarks

1 Financial Technologies

While there is no consensus definition of fintech, the term is most commonly used to refer to technologically enabled financial innovations with applications in such areas as transfer of funds and payments, borrowing and lending, asset management and insurance. The activities that define fintech include: payments and transfers using mobile apps, investments in and payments via crypto-currencies, peer-to-peer lending and insurance, crowd sourcing via platforms such as Kickstarter, loan and insurance comparison websites, and robo-advice on both investment and asset management.

In developed countries, we think of fintech as largely a private-sector phenomenon consisting of transactions between and among businesses and households. If I were to follow the same approach in describing the role of financial technology in India, I would miss a large part of the role that technology is playing there in revolutionizing the payments system. This is especially true when we are considering the area of the economy in which financial technology intersects with inclusion and development. For this reason, in discussing the role of financial technology in India, I will take a broader view of it along two dimensions. First, I will include in financial technology the role that technology plays in transactions in which the government is one of the

parties. Second, in defining financial technology, I will include all cashless transactions, whether or not they involve the use of the latest innovations or mobile-based applications. As I will discuss later, equipping individuals and households to transact digitally through such instrumentalities as the Business Correspondent model and payment banks represents a major step towards financial inclusion in a poor country like India.

1.1 Actors in the Economy and Transactions Among Them

For a poor country with per-capita income at approximately \$2000 per annum in current dollars in 2018, India has deployed financial technologies on a surprisingly large scale. In the following, I will outline the components of the infrastructure that India has built

to bring digital modes of transaction to individuals and households. I will also explain how the government has been using this infrastructure to disburse the benefits under its various social schemes among the poor and what role businesses are playing in the spread of fintech in India.

But as an introduction to this discussion, it is useful to first consider a schematic chart providing the transactions that take place in an economy among various groups of actors. It is the efficiency of these transactions that fintech can greatly improve. In Table 1, I identify three broad groups of actors in the economy: Government (G), Households (H) and Businesses (B) where I include all entities other than the government and households such as non-profit institutions in businesses. The table illustrates types of transactions that take place among these three entities in India.

Table 1: Illustrative List of Transactions Among Major Actors in the Economy

Transacting Parties	Transaction
Government <> Government	<ul style="list-style-type: none"> Employee payroll, pension, insurance Devolution of revenues to states Centrally Sponsored Schemes
Government <> Households	<ul style="list-style-type: none"> Direct Benefit Transfers (DBT) NREGA wages Income tax by individuals to government
Government <> Businesses	<ul style="list-style-type: none"> Procurement of goods and services Subsidies Central Sector Schemes GST, Tolls, Custom Duties, Corporate tax
Households <> Households	<ul style="list-style-type: none"> Loans Transfers Rental
Households <> Businesses	<ul style="list-style-type: none"> Sales of goods and services Salaries, pensions, health benefits Loans, investments
Businesses <> Businesses	<ul style="list-style-type: none"> Input purchases, wholesale transactions Loans Transport services

As Table 1 illustrates, myriad transactions take place within and among government, households and businesses. Technology offers opportunities to reduce friction and raise productivity in the conduct of these transactions. But this requires the building of platforms that can intermediate the transactions. During the past decade, India has been engaged in building many of these platforms. The process is far from complete but considerable progress has been made.

1.2 Bringing Digital Technologies to All

One of the most important developments in building financial-technology infrastructure in India is related to individuals and households. The ability to complete transactions through non-cash, digital means requires verification of identity, having a bank account and access to instruments of digital communication such

as mobile phones. Access to investment and savings instruments also requires access to financial services conventionally provided through brick and mortar bank branches but now feasible via digital platforms. In recent years, India has made considerable progress along each of these dimensions.

1.2.1 Aadhaar: A Biometric Identity for All

If an individual is to engage in a financial transaction without using cash, the first thing she needs is a proof of identity. In a vast country such as India, where two-thirds of the population still lives in rural areas with many of these areas in remote locations, giving individuals proof of identity is a huge challenge. Indeed, until less than a decade ago, India had no systematic program of providing a proof of identity to its residents. In principle, anyone could apply for a passport or driver's license, but with the relevant offices located in far off places and many individuals lacking the basic documents required to complete the applications for them, it was not a practical option for most, especially women living in rural areas.

Surprisingly, today, nearly all residents of India have an identity card called the Aadhaar identity card. The process of issuing the card was kicked off in September 2010 and today there are 1.2 billion of such cards in existence. Each of these cards gives a definitive proof of identity to an individual backed by biometric data. The Aadhaar card carries the name, gender, address, a 12-digit unique number and a photo of the individual. A simple instrument connected by Wi-Fi to a central database can scan the fingerprints and iris of the individual and match them against those stored in the database to verify whether she is who she claims to be.

How such a massive task of collecting biometric data and issuing the Aadhaar cards could be accomplished in such a short period of time in the contentious democracy that is India is itself a fascinating tale. Its details can be found in a recent book entitled "Rebooting India" by Nandan Nilekani and Viral Shah. In this book, the authors also provide a roadmap of how the Aadhaar identity can be leveraged to take advantage of many other technologies. Thanks to the Aadhaar project, Indian residents today have technologically the most advanced and reliable proof of identity. The

beauty of this identity is that the individual need not carry a card with her to prove who she is. The proof is always there in her palms and eyes.

1.2.2 The Jan-Dhan Scheme: Bank Accounts for All

Proof of identity is just the starting point for promoting financial inclusion. By itself, it does not go very far. Its power is realized only when combined with other financial instruments. The most basic of such instruments is a bank account. Whatever other instruments private actors in the fintech industry make available must build on the bank account. Checks, credit cards, and wallets can be operated efficiently only if the individual using them has a bank account.

Creating banking infrastructure over its vast expanse has also been a challenge for India. Opening bank branches in villages with populations less than one thousand is not cost effective. In the 1980s, India experimented with spreading bank branches to the remote corners of the country using public funds but the experiment proved costly. In the end, it had to be given up on that initiative after the launch of the 1991 economic reforms. According to the *Global Findex Report* by the World Bank, only 53% of Indians above 15 years of age had bank accounts in 2014.²

One of the first major initiatives that Prime Minister Narendra Modi launched after he came to office was Prime Minister's Jana Dhan Yojana (PMJDY). Translated literally, it means People's Wealth Scheme. PMJDY is a large-scale financial inclusion effort through a dramatic expansion of bank accounts. Announced during his first Independence Day address after coming to office by the Prime Minister on August 15, 2014, the initiative went on to set a world record for the largest number of bank accounts opened in one week. This record now finds a place in the Guinness Book of Records, which states, "The most bank accounts opened in 1 week as a part of a financial inclusion campaign is 18,096,130 and was achieved by Banks in India from 23 to 29 August 2014." The government accomplished the task by getting the public sector banks to organize camps around the country where individuals could line up and successfully open a bank account within a few hours. According to the *Global Findex Report* of the World Bank, the proportion

of Indians above 15 years of age with bank accounts had reached 80 percent in 2017. As of February 28, 2018, the total number of accounts under the scheme stood at 312 million and deposits in these accounts amounted to \$12 billion.³ A significant proportion of the households still do not use bank accounts as instruments of savings and investment, however.

Since its launch, the government has added several features to the Jana Dhana accounts to promote inclusion. RuPay debit cards can be issued on the accounts. As of January 2016, banks had issued 247 million such debit cards.⁴ The accounts also entitle the holder to an accidental insurance for \$1500. Six months after opening the account, the holder is eligible for \$75 in overdraft. Account holders can also engage in mobile banking using even feature phones through National Unified USSD Platform (NUUP).

1.2.3 Digital Connectivity: A mobile in Every Hand

Once an individual has the proof of identity and a bank account, she is only a mobile phone away from acquiring the power to transact digitally. India's good fortune was that by the time the Aadhaar and Jana Dhan Accounts were launched, the mobile revolution was already under way. This revolution spread across the length and breadth of India during the first decade of the millennium.

I grew up in India in an era in which telephone was considered an absolute luxury. If you could afford it, you had to apply for it and then wait for several years before your turn came. Till as late as 1999, there were less than 40 million phones in total in the country translating into just 3.5 phones per 100 individuals. Then, after the government launched the New Telecom Policy of 1999, mobile phones began to spread like wild fire. Entry of private players, rapidly declining costs due to technological advances and tariff-free imports quickly turned this luxury into a necessity. At its peak, every two months, India was adding 40 million phones. This was more than the entire stock of phones created in the first 120 years after the phone was introduced in India. Today, there exist 1.2 billion phones in India with half a billion in rural India alone. On average, there are nearly three phones per household of five in rural India and six phones per household of four in urban India.

Bank accounts and mobile phones are two essential building blocks of a payments system that allows individuals to make money transfers and payments digitally. To turn such bank accounts and mobile phones into effective instruments of these transactions, a platform that intermediates between the payer and payee is required. Here too India has been innovative.

1.2.4 Unified Payments Interface: A Low-cost Payments System

The National Payments Corporation of India, a not-for-profit organization owned by a consortium of major banks and promoted by the Reserve Bank of India, is authorized to operate various retail payment systems in the country. The NPCI has developed an instant real-time payments system to facilitate inter-bank transactions. Known as the Unified Payments Interface (UPI), this system allows real-time transfer of funds between two bank accounts on a mobile platform. UPI withdraws funds from the bank account of the payer and deposits them directly into the payee account.

This is in contrast to a traditional mobile wallet, which takes a specified sum of money from the payer's bank account beforehand and stores it in its own account to affect future transactions. Therefore, the transfer of funds via these wallets is confined to different users of the same wallet. In contrast, the facility to transfer funds directly from one bank account to another offered by the UPI opens the door to transactions for nearly all customers with bank accounts in one of the 71 banks that subscribed to the UPI as of February 2018.

This is why the decision by WhatsApp to add the WhatsApp Pay feature to its platform created a stir in the electronic payments market. WhatsApp already has 250 million active users, nearly all of them having bank accounts. All users need to do is to link WhatsApp Pay to their UPI account, without having to share any of their confidential bank account information. They can then seamlessly make transfers to or receive transfers from other WhatsApp Pay users. Interestingly, given the large user base of WhatsApp, NPCI, which manages the UPI, did not allow a full-scale launch of WhatsApp Pay in one go. Instead, it chose a phased rollout to allow the application and bank platforms to adjust to the spike in volume.

1.2.5 Transacting Digitally Through a Feature Phone

Access to UPI through apps requires a smart phone. While smart phone users are expanding rapidly in India, at present they constitute only one-third of total mobile phone users. That is to say, two-thirds of the mobile users still rely on feature phones. Keeping this in view, the NPCI has created another service called the Unstructured Supplementary Service Data (USSD), which facilitates the use of the UPI on feature phones by dialing a code.

1.2.6 Implications of September 2018 Aadhaar Ruling by the Supreme Court

While India has created an impressive low-cost infrastructure to facilitate digital transactions, a ruling on the use of Aadhaar identity by the Supreme Court in September 2018 has thrown some sand in their way. The ruling has given a green light to the use of the biometric identity by the government in taxation and disbursement of its funds to people. But it has denied private sector online access to biometric data for purpose of verification of identity. This second part of the verdict constitutes a major setback to the use of Aadhaar identity by private entities such as commercial banks, mobile service providers and digital wallets. These entities will require an alternative for identification to fulfill Know Your Customer (KYC) requirements of different regulations. The government is considering bringing a new legislation, which will ensure full data privacy while giving access to identity verification facility to private operators upon approval by the Aadhaar holder. But until then, the use of Aadhaar databases for purposes of verification of identity has been denied to private entities.

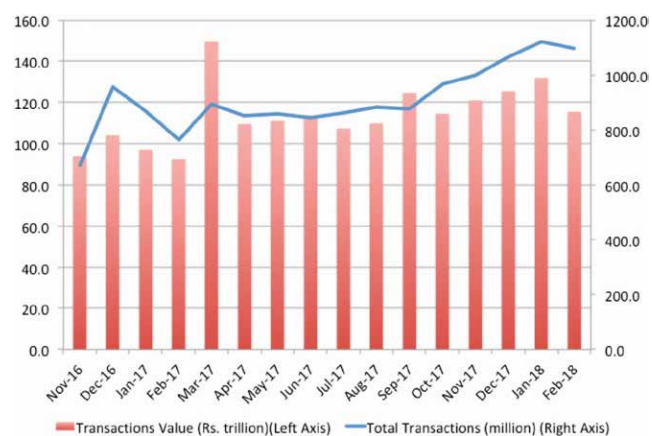
1.2.7 Rapidly Expanding Digital Transactions

In the month of November 2016, when demonetization was announced, electronic transactions numbered 671.5 million. This figure rose to 1.1 billion in February 2018. This represents a 63.5% jump in just 15 months. In value terms, electronic transactions rose from Rs. 94 trillion (\$1.5 trillion) in November 2016 to

Rs. 115.5 trillion (\$1.8 trillion) in February 2018. This represents 22.9% increase over the 15-month period. Therefore, the growth in the number of transactions has far outstripped the growth in value, implying that the strategy of the government to spread digitization among individual customers, who typically engage in lower-value transactions, has been successful. Figure 1 shows the evolution of the transactions in both number and value beginning from November 2016, the month during which demonetization was announced.

Transactions via UPI protocol have grown far more rapidly, although they begin from a low base. In number, these transactions grew from a tiny 0.3 million in November 2016 to 171.4 million in February 2018. In value terms, the increase was from 0.9 billion rupees to 191 billion rupees. Figure 2 shows the evolution in both number and value from November 2016 to February 2018.

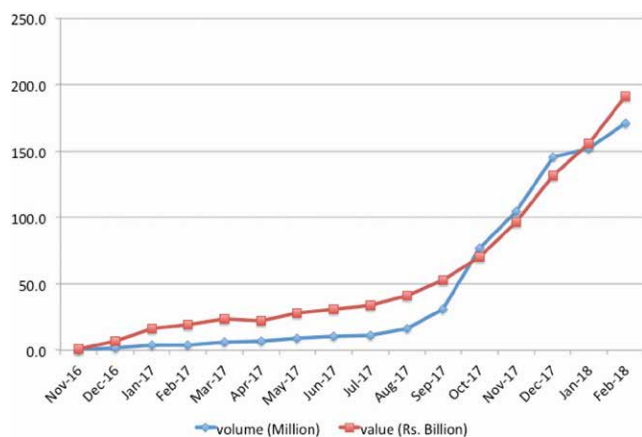
Figure 1: Evolution of electronic transactions: November 2016 to February 2018



Source: Author's construction using the RBI data from http://rbidocs.rbi.org.in/rdocs/content/docs/ELECT07022016_FEB18.xls

The government provides the UPI platform free of charge. The only fee paid on transactions taking place on this platform is that charged by the banks. In so far as competition among banks is likely to keep this charge low, transactions on UPI have the potential to eventually overwhelm those on other platforms. Indeed, given that the transactions on credit and debit cards typically charge much higher fees, in the long run, their survival is a bit doubtful. It is only a matter of time that merchants will recognize the value of accepting payments via the UPI platform.

Figure 2: Transactions via UPI protocol: November 2016 to February 2018



Source: Author's construction using the RBI data from http://rbidocs.rbi.org.in/rdocs/content/docs/ELECT07022016_FEB18.xls

1.2.8 The Business Correspondent Model: Bringing Financial Services to Unbanked Areas

While individuals are able to make and receive transfers of funds using bank accounts and mobiles, they also need other banking services. Most notably, individuals need to be able to carry out cash deposit and withdrawal transactions and use their bank accounts as instruments of savings and investment. But this requires access to a bank branch, which is often very far away from the customer's village.

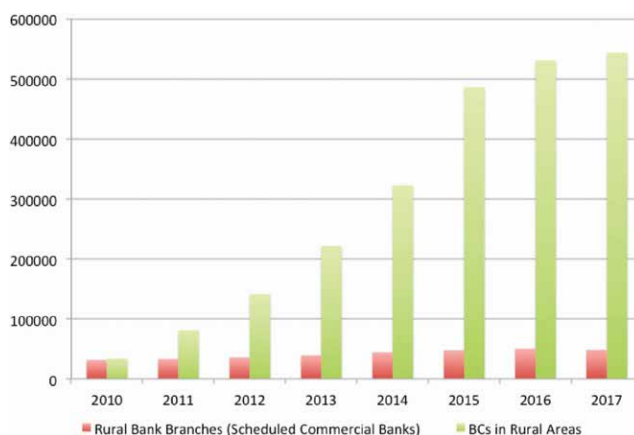
To overcome this problem, beginning in 2006, the government has promoted the Business Correspondent (BC) model in areas where bank branches do not exist. A Business Correspondent is engaged by a bank to provide banking and financial services in such locations. The services may include opening bank accounts; collecting cash for deposit in their personal or beneficiary's account; disbursing small amounts of loans; recovering installments for loans; and selling bank products such as insurance, mutual funds and pension schemes. Banks are fully responsible for the acts of commission and omission of their BCs.

Entities that the RBI allows to serve as BCs include Non-governmental Organizations (NGOs); Micro-finance Institutions (MFIs); post offices; Section 25 companies; retired bank employees, teachers, government

employees and military personnel; individual owners of kirana, medical and fair Price shops; agents of Small Savings schemes of the Government of India and Insurance Companies; petrol-pump owners; and authorized functionaries of Self Help Groups (SHGs) with links to banks. The RBI advises banks to keep charges of the BC services at levels that are seen as reasonable and fair. BCs use mobile, PoS machines and micro-ATMs to move funds across bank accounts via UPI protocol.

Going by data, the BC model has been highly successful in bringing basic banking services to rural areas. The spread of BCs to Indian villages has far outstripped the pace of brick and mortar branch expansion. Figure 3 provides the total number of branches and BC in rural areas on an annual basis beginning in the end of March 2010 and ending in the end of March 2017.

Figure 3: Bank branches and Business Correspondents in rural India: 2009-10 to 2016-17



Source: author's construction using the data from RBI Annual Reports

Data on basic savings deposits tells a similar story in terms of absolute number of transactions though not their value. Table 2 reports the key data for years 2009-10, 2015-16 and 2016-17. Starting at a much lower level at the end of March 2010, the number of accounts under the BC model jumped above those at the bank branches by the end of March 2017. But in value terms, the deposits with bank branches remained significantly higher than those with BCs. This is as one would expect given that branches are much larger and located in areas with vibrant commercial activity.

Table 2: Basic Savings Bank Deposits in Branches and with Bank Correspondents

Entity	End March 2010	End March 2016	End March 2017
Deposits in Million			
Branches	60	238	254
BCs	13	231	280
Total	73	469	533
Value in Rs. Billion			
Branches	44	474	691
BCs	11	164	285
Total	55	638	977

While the data shows impressive progress in spreading bank accounts and deposits through the BC model, critics have noted that this remains a supply driven model. The key evidence supporting this criticism is the presence of a substantial proportion of the accounts being dormant and virtually no credit activity. In addition, the rate of usage of active accounts is low. Compensation to BCs is poor in relation to the services expected of them. Opportunities for the expansion of new bank accounts have also greatly diminished due to near saturation under the Jan-Dhan Scheme. Scope for earning fees on deposit and withdrawal transactions remains limited.

1.2.9 Payments Banks: Yet Another Innovation for Inclusion

To enhance the reach of digital payments further, the Government of India has introduced payments banks launched in August 2015 with the grant of “in principle” licenses to 11 of the 41 applicants. The recipients of the license were given 18 months to fulfill all requirements after which they could begin operations. Bharti Airtel, a telecommunications company, was the first to go live as a payments bank in March 2017. Others to go live include India Posts and Paytm. A few others such as Tech Mahindra and Sun Pharmaceuticals surrendered their licenses.

Payments banks are registered as public limited companies under the 2013 Companies Act with a license from the RBI. They are not commercial banks, though the license from the RBI grants them the permission to perform some of the banking functions including remittance services, mobile payments, fund transfers, issuance of ATM, debit card services, net banking services and sales of third-party financial products such as insurance and mutual funds. However, payments banks are not allowed to advance loans or issue credit cards.

Currently, payments banks are allowed to accept deposits up to Rs. 100,000 and can pay interest on them. They earn part of their profit by depositing the funds received in banks that pay higher interest than what they pay their customers. They also earn profits by charging a merchant discount rate (MDR) on transactions undertaken by deposit holders. Other sources of revenue may include data monetization, cross-selling of financial products, and forming credit access platforms.

For example, Airtel Payments Bank pays 7.25% interest on savings accounts and charges a 0.65% transaction fee. Airtel mobile number of the deposit holder also functions as the account number. The bank has launched an app and an online debit card in collaboration with MasterCard that can be used at online merchant portals accepting MasterCard. The bank also offers customers a free personal accidental insurance cover of Rs. 100,000 on its savings accounts.

1.3 Changing Landscape of Government Transactions

As shown in Table 1, in carrying out its business, the government must transact financially with its own ministries, states, and local government as well as with businesses, individuals, and households. Today, technology plays a central role in facilitating these transactions. I shall briefly touch upon some key components of this technology and associated financial flows.

1.3.1 The Public Finance Management System

The government has deployed technology to cut down friction in its own payments system. Initially launched in 2009 as a system for tracking funds released by the central government to states through the erstwhile

Planning Commission, the Public Finance Management System (PFMS) has evolved into an end-to-end solution for processing, tracking, monitoring, accounting, reconciliation, and reporting of financial flows into and out of the central government. It is expected to provide a unified platform for tracking releases of financial flows and their utilization down to the last mile. The plan is to eventually integrate all existing stand-alone financial systems to integrate into PFMS. These would include all payments of the Government of India, tax and non-tax receipts, Human Resource Management Information Systems, pension systems and General Provident Funds.

A major strength of PFMS is its integration into the core banking system. This integration gives the system the unique capability to push online payments to almost any entity within the banking system including state governments, local governments, various agencies implementing myriad government schemes, and even individual beneficiaries of such schemes. PFMS already interfaces with core banking systems of 170 banks including all public sector banks, regional rural banks, major private sector banks, RBI, India Post, and cooperative banks.⁵

The benefits of real-time payments and an accounting system cannot be underestimated. First, by allowing just-in-time transactions, it cuts the interest cost that is otherwise incurred when funds sit unused in transit. For example, states are the implementing agencies for various Centrally Sponsored Schemes. The central government may disburse funds for these schemes to the states but states may take some time before they disburse them to implementing agencies. While these funds sit idle with the state governments, the central government incurs interest costs on them. A just-in-time payments system can ensure that the central government has to release funds only when the implementing agencies are ready to receive them. Second, the system can also eliminate the need for manually balancing books, thereby minimizing the cost of accountants. Finally, the system also allows tracking and monitoring of projects and can help improve efficiency by providing real-time data to monitoring agencies.

1.3.2 Direct Benefit Transfers: PFMS, Aadhaar and Bank Accounts Come Together

In India, the central government sponsors several schemes, jointly funded by both itself and state governments, involving payments and cash or in-kind transfers to individuals or households. A food subsidy program under the National Food Security Act, 2013 provides wheat and rice at less than 5% of the market price to 75% of the rural and 50% of the urban population. Cylinders of liquid petroleum gas (LPG) and kerosene are provided for cooking at subsidized prices. Farmers are provided fertilizer, especially urea, at subsidized prices. The government runs a massive employment guarantee program under the National Rural Employment Guarantee Act (NREGA), 2005, which entitles one adult in every household to 100 days of employment per year at a specified wage. The government also provides scholarships to students and pensions to widows.

In each of these programs, there has been a history of ghost beneficiaries and a collection of benefits multiple times by the same individual. There are leakages in the system through other channels as well. For example, employers under NREGA programs choose to disburse only a part of the wages due to workers while skimming off the rest. Similarly, sellers of LPG cylinders divert a part of the supply to commercial LPG users who are not entitled to subsidized LPG cylinders.

In recent years, the government has been systematically plugging these leakages through the use of Aadhaar verification and direct benefit transfer (DBT). It has been able to eliminate millions of ghost beneficiaries as well as multiple collections of benefits by the same beneficiary. Other forms of leakages have also been plugged by depositing the benefit directly to the Aadhaar seeded bank account of the beneficiary. For example, LPG cylinders are now sold at the market price instead of subsidized prices. Once the seller records the sale to a beneficiary in a centralized system, the subsidy is deposited directly to her Aadhaar seeded bank account. Similarly, once an employer under NREGA files information on a worker having performed work in a centralized system, wages are transferred directly to her Aadhaar seeded bank account. The approach applied to the LPG subsidy is also currently being extended to the disbursement of fertilizer subsidies.

Estimates of savings through the elimination of ghost beneficiaries and DBT of approximately \$2.5 to \$3.3 billion annually over a three-year period have appeared in the media. It is difficult to verify the accuracy of these estimates but they seem plausible. It is also a reasonable guess that these savings will multiply in the years to come as the scope of DBT expands and some of the in-kind transfers are converted into cash transfers, a process that is currently under way.

1.3.3 Government Procurement: The Government e-Marketplace

In a new experiment, in August 2016, the government launched a Government e-Marketplace (GeM) for its procurement of goods and services in a transparent manner. GeM is a paperless and cashless open platform for procurement of common-use goods and services with minimal human interface. Time-bound payment to sellers selling on the GeM platform is facilitated through integration with PFMS. Effort is also under way to integrate GeM with payment systems of railways, defense, public sector enterprises, and state governments.

The GeM experiment is at present in its infancy. But it holds great promise in a country like India where multiple layers of rules and regulations make procurement opaque, costly and time consuming. In principle, the marketplace can result in speedy procurement at competitive prices and hence major savings for the government. As an example, tickets for air travel by government employees are currently purchased through a monopoly agent. By all accounts, prices charged by this agent are exorbitant. Moving the procurement of the tickets to GeM alone can save the government millions of dollars.

1.3.4 E-National Agricultural Market

Traditionally, agricultural markets in India have been both opaque and fragmented. Each farmer is required to sell her produce in a government-assigned marketplace called a mandi. In mandis, commission agents and traders collude to buy the produce at minimal prices and then sell to wholesalers and retailers at the maximum prices. Prices within and across mandis can vary by wide margins.

To introduce competition within and across mandis, in April 2016, the government launched the e-National Agricultural Market (e-NAM) initiative. Under it, the government has already connected 470 mandis across 14 states electronically. In these markets, the farmer can use an electronic platform for auction to sell her produce to the highest bidder. Open e-auctions have gone some distance towards eliminating dependence on commission agents and bringing transparency to the sales process and also helped speed up payments to farmers. Farmers can bring their produce to the mandi in the morning and generally return home in the evening after auctioning the produce and receiving payment. Because transactions must be done electronically using bank accounts, payments cannot be delayed. In the past, they had to often stay overnight and would not get payment for one to two weeks. Efforts are currently under way to connect another 109 mandis to e-NAM.

1.3.5 Goods and Services Tax Network

Recently, India replaced more than a dozen indirect taxes by a single Goods and Services (GST) tax. Use of a technology-based platform called the GST Network or GSTN has been key to the adoption of this tax. Sellers of goods and services above a threshold are required to register on GSTN with a 12-digit identification number. In March 2018, the total number of such sellers was 10.3 million (6.4 million original taxpayers and 3.9 million new registrants). Each seller must file a return on a monthly or quarterly basis. The return summarizes all information on sales, purchases, tax collected on sales, and tax paid on purchases. Tax due is calculated as the difference between tax collected on sales and tax paid on purchases. A major task of GSTN is to match buyer and seller invoices to ensure that credit being claimed by the buyer matches the tax collected from him by the seller.

1.4 Businesses as Providers of Fintech Services

Although reference to businesses' participation in fintech has been made in the context of transactions by governments and households, it is important to highlight their role here, especially in intermediating digital payments.

1.4.1 Digital Payments

Private-sector players dominate the market in the provision of digital payments. The largest player currently is Alibaba backed Paytm, which has 300 million registered users and 7 million offline merchants. It is adding 10 million users each month and accounts for 250 million transactions per month. Approximately half of these transactions originate in small towns and villages.

In November 2017, Paytm started accepting UPI payments, which took off immediately. In February 2018, its UPI transactions touched 68 million out of a total of 171.4 million UPI transactions. Current notable competitors of Paytm include Mobikwik, Google Tez and Flipkart-owned PhonePe and Amazon Pay. The biggest disruption is expected to occur when WhatsApp Pay fully enters the market.

An important promise of providers of digital payments services is that they can become sources of credit for their users. Transactions conducted on their platforms provide useful data on payments habits of their customers and may be capable of being leveraged for lending activities. If this turns into reality, credit markets for small borrowers would undergo a major change in India.

1.4.2 Other Fintech Services by Private Businesses

Among other important fintech services provided by private businesses, mention may be made of the following:

- Amazon, Flipkart, Snapdeal, Myntra, BigBasket, IndiaMart, Make My Trip, Yatra and Trivago are examples of some major players in e-commerce.
- BankBazaar is a major loan comparison portal offering personal loans, home loans, credit cards, mutual funds, fixed deposits and savings deposits. It also offers health, life and home insurance policy comparisons. PolicyBazaar and Apnapaisa are the other major players in this space.
- Peer-to-peer lending is in its infancy; nevertheless, several sites have emerged. Prominent among them are Lendbox, Faircent, I-lend, Easy Rupiya, and LenDen Club. Some of these portals have several thousand lenders.

- India has about 15 cryptocurrency exchanges of which four are funded. Bitcoin, Ethereum and Ripple in that order are the most popular crypto currencies in use at these exchanges.⁶ The government has neither endorsed nor banned cryptocurrencies. It regularly warns of risks associated with transacting in them, however.

2 Digital Revolution and Entrepreneurship

Let us now turn to entrepreneurship in the digital technology space. Implicitly, we have already introduced such entrepreneurship when discussing fintech. Entrepreneurs operating in fintech are all engaged in digital technology entrepreneurship. But we may now consider the entrepreneurship aspect of Digital Revolution more directly.

In the literature on entrepreneurship and digital technology, a distinction is drawn between digital technology entrepreneurship and digital entrepreneurship. The former refers to entrepreneurship based on new ICT [Information and Communications Technology] products such as the iPhone and the latter on products and services based on the Internet. Broadly, the former may be thought of as involving manufacturing and the latter creating services using new software and existing digital devices and platforms as exemplified by WhatsApp.⁷ In the following, I discuss entrepreneurship of each kind.

2.1 Digital Technology Entrepreneurship

India has done well in digital-device space at the innovation level. Unfortunately, however, with one major exception, it has not done well at translating the innovations into large-scale commercial enterprises. A recent paper offers a fascinating discussion of highly cost-effective innovations by Indian entrepreneurs that can potentially impact the lives of the masses, not just in India, but worldwide. But in all cases but one, so far, this impact has been extremely limited.⁸

2.1.1 Jio Mobile and Broadband

The most successful low-cost digital technology innovation that has also made a major difference to the lives of the masses is Jio's Greenfield 4G Long Term

Evolution (LTE) network. Because Jio joined the telecommunications world late, it has no 2G or 3G legacy services. Its unique configuration allows Jio to offer free voice calls to any network across India. It has no national roaming charges, making its network seamless throughout the country. The remarkable thing about Jio is that it offers 4G Internet to customers at just 10 cents per gigabyte (GB). Jio's phone is offered effectively free of cost to customers.

Jio was launched on September 5, 2016 and within the first month, it acquired a record 16 million subscribers. It crossed the figure of 50 million subscribers in 83 days and had signed up 100 million subscribers by February 22, 2017. By July 5, 2018, Jio had 215 million subscribers. This is a feat accomplished in just 22 months. Competitive pressure brought by Jio has sent the prices of broadband services on mobile phones tumbling. The result has been a rapid expansion of the use of digital technologies in India.

While the innovations underlying Jio have made low-cost provision of its services possible, the fact that it is owned by one of the largest conglomerates of India, Reliance Industries Limited (RIL), has been crucial to its rapid spread across India. With its deep pockets, RIL was able to rapidly scale up the operations of Jio. So far, younger entrepreneurs who are financially less capable have had far less success in scaling up their digital technology startups even though underlying innovations in some cases have been equally cost effective with potentially large markets. At the same time, it needs pointing out that younger Indian entrepreneurs in digital as opposed to digital technology space have had enormous success in attracting and mobilizing investment funds.

2.1.2 iBreastexam

One low-cost digital technology innovation has been a device called iBreastExam by young entrepreneur Mihir Shah who launched startup UE LifeSciences in 2009. The device offers a painless and non-invasive scan, which can detect breast cancer with great accuracy at a cost of just \$1. The exam is entirely radiation free and can be operated by a community health worker. The device has the United States Food and Drug Administration clearance and has the CE mark required for sales in the European Economic

Area consisting of 28 countries of the European Union and three countries of European Free Trade Area. The device is currently sold in more than 25 countries in Africa and Asia. Recently, the New York Times published an article extolling its virtues.⁹ Nevertheless, despite the existence of a vast potential market for the device due to its low cost, ease of operation, and non-invasive nature of the examination, its sales have been relatively limited. The total annual revenues remain between one to two million dollars.

2.1.3 Electrocardiogram Sanket

Another similar innovation is a portable matchbox size Electrocardiogram (EKG) machine called Sanket. The device sells for less than \$100. It connects remotely to a smartphone and records and displays EKG on it. The report can be shared instantly with a doctor using the smartphone. Sanket has filed for multiple patents. Once again, the device has not had notable commercial success.

There are several other stories of devices such as those that can detect multiple eye diseases and diagnose mosquito-borne diseases at low cost, but they all had difficulty scaling up. So far, outstanding successes in the digital technology space such as that achieved by the Jio phone have not emerged in a big way in India.

2.2 Digital Entrepreneurship

The story has been different in digital entrepreneurship with several entrepreneurs successfully scaling up their operations. In some cases, startups have made inroads even in foreign countries. I discuss a handful of the startups in the digital space below. Some of them have appeared earlier in our discussion of fintech. Nevertheless, it is important to discuss them here to highlight their innovation and entrepreneurship aspects.

2.2.1 Flipkart E-commerce Company

The biggest success story in Indian digital entrepreneurship space has been Flipkart.¹⁰ Two IIT graduates started it in September 2007 as a website offering home delivery of books. In 2018, Wal-Mart acquired it for \$16 billion. This is the largest ever acquisition of an Indian startup. In 2007, Flipkart made just 20 deliveries in total. The following year, this figure climbed up to 3,400 deliveries. In 2009, the startup acquired

sufficient visibility to receive a venture capital investment of \$1 million. It began the year by hiring its first employee and ended it with 150 employees. In 2010, Flipkart began selling movies and electronic products such as video games and mobile phones. The following year, the company expanded into selling cameras, computers, laptops, large appliances, and stationery. It also launched its digital wallet and acquired two digital content companies and expanded the delivery network to 600 cities.

In 2013, Flipkart adopted a marketplace model and brought third-party sellers to its platform. That year, it also raised \$360 million and the following year, \$1.6 billion. In 2014, it acquired online fashion retailer Myntra and majority stakes in after-sales service provider Jeeves and payments platform Ngpay. By the end of the year, it was valued at \$11 billion. In the following years, the company made several additional acquisitions. By 2016, its mobile app had 50 million users and it had 100 million registered customers. In 2017, Tencent invested \$1.4 billion and SoftBank's Vision Fund \$1.5 billion in the company. The same year, Flipkart also acquired eBay India. By 2018, when Wal-Mart acquired it, the company had 130,000 third-party sellers and was expanding its product catalogue to house 80 million products.

2.2.2 Paytm Payments Wallet

As previously mentioned, Paytm (pay through mobile) began as a digital wallet in 2010. The founder started the company with a \$2 million investment of his own. Based on secondary shares sale at the end of January 2018, it is now valued at \$10 billion. Its operations include a payments bank and an e-commerce business. Alibaba Group and SoftBank are both investors in Paytm.

Paytm wallet allows a user to transfer funds directly into a recipient's account using a QR code or mobile number. In May 2018, the company had seven million offline merchants spread over India's 600 districts. The first of these numbers rose from just one million at the beginning of 2017. Annualized gross transactions value of the company crossed \$20 billion in February. This represented a four-fold increase over the previous year. The number of transactions using Paytm far exceeds the total number of debit card transactions.¹¹

By August 2018, Paytm had 300 million registered users. This figure compares with 520 million Alipay users and 237 Paypal users around the same time.¹² On average, one in five Indians already uses Paytm.

2.2.3 Ola Cab Service

Ola, a cab hailing service, represents another major successful Indian startup in digital space. The startup was launched in 2010 in competition with the American cab hailing service called Uber. Founded by two young entrepreneurs, it operates in more than 110 Indian cities today. It offers licensed taxis, private hire cars and rickshaws and has a network of approximately one million drivers. The company has been valued at \$7 billion and has raised approximately \$3 billion in investment funds. Its investors include SoftBank, Tencent, Didi Chuxing and DST Global. In January 2018, Ola launched its service in Australia and currently operates in seven cities there. At the end of August 2018, it also launched licensed taxi and private hire vehicle services in South Wales in the United Kingdom.¹³

2.2.4 Rivigo: A logistics Startup

An especially creative startup, which can make a major contribution to transformation of logistics sector in India, is Rivigo.¹⁴ Launched in 2014, the startup says on its website, "We are transforming logistics in India making it human, faster and safer." Under the conventional trucking model, a single driver drives the truck to its final destination hundreds, even thousands, of miles away with multiple stops on the way to catch up on sleep. Stops on the way cause delays in reaching the destination and the driver remains separated from his family for days, sometimes weeks. Temptation to keep driving the truck for long hours to complete the task sooner can also lead to fatigue and result in accidents.

To overcome these problems, Rivigo has invented what it calls a "relay" model of truck transportation whereby a driver drives the vehicle for four or five hours and, at a designated pit stop, meets another driver driving a truck in the opposite direction. The drivers exchange the trucks with each other at the pit stop and drive back to where they came from. Upon returning to a home pit stop, each driver hands over his truck to another driver who carries it to the next pit stop. This "relay" driving

of trucks keeps trucks moving continuously while also allowing each driver to return to his home the same day to be with his family. The model has allowed the startup to substantially reduce the time a truck takes to reach its destination while also saving the drivers from having to spend long periods away from family. With more humane trucking jobs, the startup is also able to recruit drivers with greater ease.

In four years, by March 2018, Rivigo had a fleet of 3,000 trucks. The company has created a network of 70 pit stops nationwide. Each driver drives about 250 kilometers, or five hours, between pit stops. Simultaneous movement of a large number of trucks in many directions requires solving a complex programming problem. A sophisticated algorithm does routing and assignment of drivers. Whenever one or more trucks break down, the algorithm re-optimizes and rejigs the assignments. Each driver carries a mobile app, which provides necessary instructions in real time.

Rivigo also deploys sophisticated technology to monitor pilferage of gasoline and refrigeration of perishables it transports. During its years of operation, it has collected vast volume of data, which it is beginning to use to deploy Artificial Intelligence. In 2017, the company raised \$50 million and was valued at \$1 billion.

2.2.5 OYO Hospitality Company

Started in 2013 by an 18-year old entrepreneur, OYO (“on your own”) is a hospitality company offering budget hotel rooms. The startup partners with hotels to give guests a similar experience in terms of certain basic amenities across the nation at highly competitive prices. In January 2013, the startup had just one hotel with which it partnered. That number rose to thirteen in July 2014 and rapidly climbed up to more than 8500 by September 2018. In 2018, OYO offered hotel rooms in 230 Indian cities. It has also expanded its operations abroad in Malaysia, Nepal and China. In 2017, the startup raised \$260 million with SoftBank being the largest funder. Although the current valuation of OYO is placed at \$1 billion, it has so far been running in substantial losses and its business model has been questioned.¹⁵

2.3 Startup India

In 2015, the Government of India announced its Startup India initiative. Under it, the government created a simplified set of rules for enterprises qualifying as startups. It also created a fund of 100 billion rupees to provide financing for startups.

Startup India defines a startup as an enterprise that is less than seven years old and has a turnover of less than 250 million rupees. Under the Insolvency and Bankruptcy Code, a startup can exit in 90 days. It can comply with laws through self-certification and is free from inspections for the first three years of operation. It is also exempt from capital gains and other taxes in the first three years. As a part of Startup India initiative, the government also launched the Atal Innovation Mission, which offers funding for incubators and Atal Innovation Labs in schools.

3 Concluding Remarks

In this paper, I have analyzed the manner in which the Digital Revolution has progressed in India in two areas: fintech and entrepreneurship. In discussing fintech, I have described the key changes that digital technology is bringing to transactions taking place among the government, individuals and businesses. The focus of this discussion has been on inclusion and development aspects of the change spawned by digitalization. The government has played a very active role in driving the change in this area in India.

The key to the ongoing change in fintech, which has a considerable distance to go in India, is a biometric identity known as Aadhaar. Nearly every financial transaction requires definitive proof of identity of the transacting parties. Aadhaar provides this proof without any document via biometric verification. This is a major asset the country now has. Though there remain some legal issues related to data privacy to be resolved, with the matter under consideration by the Supreme Court, the government and businesses are already using this asset effectively in creative ways.

Regarding entrepreneurship in the digital space, a distinction can be drawn between digital technology entrepreneurship and digital entrepreneurship. The former typically involves invention of devices that fulfill one or more needs while the latter relies principally

on new software, which is used on existing devices and digital platforms. I have shown that India has had limited success at best in digital technology entrepreneurship. Though startups have innovated highly cost-effective devices, they have not been able to turn them into major commercial successes. This outcome mirrors India's generally limited success in the manufacturing sector. The story in the digital space has been a happier one with a large number of startups successfully scaling up and even taking their innovations to foreign markets.

Four final points must be made. First, no technology can substitute for growth in so far as inclusion is concerned. In the end, the real empowerment comes from having command over financial resources, and that command comes from income. Indeed, without access to income, even the spread of financial technology risks remaining a supply side phenomenon. Whether or not individuals and households use the supplied technologies critically depends on their incomes. As an example, though the government and banks have been able to proliferate business correspondents, the use of their services has remained limited simply because incomes and commercial activity in the smaller villages are limited.

My second point is that mere availability of technology will not lead individuals to adopt it. Incentives matter. As an example, if tax rates are high, parties involved in a transaction have an incentive to use cash to make payments and not risk creating a digital record of the transaction by making or receiving payment digitally. This is particularly true of small businesses. Likewise, if tax enforcement authorities have a history of harassing taxpayers, small businesses would try to remain out of the tax system. Once again, they would prefer to transact in cash as long as possible.

My third point is that it is important not to fall into the trap of turning technology into an enemy of good policies. Momentum for the removal of policies that are popular but nevertheless promote inefficiency comes from poor implementation of those policies. Large leakages and poor targeting of subsidies can provide critics much needed ammunition to advocate for their removal. To the extent that technology becomes the means to effective implementation of these anti-growth policies, it turns into an enemy of reform. In such circumstances, the task of convincing the policy makers that what is needed is not effective implementation of the poorly thought out policy, but its removal, becomes yet more difficult for economists.

Finally, India needs to keep a level playing field between domestic and foreign investors in the digital space. While India must take all necessary steps to ensure cyber security, it must resist calls for restrictions on foreign investors to promote domestic entrepreneurs. Such restrictions harm the consumer by denying her the best service. They also exert negative influence on productivity by blocking the entry of enterprises employing the latest innovations. Indeed, to the extent that most successful domestic startups in the digital space themselves achieve high valuations after foreign investors make sizeable investments in them, tilting the playing field in favor of domestic investors is self-defeating. In such situations, they will have to opt out of foreign investment to avail the benefits of being considered as domestic enterprises. It is important to remember that for many years to come, foreign venture capital, angel investment, and private equity will remain critical to the growth of startups in India.

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By Accident or Design? Shenzhen as a Global Hub for Digital Entrepreneurs

by Kirsten Lundberg¹

NOTE: This case history was written as the basis for scholarly discussion and discourse. It does not advance policy recommendations. It is a history of Shenzhen's evolution and raises such questions as: Can Shenzhen's example be duplicated? If so, how? How much of Shenzhen's success derived from its proximity to Hong Kong? How much from being a greenfield development site? Did the absence of established state-owned enterprises contribute meaningfully to the city government's willingness to assist private-sector players? In general, did Shenzhen's municipal government lead or follow? Can government legislate innovation? Other questions undoubtedly will occur to readers; it is our hope this work and those questions become the catalyst for further research.

By 2019, the south China coastal city of Shenzhen was recognized worldwide as a digital technology powerhouse. The media branded it a second Silicon Valley. Shenzhen annually registered record numbers of patents under the international Patent Cooperation Treaty. Incubators and accelerators supported an exploding number of start-ups in such diverse fields as medical devices, new materials, robotics, and artificial intelligence.

In its early years, from 1981–93, the city's GDP grew at an astonishing average 40 percent a year; that rate slowed to a still-impressive 16.3 percent for 2001–05 before settling at annual growth of 10 percent or less. In 2017, GDP hit CN¥2.2 trillion (\$338 billion), higher than countries like Portugal or Ireland and double its 2011 output.¹ Shenzhen became headquarters to multiple billion-dollar companies, and to 65 percent of global smartphone brands. With 90 percent of its companies in private hands, Shenzhen held pride of place as China's capital of private industry. Investment money poured into what had become China's wealthiest city.

Yet barely 40 years earlier, Shenzhen had been a backward area of fields, rice paddies, and fishing villages. How had China pulled off the seemingly impossible feat of building a world-class city in the blink of an eye? What accounted for its outsize expertise in digital technology? Why did entrepreneurs from China and abroad flock to live there? More specifically, how did government and public policies contribute to its status as a global mecca for digital entrepreneurs? Was Shenzhen a one-off, or might any government, through careful planning, create such a phenomenon?

A close look at Shenzhen's policy history could hold clues to the answers. Undoubtedly, a young and risk-taking population, lured by ambition to China's first Special Economic Zone (SEZ), deserves chief credit for the city's success. But especially in the early years, municipal leaders took advantage of the unusual latitude offered by SEZ status to experiment. City leaders moved early, fast, and far to devise the country's first land sale, first labor contract, first stock exchange. They were willing to risk failure—and embraced what worked by embedding successful

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industries and strategies in municipal Five-Year Plans and other public policies. Their goal: make Shenzhen as attractive a place as possible to work, invest, and live.

Accounts differ on just when Shenzhen decided to bill itself as a center for high-technology manufacturing. Some say from its creation; others date it to 1992, or 1996. Regardless, Shenzhen by the early 21st century had become the world's electronics factory, turning out 90 percent of global production. At first, these goods copied others' designs. But with the advent of cell-phones, copycats morphed into inventors—local engineers created better phones that cost less.

Seemingly overnight, Shenzhen companies transitioned from filling orders for others to designing, making, and profiting from their own groundbreaking inventions. Instead of cheap copies, the city by 2010 had earned a reputation for quality originals. The pragmatic city government moved to capitalize on the astonishing success of local business. It saw its job as building an innovation-friendly ecosystem that would maintain Shenzhen's position at the forefront of digital creativity.

Among numerous incentives to lure skilled professionals, Shenzhen offered cash bonuses to Nobel laureates who chose to relocate there. It funded dozens of incubators for inventors. It strengthened legal protection for intellectual property. It created a municipal investment fund that took cash positions in promising start-ups, both in China and abroad. It gave academic institutions incentives to open local branches. It built laboratories and expanded tax-free zones. It enhanced social services and cultural attractions.

Whether this would prove enough was an open question. Competition was fierce domestically and internationally. Building spaces for innovation did not guarantee inventions would result. The Chinese economy after 2015 slowed from the red-hot growth of earlier decades. Trade tensions with the U.S. and others threatened its export-led economic model. President Xi Jinping had reasserted political control, and observers debated the sincerity of his support for a free market. Shenzhen was a good place to live and work, but it wasn't Paris or Singapore or San Francisco. What policy tools might local government use to keep Shenzhen a digital technology leader?

Shenzhen—Pioneer

China's central government created the city of Shenzhen in 1979 as an economic experiment.² Communist Party Chairman Mao Zedong's Cultural Revolution and Great Leap Forward had left the country impoverished and backward. After Mao's death in 1976, reformer Deng Xiaoping prevailed as China's preeminent leader. In December 1978, the Communist Party Central Committee (CCCCP) officially adopted his Reform and Opening, or Open Door, policy.

Aiming to provide jobs and build prosperity, Deng advocated what he called "socialism with Chinese characteristics," a gradual transition from a command to a market-based economy. "The point of reform," wrote Shenzhen resident and expert Mary Ann O'Donnell, "was not to flip flop from collectivism to capitalism, but to use aspects of capitalism to achieve socialist goals."³

In 1979, the CCCCPC designated four cities in the southern Guangdong and Fujian provinces as Special Economic Zones (SEZ), and authorized them to try a variety of market mechanisms in order to demonstrate what could work in China.⁴ All four locations were deliberately far from Beijing—perhaps to reduce temptation for the central government to meddle, or to easily conceal mistakes—and close to prosperous centers like Macau or Taiwan.

From the start, the central government granted the new SEZs unprecedented self-government privileges. In a country accustomed to central control of everything from factory output to social policies, these local governments were given flexibility to develop their own policies on foreign trade, foreign exchange, and economic development. They could set their own policies on city planning, pricing, wages, business management, and the economic activities of foreign individuals and enterprises.⁵ As Professor Li Jinkui, a senior research fellow at Shenzhen's China Development Institute (CDI), puts it:

The central government gave them an abstract experimental zone of Opening and Reform, where it was left up to them to decide what to do, and to experiment. Once the work was done and the achievements reached, the central government would subsequently endorse their actions as correct.⁶

Finally, Beijing granted legal entities and individuals permission to create private companies in the SEZs. In China at the time, capitalism was a dirty word, and any enterprise with more than eight employees was a “capitalistic establishment” liable to prosecution. The SEZs had an extraordinary license to improvise.

SSEZ. On August 26, 1980, the government designated 327 (later 396) square kilometers of southern Guangdong as the Shenzhen Special Economic Zone (SSEZ).⁷ Bao’an County, as the area was known, was a neglected region of agricultural villages, lychee orchards, and rice paddies, with a 1979 GDP of CN¥196 million (US\$30 million).⁸ The county market town, Shenzhen, had a population of barely 30,000.

Shenzhen had a unique geographic advantage: close proximity to Hong Kong, then a British colony and a global financial center. Over the years since the 1949 founding of the People’s Republic of China, hundreds of thousands of ethnic Chinese had fled the mainland across a bay to Hong Kong.⁹ Beijing hoped some of those expatriates would see promising investment opportunities in the new SEZ.

The vision was ambitious. The central government rejected the city’s first proposed “master layout plan” of August 1980 as too modest; it wanted to see a large industrial city. The SSEZ was to be “a ‘window’ for observing global trends in economic, technological and scientific development; an ‘experimental ground’ of reforms; and a ‘school’ for human resources training.”¹⁰

In 1981, Beijing gave Shenzhen the same administrative status as the provincial capital, Guangzhou. That meant city leaders reported directly to Beijing, and the central government appointed both Shenzhen’s mayor and its Communist Party secretary. Wayne Huang, founding dean of the SUSTech Business School, notes that “everyone knows if he is chosen to be the mayor or party secretary to lead this city, they have a great future. But they have to show some solid KPIs, key performance indicators, or they won’t be promoted. So they are very motivated.”¹¹

First City Government

The officials assigned to run Shenzhen’s early government came from multiple jurisdictions; they owed their appointments to stellar credentials as revolutionaries, and a demonstrated loyalty to Deng. Circumstances obliged them to be innovators. As one-time Shenzhen Vice Mayor Ming Li points out, officials were expected to find their own way. “The central government gave policies, but no funds,” he says.¹²

Government officials working here, me included, do not ask the provincial or central government for funds when faced with difficulties in local development. Instead, we try to find solutions via the market and global cooperation.

Their assignment was to open China to outside investors and build a market economy. In 1981, Liang Xiang was named Shenzhen’s first party secretary and mayor. He joined Yuan Geng, already in place as vice chair of China Merchants Group (Hong Kong). In 1983, Luo Zhengqi arrived as first president of the newly created Shenzhen University. The trio, wrote scholar O’Donnell, were “willing to take responsibility for actions they believed to be correct, even if those actions were unapproved outside or within Shenzhen’s borders at the time.”¹³

In a country where the government had long assigned citizens housing and jobs, Shenzhen created the nation’s first property and labor markets. In August 1984, the city allowed employers to hire workers for a set time period, adjust salaries to match performance, or fire bad workers.¹⁴ In November 1984, the city abolished vouchers for food, clothing, and other necessities, replaced by a cash market. In June 1988, a comprehensive housing reform ended government distribution of housing and allowed individuals to rent or purchase housing.¹⁵

Land auctions. City government had to find a way to build residential, commercial, and industrial areas. To locals’ surprise, foreigners—even in Hong Kong—at first took little interest in investing in Shenzhen. Instead, Chinese ministries and departments (eventually 24) took advantage of tax exemptions and free land to build the city’s first enterprises.¹⁶ Ironically, the city gave so much land for free to ministries that land scarcity became an enduring problem.¹⁷ But the factories generated enough revenue to start building the city’s infrastructure: electrical lines, water mains, roads.

Then in 1984, Beijing designated an additional 14 coastal cities “open,” creating internal competition for resources. In 1985, to curb a construction boom in many parts of China, the central government imposed stringent fiscal and credit constraints. Shenzhen saw capital construction investment plunge from CNY¥2.8 billion in 1985 to CNY¥1.9 billion in 1986.¹⁸ The lesson was clear: Shenzhen could not rely on government. It would have to find other ways to generate revenue.

Luo Jinxing, vice director general of the Shenzhen Housing Authority, saw a way to bring the city the money it needed. He created a Special Economic Zone Real Estate Company to partner in China’s first joint ventures with Hong Kong investors.¹⁹ In December 1987, Shenzhen auctioned off “use rights” for a 93,000-square foot parcel.²⁰ One of Luo’s joint ventures bought the parcel for CNY¥5.25 million (\$1.42 million).

It was the city’s first revenue from a land auction. As former Vice Mayor Ming Li puts it: “The first bucket of gold in Shenzhen was earned from land auctions The government took the money from auctions to construct the urban infrastructure, such as roads, or plumbing networks.” Such experiences led Shenzhen’s leaders to become, says Ming Li, “innovative problem solver[s]. Instead of asking others for monetary support, we have had to find our own solutions to problems. Self-reliance has become a habit.” Before long, it identified other funding sources: in 1989, the city’s Second Master Plan explicitly called for more exports and more foreign investment.²¹

Flocking to Opportunity

That kind of city proved a magnet for China’s most ambitious young people. Millions, including military brigades sent by Beijing, came to build the city—construction workers, plumbers, electricians. “From one year to the next, there were cranes everywhere,” reported an observer. “The whole place was a construction site.”²²

Other immigrants were young professionals trapped in dead-end jobs, mired in poverty, or unhappy in good jobs. “If a young man has neither political nor academic advantages, and the only thing he has to offer is hard work, then Shenzhen is the place where he has the biggest shot,” says CDI’s Li, who him-

self arrived in 1989. SUSTech Dean Wayne Huang concurs: “You don’t need connections. You create your own connections. That appeals very well to risk-taking, ambitious young people.” Entrepreneur Su Ming mentions another attraction: “You can make money here.”

In 1984, Deng made a ceremonial inspection tour of three SEZs, including Shenzhen. He was curious to see it, but he also wanted to undercut the city’s critics in Beijing. During the tour, he commented repeatedly on Shenzhen’s progress and voiced his approval of its reforms. At the end, he pronounced that “the development and experiences of Shenzhen have proved the correctness of our policy on the establishment of special economic zones.”²³ The following year he added that “the open policy will not be changed. If changed, it will only become more open. Without the open policy, there is no hope for” China’s modernization.²⁴

Nonetheless, in 1985 authorities created a division between the SEZ proper and greater Shenzhen. To control migration, the government completed construction of an internal border called the Second Line (the First Line was the border with Hong Kong). Almost as well guarded as an international border, sentries manned 163 watchtowers along a 90-kilometer patrol road. To enter the SEZ, migrants had to obtain a Boundary Region Pass, granted only after providing proof of employment, political affiliation, an invitation from within the SEZ, and a fee payment.²⁵

Even with that added obstacle, the population exploded. The Shenzhen Planning Bureau in 1981 predicted that the SEZ population would reach 400,000 in 1990 and 1 million by 2000. The region hit every milestone early. From 310,000 in 1979, the population reached nearly a million in 1986, 1.5 million (4.49 million in greater Shenzhen) by 1995, and 3.19 million (8.46 million) in 2006.²⁶

It made for a strange mix, with non-locals far outnumbering locals. “It is those who have ambitions to achieve a career and personal development that have made it here from all over China,” says former Vice Mayor Li Ming, who arrived in Shenzhen in 1992. “Non-locals make up more than 90 percent of Shenzhen’s population.” The city’s predominant language became Mandarin, not Cantonese as in the rest of Guangdong.

Hukou. But the flood of blue- and white-collar workers caused a host of problems. One of the thorniest was the *hukou*, or residence permit. Across China, access to social services including education and housing required a *hukou*. In large, desirable cities, these were nearly impossible to obtain. As a result, moving from one city to another was rare.

Shenzhen, faced with millions of workers with no right to housing, had to improvise. In 1984, the authorities allowed migrants without a *hukou* but with a job to register as temporary workers.²⁷ Nonetheless, some workers found only seasonal or temporary jobs—and remained unregistered. In general, unregistered workers earned less, had no access to subsidized healthcare or education, and had to pay hefty fees for their children to attend school.²⁸

Housing. To house them, the city built as fast as it could. The term “Shenzhen speed” was coined when city construction firms in the 1980s succeeded in putting up skyscrapers at an average 2½ floors per day. As the city grew, millions who could not afford market rent lived in huge, subsidized corporate dormitories. As one academic put it, Shenzhen’s “growth was propelled by a purposeful push from a powerful state. Its boom was sustained by the extended implementation of favorable policies and rapid and continued build-up of large-scale, state-financed infrastructure.”²⁹ The city also granted property ownership rights to villages inside the SEZ—and enterprising villagers rushed to profit from the newly created real estate market. Before long, the encroaching city swallowed what became known as “urban villages.”

An Economy Rises

In the midst of this frenzied building boom, an economy grew in Shenzhen. Its core was manufacturing, most of it labor-intensive, low-technology assembly of household electronics like telephones and calculators. Production costs in Shenzhen (as in China generally) were significantly lower than in developed economies. While their quality was often shoddy, Shenzhen products satisfied millions of consumers both in China and abroad. The city also developed a sophisticated shipping industry.

As the city had hoped, Hong Kong businessmen soon saw the virtue of building factories in Shenzhen. The city’s foreign direct investment (FDI) rose from CN¥30 million (\$17 million) in 1981 to CN¥2.49 billion (\$720 million) in 1986.³⁰ To further attract foreign investors and business owners, Shenzhen in 1987 created an Office of Foreign Investment Promotion to plan, approve, manage, and provide services for foreigners.³¹ The same year, it opened the Shatoujiao Bonded Industrial Area to attract more FDI.

The city realized that to flourish, its local enterprises needed financial services, starting with banking. In 1982, it admitted the first foreign bank to China (the Hong Kong-based Nanyang Commercial Bank).³² On July 8, 1983, the Joint Investment Corporation of Bao’an County issued the country’s first stock. In 1985, the city opened a foreign exchange center, followed in May 1988 by the Shenzhen Foreign Exchange Trading Center, which ended the country’s longstanding ban on trading currencies.³³ It established the first capital goods market and futures exchange in China. In 1986, it was the first city to privatize a state-owned enterprise (SOE).³⁴ In 1987, the China Merchants Bank became the first joint stock commercial bank on the mainland. The Shenzhen SEZ Securities Corporation was China’s first securities firm.

Shenzhen’s GDP rose from CN¥196 million in 1979 to CN¥13 billion in 1986 at an annual rate most years of 30+ percent.³⁵ By 1989, Shenzhen was well on its way to becoming a thriving metropolis of small manufacturers. But the entire development model it represented was about to come under intense attack.

Threat and Recovery

From April 15 to June 4, 1989, a million student-led Chinese protestors gathered in Tiananmen Square in Beijing to call for greater democracy, freedom of the press, and freedom of speech. The students were no fans of untrammelled capitalism, either; they protested equally against the kind of social and financial inequality they saw emerging in Shenzhen. The government took a while to decide how to respond, but once it did, the results were bloody. At least 300 died; thousands were arrested.³⁶

In the wake of Tiananmen, ideological opponents of SEZs gained influence nationally.³⁷ To Party conservatives opposed to market liberalization, cities like Shenzhen were an affront, veering far too close to capitalism.³⁸ These critics also pointed to the 1989 fall of the Berlin Wall and subsequent collapse of the Soviet Union as a cautionary tale of what happened when a state loosened economic and political controls.³⁹ The critique had a chilling effect on commerce: by 1990, many foreign investors had fled China and its growth rate fell to one-third that of recent years.⁴⁰

Many leading Beijing officials called Shenzhen a mistake. What city leaders saw as flexibility and experimentation, SEZ critics decried as lawlessness and chaos. “The perception at that time was [Shenzhen] was very corrupt,” says Dean Huang, that “with money you could buy everything.” Shenzhen had also skirted a national law that required employers to give permission for employees to transfer to new jobs. “Shenzhen at that time had a policy that said even if you don’t have an official stamp agreement, we accept you,” recounts Huang. Provincial governors nationwide complained to Beijing. “They wanted the central government to punish the Shenzhen city government,” says Huang.

City leaders were unsure how Beijing would react post-Tiananmen. They prepared two action options: resign or stay the course. For months, Shenzhen government officials, entrepreneurs and financiers waited anxiously to see whether they would be allowed to continue their economic experiment. Meanwhile, the city government further improved business conditions. In December 1990, it established the Shenzhen Stock Exchange—another first.⁴¹ It also permitted former SOEs to go public.

Exonerated. Finally, in January 1992, Deng made another southern tour, a follow-up to his famous 1984 trip. He had stepped down from his government and Party positions, but his words still carried great weight with policymakers. In Shenzhen, Deng made the case for a socialist market economy. “If China does not practice socialism, does not carry on with ‘reform and opening’ and economic development, does not improve the people’s standard of living, then no matter what direction we do, it will be a dead end,” he said.⁴² He urged the city not to “act as women with bound feet”; in other words, to move boldly.⁴³

Deng’s visit produced immediate benefits: the Standing Committee of the National People’s Congress later in 1992 granted the Shenzhen Municipal People’s Congress (city legislature) and its Standing Committee the power to pass its own laws, including setting its own tax rate and structure. Only the national and provincial People’s Congresses had such legislative authority. The city in rapid succession adopted a minimum wage and social insurance package (pension, medical, housing), expanded privatization, and implemented governance reforms for SOEs.⁴⁴ Shenzhen’s 1993 FDI rose to US\$497 million from \$250 million a year earlier.⁴⁵

Indirectly, Tiananmen benefited Shenzhen. Many of those disillusioned by or caught up in Tiananmen sought new opportunities in the experimental city to the south. “In Shenzhen, whatever you do, nobody judges or interferes,” notes CDI’s Li, who himself moved to the city in the wake of Tiananmen. His CDI colleague Nan Jie agrees. A lawyer, she also moved to Shenzhen after 1989, and found that “everything felt fresh, as if everything had just begun from zero.”⁴⁶ She adds:

Shenzhen is the Chinese city that agrees the most with international rules and values. That is the biggest difference. Here they don’t care about whether you are a capitalist, Communist, or socialist. They only prioritize efficiency, global collaboration, and global rules. Politics is not the priority.

Moving Toward High-tech

Reenergized Shenzhen government officials realized they could not rest on their laurels. As competition grew within China as well as from other Asian countries, low-cost manufacturing was no longer a reliable economic engine. The high-technology industry seemed to offer promise. As early as 1982, in its first Outline Plan for Social Economic Development, the city government had called for a focus on high-tech—which at the time meant consumer electronics—and capital-intensive enterprises.⁴⁷

Shenzhen had even made a stab at cornering the Chinese electronics market when, in 1986, the national Ministry of Electronics teamed with the city government to establish the Shenzhen Electronics Group Company, a state effort to operate China’s first elec-

tronics parts supply market. The ministry contributed experts while the city gave land and tax exemptions. The business focused on small, consumer electronics like televisions which could be easily copied from existing models.

But the state-operated enterprises failed. So the city government took a pragmatic decision: get out of electronics, and let private enterprise take over. “If it was unable to lead the development of this industry itself, why not let market forces do the work instead?” summarizes Michael Hou, chair of research for a Shenzhen futures brokerage.⁴⁸ There were candidates already in place, although no one could have predicted their future course. In 1987, entrepreneur Ren Zhengfei established a small company he called Huawei to import phone switches from Hong Kong and reverse engineer them. “The government,” says Hou, “kept its hands out of equity rights and investments in private, high-tech businesses, allowing them to operate enterprises on their own terms.” The following year the Taiwan-based electronics firm, Foxconn Technology Group, opened a factory in Shenzhen.

As of 1991, Shenzhen’s output in high-tech was valued at a modest \$340 million.⁴⁹ Some wanted to change that. One of them was Zhou Luming, who in early 1992 moved from a university job in Wuhan to work in the Law and Regulation Office of Shenzhen’s Department of Science and Technology. A year later, he was director. He moved because he realized that “all these academic articles we were writing were unable to resolve real problems,” and he hoped for better in Shenzhen.⁵⁰ But on arrival, he was “extremely disappointed, because there were no systematic incentives [to attract] innovative talent before 1992. Everyone was still gaming the stock market and real estate market, or just doing conventional trading.”

Then in August 1992, public protests shook the Shenzhen government. Some 700,000 frustrated would-be investors rioted because shares for a new issue on the Shenzhen stock market were insufficient to meet demand. The protesters were sure that corruption among officials at the People’s Bank of China lay behind the snafu.⁵¹ The stock exchange crisis, says Zhou, coincided with declines in Shenzhen’s real estate, trade, and manufacturing sectors. The protestors “had quite a scandalous conflict with the

police,” he recalls, but protest “was a key catalyst to force Shenzhen to switch from its traditional focus on stocks, real estate, and trade to the innovative high-tech sector.”

From where he sat in the five-person Law and Regulation Office, Zhou could see for himself just how far Shenzhen still had to go to encourage high-tech. One of his assignments was to design a system for valuing intangible assets—an essential tool for any technology company that relied on knowledge and ideas. “It was unimaginable before 1992 in China that technology knowledge could constitute valid capital, a basis for investing in a company,” he says.

To his satisfaction, Shenzhen became “the first to introduce a policy that allowed investing in a company with technology as its capital.” Even then, the national 1993 Companies Law limited investment in intangible assets to 35 percent, forcing nascent technology firms needlessly to acquire real estate and other real property in order to reduce the percentage of their most valuable asset—knowledge. In Shenzhen, that limit was quickly lifted to 90 percent.⁵²

Policy shift. In May 1993, the city formally announced a new focus on high tech, specifically software, telecommunications, microelectronics, optical-electro-mechanical integration, and new materials.⁵³ The city’s 9th Five-Year Plan (1996–2000) called for it to become a “world class city.”⁵⁴ In 1996, it further advanced high-tech enterprises by creating the Shenzhen High-Tech Industrial Park (SHIP).

The government published plans, but in practice Shenzhen policy followed where companies led. “The decision to make the shift has always been made by the enterprises themselves, not the government,” emphasizes Zhou. “The innovative mindset always originated within enterprises.” Research conducted by lawyer Nan Jie (CDI) found that in fact the largest Shenzhen companies “did not get even one penny from the government during their founding days, which was totally the opposite of our expectation. I do not think government policies played a role in pushing the advancement of these enterprises.”

Shenzhen expert Mary Ann O’Donnell agrees. “It’s not that [government] said, let’s do IT,” she notes.⁵⁵ Instead, it adopted an “own it if it works” mentality. “You see it all the time in Shenzhen’s history: some-

thing gets tried, and they see if it works. If it works, you formalize it. And if it doesn't work, you forget about it. You pretend it never happened," she adds.

Others concur. Risk analyst-turned-researcher Hou points out that "the massive electronics and digital industry around Shenzhen, which created a mature supply chain, laid the foundation for developing a high-tech industry." David Li, a Shenzhen veteran who in 2015 founded the Shenzhen Open Innovation Lab technology incubator, adds that "the Chinese government doesn't gather round a whole bunch of experts and say, OK, well, let's find a path. It says here is a playground, let's experiment. Go figure out something you want to do, something you can do to make money."⁵⁶

Innovation, argues CDI Senior Research Fellow Li, was Shenzhen's lifeblood. In Beijing, he notes, government protected state-owned enterprises from failure, making innovation "only an option instead of a necessity." Innovation centers for Shanghai's mostly foreign-owned businesses were located abroad. But "for enterprises in Shenzhen, no innovation led to their own demise," he says.

Learning to Innovate

Business people were not the only ones in Shenzhen who had to learn to innovate. City government officials of necessity became creative. As one research report says, in China's centrally-planned economy "no local government had any clue as to how to build a city that would appeal to foreign investors."⁵⁷ Internet entrepreneur Su agrees that Shenzhen's first officials "had a weak educational background. . . . They rose from very low military ranks, actually without any wisdom or vision. But they were advocates for a market economy."

Former Law and Regulation Office Director Zhou confirms that by and large, he and his colleagues had "zero experience in the fields at hand. But during Shenzhen's trials and experiments, a lot of specific issues began surfacing and I really just had to face up to them What else could we do but come up with solutions?" In Beijing, officials solved problems that city leaders identified, but in Shenzhen, "I would take a look to see what the problems were in industries, and then I would cope with the problems I had personally identified," he says.

As part of that coping, city officials also had to learn when and how it was safe to depart from central government plans and policies. As an SEZ, it had unusual autonomy. But in the end, central diktats trumped local needs. For example, the city had promulgated successive master layout plans which the State Council approved: in 1982, 1986 (approved 1989), and 1996 (approved 2000).⁵⁸ Each plan stipulated the amount of land devoted to a host of uses, from industrial to residential, utilities, and recreation.

But, as one study puts it, "the bold planning ideas were constrained by the planned population figure defined by the central government."⁵⁹ China's central planners consistently projected lower-than-actual population for Shenzhen. The projections affected funding allocations, so the undercount undercut the city's efforts to deal with residential overcrowding (illegal construction filled the void) and limited its ability to provide adequate social services.⁶⁰ The contradiction also led to false statistics, for example the city's per capita GDP rate.

Still, city officials did their best to create a climate friendly to investors, especially foreigners, and corporations. Most public officials saw the city's interests as aligned with business. One Shenzhen anecdote illustrates this: in the late 1980s, the central government issued an arrest warrant for Huawei founder Ren Zhenfei because he allowed his employees to acquire company shares. The government claimed Ren had violated finance regulations. Vice Mayor Li Chuanfang, who was out of town, immediately flew back to defend Ren and prevented the arrest.⁶¹

July 1997 saw the first appearance of the *Shenzhen Daily*, the only English-language publication in south China (published by the Communist Party).⁶² In 1998, it streamlined the approval process for new businesses (including, that year, digital products firm Tencent) and reduced administrative interventions. It also established an online procurement platform for government intended to facilitate transparency and deter corruption. It modified the laws and regulations governing audits of projects in which the government had invested.⁶³ As SUSTech Dean Huang puts it, Shenzhen tried to be a "small government, big society model, whereas inland China was a very traditional big government, small society model."

Pay them to come. The city also expanded on an earlier idea: pay technology entrepreneurs to consider Shenzhen. In 1992, the city had been the first in China to create city-sponsored entrepreneurship venture capital grants. The 1992 round of grants were distributed from the so-called Innovation Fund aimed at small- to medium-sized businesses, while a second round of investments in 1999 came from the High-Tech Investment Fund.

In 2000, it put additional money into luring tech-savvy overseas Chinese. The Municipal Finance Bureau allocated CN¥10 million (\$1.46 million) and the Funds for Technologies another CN¥20 million (\$2.93 million) a year for overseas students to start businesses in Shenzhen. It opened a Shenzhen Overseas Chinese High-Tech Venture Park inside SHIP, which provided entrepreneurs with infrastructure as well as finance, consulting, training, networking, and marketing services.⁶⁴

Results were encouraging: in 2000, high tech contributed 42.3 percent of Shenzhen's gross industrial output value.⁶⁵ It was ironic that the city pushed for digital innovation even as the central government, alarmed by the unfiltered information available on the Internet, reacted in 1998 with draconian restrictions on non-Chinese websites, throwing up what became known as the Great Firewall of China.

We'll handle it now. In some ways, Shenzhen could be seen as the victim of its own success as Beijing created scores of other SEZs—and competition for Shenzhen—across the country. After Shenzhen proved the concept, in 1990 Shanghai's Pudong district became an SEZ. In 1992, Beijing endorsed SEZ-like policies across some two dozen additional inland cities, including all provincial capitals.

A 2003 *People's Daily* article even contrasted Shenzhen unfavorably with Beijing, Shanghai, and Guangzhou, and predicted its decline to second-tier status. After iterating the alleged defects of its financial markets, urban planning, safety, and social policies, the article noted that “obviously, Shenzhen is no longer in the same rank with Shanghai, Beijing, Guangzhou and other cities, but has begun to be comparable to cities such as Suzhou, Qingdao and Dalian.”⁶⁶ The implicit message to Shenzhen, says technology pioneer David Li, was, “you have made your contribution to the

motherland, and now the real cities of China will take over. So you guys can go into the sunset and die.” But something unexpected happened: Shenzhen did not fade away. It all started with DVDs.

Intellectual Property

In the late 1990s, the primary entertainment vehicle for consumers was DVDs. In China, most DVDs were pirated and wouldn't play in brand-name machines, so Shenzhen manufacturers created DVD players that would play anything—and sold millions of them. “Intellectual property didn't matter,” says David Li. “Everybody copied everybody The practice was everybody's competing with everybody, but you don't litigate” over copyright or patents.

Protecting intellectual work had never been a priority in China. Part of the problem, explains lawyer Nan Jie of the China Development Institute, was that the public never understood the concept of intangible property. “If I steal your chair, then you lose a chair to sit on. But if I take away something ‘intangible,’ you are still able to keep using it, aren't you? So they don't consider this a form of felony,” she says.

“Back then, we had a lot of conflicts caused by tech professionals who quit their jobs and did their own start-ups with technologies taken from their previous employers,” recalls Zhou Luming. In the 1990s, his Law and Regulation Office crafted an intellectual property law for Shenzhen, “the first law concerning commercial secrets in Chinese legal history.”

WTO. But by 2000, the Chinese government was paying a lot more attention to intellectual property rights (IPR). It wanted to join the World Trade Organization (WTO); membership would mean lower global tariffs on Chinese goods and greater foreign investment. So China changed or updated numerous laws to meet membership requirements. For one thing, it acceded to the global Patent Cooperation Treaty. It cut subsidies to state-owned enterprises and lowered its own tariffs and trade barriers in telecommunications, the financial sector, and other industries. It also, for the first time, allowed “capitalists” to become members of the Communist Party. “Allowing private entrepreneurs into the party really reinforced a certain mutual dependence between the party-state and the private

economy,” said Kellee Tsai, dean of humanities and social sciences at Hong Kong University of Science and Technology.⁶⁷

Importantly, the Chinese government promised strengthened protection of IPR. Laws had been on the books since the “Rules for the Implementation of Trademark” law passed in 1983. In 1992, Beijing had signed an MOU with the U.S. on protecting intellectual property.⁶⁸ Even the Shenzhen Administration of Industry and Commerce had established a Shenzhen Trademark Office in 1993.⁶⁹ But now the central government signaled its serious intention to enforce the law.

In December 2001, China formally joined the WTO. Within three years, exports doubled and in four, they tripled.⁷⁰ Investment poured in, and manufacturers moved to China in droves. IBM alone set up eight companies, while Japan’s Sanyo Electric had 10.⁷¹ On July 21, 2005, Beijing introduced a managed floating foreign exchange rate system, and discontinued pegging the yuan to the U.S. dollar. In December 2006, it opened its financial sector to foreign banks.

WTO membership was especially important to a city like Shenzhen, whose fortunes were so closely tied to the global economy. In 2002, the city set up a WTO Affairs Center for consulting, training, forums, and legal counsel.⁷² While hardly a backwater until now, Shenzhen was about to take on a role its leaders could hardly have imagined.

Administrative Reform

Shenzhen government started the century with an administrative reform. Paradoxically, the relatively light hand of early Shenzhen bureaucrats had become heavier with time and experience, and segments of the business community had started to complain about cumbersome government regulation. Others, on the other hand, pointed to insufficient enforcement; tens of thousands of unlicensed businesses, from retail outlets to restaurants, medical clinics, and real estate projects, operated unchecked.⁷³

The 1980s and ‘90s had already seen five phases of reforms that restructured the bureaucracy’s role in economic activity and allowed it to focus on macro-economic rather than day-to-day issues.⁷⁴ In 1989, for example, a new Shenzhen Urban Planning and Land

Administration Bureau brought planning, land administration, housing development, and management under one roof.⁷⁵

In 2001, city leaders further combined disparate units that had dealt with transport, trade, and media into, respectively, the Transportation Bureau, the Trade and Industry Bureau, and the Culture Bureau. “These functions were formerly scattered in different departments, and the reshuffle has resulted in evident improvement of efficiency,” said Mayor Xu Zongheng.⁷⁶

In 2003, the city tried to reduce what one observer saw as the government’s tendency to “overreach, neglect and misjudge” by separating government functions into discrete decision-making, executive, and supervisory bodies.⁷⁷ The changes, wrote one expert, converted city government “from an omnipresent one to a more limited one, from a regulator/administrator to a service provider, and from a power-holder and influence-wielder to one with a civil service identity and accountability.”⁷⁸ It reduced the number of administrative requirements for businesses from 1,091 to 239, and abolished 145 of 225 temporary government agencies.⁷⁹

In April, President Hu Jintao, on a visit, lauded Shenzhen as an “open window and experimental ground” that should remain in the vanguard.⁸⁰ Meanwhile, the city’s 10th Five-Year Plan (2001–05) emphasized global economic integration and went beyond growth targets to discuss quality of life, the environment, and the need for legal and democratic institutions.⁸¹

To lure foreign businesses, the city offered a raft of incentives from cheap land prices to tax breaks, rapid customs procedures, permission to repatriate profits and capital investments, duty-free import of raw materials and intermediate goods, exemption from export taxes, and a limited license to sell domestically.⁸² The foreign corporate tax rate, for example, was 15 percent, compared to 30 percent for Chinese companies—until China in 2007 established a common effective tax rate of 25 percent for all firms. Still, for foreign firms it maintained a two-year exemption from corporate income tax, plus a half-rate for the next two years.

Additionally, foreign professionals were exempt from the 3 percent local income tax. The city offered individual foreign businessmen and women housing subsidies, assistance with children’s school tuition, and help in securing a *hukou*.⁸³ The benefits helped persuade Jef-

frey Holtmeier, in 2004 CEO of Konzept International Inc. to locate to Shenzhen. The software development company was looking for a China base and, he says, chose Shenzhen “based on the attractive corporate tax incentives provided to technology companies.”

The reduction in income taxes and other benefits offered to our company enabled us to expand our development team in order to deliver our digital media solutions much faster to the market. Over a five-year period, these incentives amounted to more than US\$1 million, which was reinvested into the company.⁸⁴

Taken together, the government reforms and business incentives put Shenzhen in a good position to benefit when the next technology revolution unfolded in its own backyard. It started quietly enough.

The Phone Tsunami

In the early 2000s, Shenzhen had reason to remember the lesson it learned from DVD players: make what the public wants, cheaply and quickly. Early in the 21st century, Nokia, Samsung Motorola, and others used Shenzhen factories to manufacture a growing line of cellphones. Local entrepreneurs proved ready and willing to provide the same product, at a better price. “In 2002–2003, the really big break comes to Shenzhen,” says David Li.

It is the introduction of the GSM mobile phone.⁸⁵ [The cellphone] is one of those devices where you don’t need to educate your users The only question the user has is, can I afford it? A lot of phones were already produced here, so the know-how was here. Shenzhen jumped into making mobile phones—and that’s the [start of the] golden 10 years of Shenzhen.

Eager entrepreneurs saw an opportunity. Cellphones could cost as much as \$600 to \$800 in the West. With reverse engineering, Shenzhen inventors were able to recreate the same phone for under \$100, often using the exact same machinery. What phone makers found in Shenzhen was a complete supply chain, plus designers and manufacturers. Huaqiangbei Commercial Street was the most visible symbol of the city’s focus on electronics.⁸⁶ It comprised over 20 electronics malls, some 10 stories high, spread across 21 million square meters.⁸⁷ For years, the city’s small businessmen had

turned to Huaqiangbei for components to make cheap copies of others’ products. There was even a word for the knockoffs: *shanzhai*.

But a funny thing happened in the decade 2003–13. Shenzhen entrepreneurs flipped *shanzhai* from a liability to an asset. Individuals discovered that instead of simply copying existing phones, they could produce better ones by adding features that appealed to consumers. Seemingly overnight, manufacturers turned from reverse engineering (copying) to creative engineering—inventing new commercial features and products. What’s more, their products cost less, much less. “These guys were figuring out how to copy premium goods on a shoestring budget,” noted one long-time Shenzhen watcher.⁸⁸

Individual inventors experimented, trying component combinations to yield new capabilities. Creators moved from concept to product within weeks; the same process in the U.S. or Europe could take months. Inventors accepted that what was hot today would be obsolete tomorrow; they were already onto the next thing. Thousands of small-scale technology producers made fortunes. Clever engineers could make \$3,000 a day in Huaqiangbei with ever-evolving products.

Whereas the economics of production in the West mandated large manufacturing runs, companies frequently created a few thousand units in Shenzhen to test a product’s appeal to consumers. Depending on the response, a firm could either cut its losses or ramp up production. Innovation examples included phones that accepted two SIM cards, UV lights to detect counterfeit bills, compasses that pointed to Mecca, batteries that lasted a week, or hoverboards.⁸⁹ As Eric Pan, founder and CEO of Seed Studio, put it: “Ordering electronics here is now like service in a restaurant.”⁹⁰

CDI’s Li Junkui observes that in Shenzhen, “all the work procedures are already segmented to the extreme. Specialized personnel are equipped to deliver work of optimum quality at each and every step of the production process.” Will Canine, co-founder of a company that made robots to handle liquids, agreed:

When you’re creative, you want to try an idea and move on to the next idea and then the next idea. That’s the kind of dynamic flow that’s possible in hardware in Shenzhen that’s not possible in the United States.⁹¹

When Apple in 2007 launched the iPhone, it selected FoxConn in Shenzhen to assemble them.⁹² When the smartphone really took off in 2012, Shenzhen companies such as Vivo, Oppo, Huawei and ZTE devised and marketed their own, cheaper, versions. At one point, estimates entrepreneur Su Ming, fully a third of the city's population worked in cellphones.

Metrics of a Boom

The low-cost, low-skill work that distinguished early Shenzhen gave way to a more complex model. From being the world's factory, Shenzhen became a technology incubator. A center for information and communications technology, it designed and assembled desktops and laptops, software, and telecommunications equipment. "Even Huawei benefited tremendously from the ecosystem," says David Li. "Huawei could not have scaled without that supply chain."

Private business boomed. By 2005, 135,000 of the 170,000 registered companies in Shenzhen were private.⁹³ Multiple technology giants had headquarters in Shenzhen, from Huawei Technologies Co. Ltd. (telecoms) to Tencent Holdings Ltd. (Internet, gaming), Da-Jiang Innovation (drones), and ZTE (telecoms). Twenty-two local companies were among China's top 500 firms. The city was also home to some 300,000 small-scale businesses.

The high-tech sector alone grew 46.5 percent over two decades, scoring a 2004 output of \$39.5 billion.⁹⁴ In 2007, Shenzhen topped all Chinese cities with 2,480 new patents, and its high-tech businesses contributed a record amount to GDP.⁹⁵ The following year, 2008, high-tech output from companies whose assets included intellectual property was \$75.49 billion.⁹⁶

Foreign investments continued to pour in. As of 2008, FDI was growing an average 28.6 percent a year, and that year reached \$4.03 billion.⁹⁷ Of the world's top 500 companies, 164 had investments in Shenzhen. Trade had leapt from \$17 billion in 1979 to \$287.5 billion in 2007, while GDP had grown from \$4 million in 1980 to \$114.47 billion in 2008. Per capita income rose in parallel, from \$122 in 1980 to \$13,196 in 2008.⁹⁸ The Shenzhen stock exchange was as important as the one in Shanghai.

As of 2007, Shenzhen had been China's premier export city for 15 years straight; its exports had grown to over \$150 billion a year.⁹⁹ In June 2008, the central government named it China's first National Innovative City.¹⁰⁰

Riding the Tiger

While Shenzhen city officials were gratified that earlier policies had laid a strong foundation for growth, their challenge as the city prospered was to stay on top of business conditions and keep firms in the forefront of technology innovation. That meant rewarding what worked, while leaving the mechanics of experimentation to companies.

Despite its progress, Shenzhen had its critics. Long-time Shenzhen watcher George Zhibin Gu noted that "China's modern tradition of government domination is still going strong in Shenzhen," and government was still too close to business.¹⁰¹ For example, "innumerable transactions that could be privately handled require official involvement," from permission to engage in international trade to hiring and travel. Building a hotel required 105 separate approvals.¹⁰² Meeting government demands created fertile ground for corruption. One clerk, Wang Jianye (later executed), extorted millions of dollars from businesses that needed his approval for foreign currency transactions.¹⁰³

As one China-based business consultant put it: "the government must change its functional role to become a servant of the public, rather than a mandarin-like institution where supplicants must appear to beg for favors."¹⁰⁴ Special privileges for private firms "have attracted resentment from local Chinese business owners," he wrote. In response, some locals registered their companies offshore to gain the same privileges.

Corruption. What's more, as elsewhere in China, the Shenzhen government suffered from corruption, in part, said critics, because government controlled too many business functions.¹⁰⁵ Over the years, the city had arrested hundreds of local government officials on corruption charges, including the top three leaders of the Nanshan district: Party Chief Yu Dehai, Chief Administrator He Cuben, and People's Congress Chair Pen Hu, all convicted of extortion.¹⁰⁶ A generation later, in June 2009, the city detained deputy party secretary and Shenzhen Mayor Xu Zhongheng

on charges of accepting CNY33 million (\$US5.1 million) in bribes to change zoning, interfere in project contracts and facilitate promotions.¹⁰⁷ Five other city officials also lost their jobs.

Meanwhile, principled city leaders tried to steer a middle course that allowed them to influence private sector behavior without controlling it. One tool that continued to be valuable was tax breaks. To encourage exports, for example, the city offered a 10 percent corporate tax rate to firms that exported 70 percent of output. High-tech enterprises and exporters paid only half the city's industrial land-use fees for the first five years of operations. They paid no transaction fees for the transfer of land-use rights; and were exempt from registration and trading charges for production and operations facilities.¹⁰⁸

To promote innovation, the city gave companies using state-of-the-art technology the same 10 percent corporate rate for three years. High-tech manufacturers enjoyed a 6 percent rebate on value-added taxes (the rate was 17 percent), in exchange for spending the refund on research and development. It gave software companies two years' exemption from corporate taxes after their first profitable year, and half-rate the following three years.¹⁰⁹

Shenzhen lured some promising firms with generous subsidies. For example, BGI, the former Beijing Genomics Institute, moved to Shenzhen in 2008 after the city offered rent-free facilities and annual grants of \$3.1–\$4.6 million for equipment and research.¹¹⁰ At one point, BGI owned half the world's genome-sequencing machines. The city also got into the loan business, co-signing loan agreements with local banks—often at a discounted interest rate—for high-risk but promising technology companies, or those with proprietary products.

It made grants as well, aimed at rewarding what it saw as the best companies. “Grants in Shenzhen are rarely project specific, but more reward oriented,” says David Li, whose Open Innovation Lab won a government grant. “They tend to help companies that are already doing well. For the Lab, the government grant helped us bootstrap building an open innovation platform that connected global makers and entrepreneurs to Shenzhen.”¹¹¹

“The government serves the high-tech industry; it does not interfere with it,” observes former Vice Mayor Li Ming. “What a business does—how it operates, and how it sells its products—are all up to the enterprise itself.” Shenzhen's government, he says, adopted the principle: “Operate in accordance to your own needs, and pay taxes in accordance with the law.” The price for such freedom was that a failing business could not expect government to bail it out. “If your business fails, we will feel sorry, but we will not interfere,” he adds.

As Shenzhen grew and prospered, it came to rival and in some respects surpass Hong Kong. The island state, long a British colony, returned to Chinese rule in 1997, with the status of Special Administrative Region (SAR). In November 2007, city leaders for the first time dared to voice a hope of closer relations with its near-neighbor. In a draft of its 2030 Urban Development Strategy, Shenzhen for the first time mentioned economic integration with Hong Kong and recommended the cities become a joint financial, trade and shipping hub, with a common capital market.¹¹²

The moniker Shen-Kong started to circulate. Clearly, economic integration faced many a barrier. For one, the Chinese currency was not yet fully convertible. Legal systems in Hong Kong and Shenzhen were different. The Hong Kong stock exchange was public, while the Chinese government owned the Shenzhen exchange. Finally, the two cities held different administrative ranks (SAR vs sub-provincial municipality).¹¹³ Still, the very fact of such an ambition marked a new level of confidence in Shenzhen.

On the Social Front

If government aimed for a light touch toward business, it could be decisive on living conditions within Shenzhen. City officials wanted it to be an attractive place to live. As former Vice Mayor Ming Li puts it: “As a government official here, you have to focus on studying policies and making plans to address the issues commonly faced by business and residents,” from better schools to hospitals, parks, and recreational facilities. “Social issues are inevitable as society progresses and develops,” observes Gong Jianhua, associate professor at the Shenzhen Institute of Administration, a Communist Party school.¹¹⁴ “We want this city to be a favorable place to live for everyone,” says Gong, who teaches social governance.

In 2007, the official population figure was 8.5 million.¹¹⁵ Some 85 percent had migrated from across China. The city continued to skew young, with an average age under 30.¹¹⁶ Shenzhen already hosted a popular tourist attraction, the Windows of the World theme park, which opened in 1994. In 2004, its first subway line began operation—a sign of the city’s growth and ambition.

But it faced social pressures. In 2005, Mayor Xu Zhongheng listed “four difficulties” confronting Shenzhen: limited land; energy and water shortages; population pressure; and pollution.¹¹⁷ The already-overcrowded city, he noted, could no longer accommodate immigrants, who to date had helped drive GDP growth. He could have added to that growing income inequality. Many factory workers and retail clerks made barely \$60 a month, and often went unpaid for months. Seven-day workweeks were not uncommon.¹¹⁸ Of 12 million residents, only 1.75 million had a *hukou*—with its attendant benefits. For even temporary residence permits, the city for years charged the equivalent of a month’s salary (\$45).

To address some of these ills, the city increased restrictions on land-use and sales approval, raised the minimum wage to \$125 a month (the highest in China), and banned certain high-pollution industries like dyeing, papermaking, and leather tanning. The resulting increases in land and labor costs drove some labor-intensive manufacturers to relocate.¹¹⁹ Shenzhen was not sorry to see them go; in fact, its district governments in early 2007 worked with industrial associations and other cities to establish 20 “enterprise transfer parks” that helped less competitive factories relocate to cheaper sites.¹²⁰

To improve the ongoing scarcity of *hukou*, the city in 2005 allowed migrants to apply for permanent resident status. But to even qualify to apply, an applicant had to have paid at least CNY¥200,000 (\$24,700) in taxes over three years, a bar too high for low-wage workers.¹²¹ So in August 2008, Shenzhen introduced a 10-year, no-cost “permanent residence card” for temporary migrant workers that would qualify them for the same housing, medical, education, and pension benefits as those with *hukou*. “The introduction of the new residence certificate system is aimed at gradually removing the barriers between the permanent and migrant populations,” said Wang Pu, director of the city Office of Legislative Affairs.¹²²

The city made other social welfare changes. In 2005, it introduced a basic health insurance program that mandated employers to contribute 1 percent of salary and workers 50 cents a month toward healthcare. In 2006, the city Labor Bureau also instructed factory owners to return millions in back pay that they owed migrant workers.¹²³ The city built multiple city parks that took advantage of Shenzhen’s naturally lush landscape. It applauded companies that hired renowned architects to design the skyscrapers that were rapidly filling in the city skyline.

Elections. The city even took steps to fulfill the 10th Five-Year Plan pledge to introduce more legal and democratic institutions. In March 2008, provincial Communist Party Secretary Wang Yang announced that “the Shenzhen Special Economic Zone must not only be at the forefront in economic construction, cultural construction, and social construction, but also take the lead in building socialist democracy and the rule of law.”¹²⁴ In May 2008, city leaders announced that within three years it would hold a multi-candidate election for mayor on the Hong Kong model.¹²⁵ Candidates would campaign first at the district level, where they could give speeches and engage in public debates.

In November 2008, Party Secretary Liu Yupu followed up with a proposal to eliminate over five years the existing seven district governments (which duplicated much of city government) and replace them with a simplified municipal/district/neighborhood system more in tune with community needs. He called the new arrangement “one-level government and three-level governance,” compared to the earlier “two-level government and four-level governance” structure.¹²⁶ “We will gradually eliminate district-level governments, and we will use the experience of Hong Kong and Singapore for reference,” said Party Secretary Liu.¹²⁷

More momentously, as Shenzhen grew the government found that the Second Line internal boundary created numerous problems, from economic disparities between those outside versus inside the SEZ to smuggling, corruption, traffic congestion, daily difficulties for workers who lived outside where housing was cheaper, and more. In 2009, the Shenzhen Comprehensive Reform Experimental Plan effectively dissolved the city’s internal boundary and officially added an additional 1,553 km² to Shenzhen for a sprawling municipality of 1,948 km².

But just as it burst through its borders, Shenzhen's physical growth came up sharply against a global economic contraction that cost the world trillions.

2008 Hits Hard

The global economic meltdown of 2008 hit China sharply, if not as hard as elsewhere. Nationally, exports fell in November 2008 for the first time in seven years.¹²⁸ In Guangdong province, it caused the collapse of thousands of industrial enterprises. In the first 10 months of 2008, 15,661 enterprises province-wide closed their doors.¹²⁹ Shenzhen alone lost 50,000 jobs in the final months of 2008.¹³⁰

Professor Gong of the Institute of Administration sees the crisis as “a major turning point.” Before the shock, low-end manufacturing had still dominated the local economy. When many of those factories went bankrupt, the municipal government recast its view of the future to prioritize high-tech. “This was when the high-tech industry came to replace manufacturing as the leading industry in Shenzhen,” says Gong.

Nationwide, the 2008 global financial crisis put many political and economic reforms on hold. For example, the national government restored tax breaks for exporters and backed off pollution controls. It granted local authorities permission to freeze minimum wages and suspend employers' social insurance contributions. Tolerance of political dissent narrowed.

In Shenzhen, reform plans “now seem derailed as officials are focused on maintaining social stability,” wrote a reporter.¹³¹ Like other cities, it relaxed enforcement of protections for migrants that had come into effect under the new national Labor Contract Law on January 1, 2008.¹³² On the other hand, the city government post-2008 steadily increased the municipal budget for social goods like health insurance, unemployment insurance, and education from a floor of 60 percent, says Professor Gong. “The percentage is still steadily increasing every year,” he adds.

But as the rest of the world and China emerged from the 2008 financial earthquake and its many aftershocks, much had changed. One new element was that China felt it had weathered the downturn better than many capitalist countries. The leadership felt newly emboldened: a planned socialist market economy had

just proven itself resilient. Looking at the facts, leaders felt planning worked. What's more, one of China's most innovative cities, Shenzhen, remained prosperous. If innovation was the next frontier in a successful economy, then China would plan for innovation.

Made by China

As early as 2001, China had signaled its intention to promote scientific creativity. The 10th Five-Year Plan (2001–05) first singled out science and technology innovation as a national goal. Then in February 2006, the State Council published guidelines for a 15-year Medium- and Long-term Plan for Science and Technology Development (2006–20).¹³³ The plan aimed to “shift China's current growth model to a more sustainable one, to make innovation the driver of future economic growth and emphasize the building of an indigenous innovation capability.”¹³⁴ It called for major breakthroughs in basic research, and for more Chinese patents. A 2010 State Council directive promoted aggressive growth in “strategic emerging industries,” from environmentally friendly technologies to biotechnology.¹³⁵

The national 12th Five-Year Plan (2011–15) took the innovation theme further. The plan put in place policies and practices to prioritize domestic innovation efforts, promote domestic industry champions, and encourage technology acquisitions.¹³⁶ In June 2015, the State Council issued “Opinions on Several Policy Measures to Promote Mass Entrepreneurship and Innovation,” which laid out 30 actions in 10 areas, including fiscal and tax policy, for a transition to innovation-powered growth.¹³⁷

Made in China. In May 2015, Beijing published a “Made in China 2025” plan that aligned state and private industry's efforts to establish the country as the world's preeminent manufacturing power by 2049. It listed 10 industries in which it aimed to become globally competitive within 10 years; all the industries were high-tech, from robotics to aerospace and advanced IT. Among other goals, the plan called for a 40 percent increase in domestic components of essential technology by 2020, and 70 percent by 2025.¹³⁸ The plan allocated \$300 billion for China to become largely self-sufficient within seven years in multiple industries from aircraft to robots.¹³⁹

The 13th Five-Year Plan (2016–20), dubbed Internet Plus, built on this.¹⁴⁰ Innovation became a national goal, with an emphasis on research and development in 10 key industries: aviation, agriculture, electrical power, new energy sources, automobiles, robotics, IT, new materials, rail transport, maritime engineering, biomedicine, and medical equipment. Innovation, it stated “must be placed at the heart of China’s development and advanced in every field, from theory to institutions, science, technology, and culture Innovation should permeate the work of the Party and the country and become an inherent part of society.”¹⁴¹

In his 2015 annual government work report to the National People’s Congress, Premier Li Keqiang used the term “innovation” 38 times; a year later, he used it 65 times.¹⁴² “Innovation is the primary driving force for development and must occupy a central place in China’s development strategy,” he wrote in 2016.¹⁴³ On August 8, 2016, the State Council issued a separate Five-Year Plan specifically for Science, Technology and Innovation. The blueprint aimed to increase science and technology to 20 percent of GDP.¹⁴⁴ The goal: put to rest the connotations of low quality associated with the label Made in China, and substitute instead Made by China. A December 2016 State Council plan again emphasized emerging industries.¹⁴⁵ In 2017, the state announced a separate strategy to become dominant in artificial intelligence.¹⁴⁶

The pivot toward the private sector pioneered in Shenzhen had by 2017 taken firm hold across China. For example, revenues at state-owned enterprises in 2013 were six times higher than in 2000, but at private companies they were 18 times higher. SOE profits were seven times higher over the same period, but at private firms they rose by a factor of 23.¹⁴⁷ In 2017, the private sector produced more than 60 percent of GNP, employed over 80 percent of urban workers, and generated 90 percent of new jobs.¹⁴⁸

The national government in ways large and small acknowledged Shenzhen’s contribution. In December 2012, President Xi Jinping—in his first visit outside Beijing as top Party leader—came to Shenzhen to offer his respects to a statue of Deng.¹⁴⁹ Premier Li Keqiang in January 2015 visited Shenzhen incubators, where he touted innovation and start-ups.

The 13th national FYP (2016–20) even referred specifically to the Shenzhen region. Chapter 37, Section 4 said that “we will accelerate the shift towards innovation-driven development and work to make this region an internationally influential center of innovation We will support the Pearl River Delta as it leads opening up, innovation, transformation and upgrading, and accelerate the development of science and technology centers and industrial innovation centers in Shenzhen.”¹⁵⁰

As it had been first in China to a market economy, Shenzhen intended to be first in modeling an innovation economy.

Setting the Innovation Pace

Shenzhen was already China’s capital of private industry. In comparison, Beijing had the most state-owned enterprises (SOEs), while Shanghai’s top-10 companies were all foreign owned. But 90 percent of Shenzhen companies were private. Former Vice Mayor Li Ming identifies its four pillar industries as finance; logistics (air, rail, and marine shipping); cultural/creative industries; and high tech.

City leaders tried first to understand which public policies had so far made Shenzhen a technology leader. Those they would keep and amplify. Then they looked at the most successful local digital technology companies; what were the ingredients to their breakthroughs? Finally, what additional public policies would make it likely that other firms could follow where the pioneers had led?

One essential success factor emerged consistently: people. Not just any people, but those with advanced digital technology expertise, and those with the imagination to lead the pack in developing new products. City leaders determined to make attracting and retaining the most talented people a priority for Shenzhen’s next chapter.

To attract talented individuals, the city in the early 2000s had already created a senior corporate manager recommendation and evaluation center. It subsidized workplaces for post-doctoral professionals and granted researchers up to RMB 50,000 (\$7,321) a year toward expenses. It also budgeted RMB 200 million (\$29.28 million) for awards: the Talent in Industrial Develop-

ment and Innovation Award; the Shenzhen Mayor's Award (2004); the Shenzhen Science and Technology Progress Award; and the Shenzhen Technological Invention Award.¹⁵¹

Peacocks. In April 2011, Shenzhen launched what it called the Peacock Plan to lure foreigners, including overseas Chinese, to live and work in the city. "There is definitely a shortage of talented people," confirmed Liu Yang, an HR manager at Peking University Shenzhen Graduate School.¹⁵² The city budgeted \$12 million over five years to attract foreigners who would spur innovation. Those individuals could claim subsidies up to \$230,000 depending on skill level. Each applicant had to submit proposals in Chinese and defend them before a board set up by the city government.¹⁵³ Also in 2011, the city created the Shenzhen Science and Technology Innovation Committee to coordinate policy across departments.¹⁵⁴

Individual firms quickly got the message: innovation would yield rewards. In 2014, Shenzhen firms invested more than CN¥64 billion (US\$10 billion), or 4 percent of GDP, in research and development (R&D), putting it on a par with South Korea and Israel.¹⁵⁵ The Shenzhen Municipal Government Plan aimed to increase that to 4.25 percent of GDP by 2020.¹⁵⁶ The city rewarded companies for creating original products. "The more patents a company has, the more support it can receive from the government. If you get an international patent, the government will even reward you," says Gong. In 2018, five Nobel Prize winners opened labs in Shenzhen.

Individuals benefited as well as firms. Under the Peacock Plan, the city gave senior professionals *hukou* for themselves, their spouses, and children. It even gave qualified individuals free license plates—a significant perk in a city that strictly limited licenses as one way to combat air pollution.¹⁵⁷ As of 2018, says Gong Jianhua, the city contributed CN¥3,600 (\$600) a month toward housing for high-tech talent, both Chinese and foreign. In 2018, some 200,000 people qualified for the subsidy.

City plans also emphasized innovation. At a 2015 meeting of the Sixth Shenzhen Municipal People's Congress, Municipal Committee Secretary Ma Xingrui laid out a five-year blueprint to remain competitive in high tech, upgrade infrastructure for service industries,

and scale up education and medical services.¹⁵⁸ The city already led the world in sectors such as supercomputing, gene sequencing, and metamaterials, and was home to 1,283 laboratories.¹⁵⁹

A year later, Shenzhen's Five-Year Plan (published April 2016), aimed for GDP of CN¥2.6 trillion (\$402 billion) by 2020, compared to the current CN¥1.75 trillion. That implied annual growth of over 8 percent and made the city a strong contender against Beijing, Shanghai, and Hong Kong, even though Shenzhen was only one-third the size of Shanghai and one-eighth of Beijing. The plan called for Shenzhen to host 10,000 high-tech companies by 2020, double the 2015 number.¹⁶⁰ "The most important role government can play to help enterprises is to make a general development plan for the entire industry," says former Vice Mayor Li Ming. "The government also plays a role by pushing and guaranteeing the implementation of its policies and strategies."

Incubators. The city also did its best to make starting a new company as easy as possible. It already allocated up to CN¥3 million (US\$0.44m) in subsidies for technology incubators—workspaces where inventors (often called "makers") could collaborate and which typically offered mentorship, administrative services, and sometimes funding. In 2018, estimates Gong, the city government spent CN¥20–30 billion on high-tech from a total budget of CN¥400 billion. David Li notes that the city grants "come with no strings attached. It's not like 'OK, you get this grant and this is what we, as Shenzhen government, are thinking about what the maker movement should be.' It's 'you guys know better than us about the maker movement, so here's the money, go experiment.'"

Reaping the Spoils

The pro-innovation policies appeared effective. From 2010–15, Shenzhen's GDP grew 79 percent.¹⁶¹ High-tech exports jumped from \$11.4 billion in 2001 to \$140.3 billion in 2015. Over the same period, the number of international patent applications exploded, from 331 to 13,308.¹⁶² Concurrently, the city maintained pressure on low-grade manufacturers to exit; from 2012 to 2017, announced Mayor Xu Qin, more than 17,000 small factories closed.¹⁶³

Nonetheless, Shenzhen in 2016 was home to more than a million private companies—including Internet, biotech, new energy, new materials, and IT firms.¹⁶⁴ Manufacturers churned out circuit boards, computer chips, LEDs, touch screens, and much more. More than 25,000 companies manufactured a quarter of the world’s cellphones.¹⁶⁵ Other substantial enterprises were China Vanke (real estate), BYD (cars), Pin An Insurance, and China Merchants Bank.¹⁶⁶ Innovative start-ups included Prynt Case, a French company that created a photo-printing device for smartphones; PetCube, maker of interactive cameras for owners to monitor and play with their pets from afar; and Wear-Vigo, producer of headsets to keep drivers alert.

Serial Internet entrepreneur Su Ming reports that individuals worked at a punishing pace. He references the “9-9-6” work schedule: 9 a.m. to 9 p.m., six days a week, no vacation. Work life for business owners, he says, “is like a jungle, no rules, no laws . . . Nobody can take a break.”¹⁶⁷ He feels fortunate to have a two-day weekend. That was the Shenzhen culture, observed hardware innovator Jackie Wu: “There’s sort of a pragmatic, can-do attitude that everyone has toward making a new product that makes the process very efficient and everyone’s on the hunt for new ideas, products, and markets.”¹⁶⁸

A few companies hit gold, growing by leaps and bounds as their products found markets both domestically and abroad. Telecom firm Huawei, for example, had established an expansive campus beyond the hills above Shenzhen where it co-located manufacturing, R&D, and housing for employees. In 2016, Huawei contributed 7 percent to the city’s GDP (CN¥143 billion, or US\$20.6 billion)—equal to the contribution of the city’s next 20 largest companies.¹⁶⁹ Of its 60,000 employees, some 25,000 worked in R&D; between 2007–17, it spent \$400 billion on research.¹⁷⁰

Across the street was the FoxConn campus with 30,000 employees. Tencent, the Internet and online gaming giant that also created the messaging app WeChat, in September 2015 became the largest Internet company in Asia by value. In April 2017, it surpassed Wells Fargo as the 10th largest publicly traded company in the world, worth \$250 billion.¹⁷¹ ZTE, which also made telecom equipment, in 2017 earned CN¥108.8 billion.¹⁷²

Silicon Valley 2. Many dubbed Shenzhen the new Silicon Valley.¹⁷³ Fully 20 percent of China’s PhDs worked in its laboratories and research institutes.¹⁷⁴ Its per capita GDP, the highest in China, had grown a mind-boggling 24,569 percent from 1978 to 2014, when it hit \$25,000.¹⁷⁵ GDP growth, which had run at an astronomical 35 percent per year until 1995, had abated to a more modest but still robust 14 percent a year through 2014. While still a manufacturing hub, its products increasingly were high-tech, new-tech, and clean-tech; these industries grew from 28.8 percent of GDP in 2010 to 35.6 percent in 2014.¹⁷⁶ The city ranked eighth worldwide in number of billionaires.¹⁷⁷

At the same time, Shenzhen was not dependent for its success on a handful of behemoths. “The way Shenzhen is innovative is not just that we have a couple of superstars,” says David Li. “I mean, if you take Huawei out of Shenzhen tomorrow, Shenzhen would not be affected.” He points to the saturated smartphone market as an example. Yes, he notes, Apple had 14 percent of the global market, and Samsung had 15 percent. “But that leaves the rest of the 71 percent,” he says. “Guess who they are? They are all Shenzhen companies, with the exception of Xiaomi. . . . [There are] hundreds, probably thousands, of brands, all headquartered in Shenzhen.”

High-tech talent. Moreover, the city’s efforts to attract top talent were working. In 2015 alone, the Peacock Plan attracted 18 R&D teams specialized in biology, pharmaceuticals, life sciences, software, telecommunications, and new energy. By 2016, it had brought in 59 teams and 1,219 high-caliber professionals.¹⁷⁸ One UK-based provider of defense reports found China’s innovation goals credible. It wrote in 2016 that “one of the enduring myths in many Western CEO-suites is that the Chinese are great at copying and stealing but will have difficulty ‘out-inventing’ the West. This arrogant and outdated hypothesis is crumbling fast.”¹⁷⁹

Public funds. Shenzhen also anted up public funding for digital technology. In 2015, the city and district governments together allocated CN¥20.93 billion to new technology and started 156 strategic technology projects.¹⁸⁰ The city announced that corporate plus municipal spending on R&D would reach 4.25 percent of GDP by 2020.¹⁸¹

In November, Shenzhen announced its first Innovation Competition of International Talent. The contest, open to IT professionals worldwide, offered \$80,000 to the winner (and lesser amounts to others) to open a high-tech business or conduct research in the city. The five areas of interest were IT, electronic science and technology, biological/life sciences technology, advanced manufacturing, and materials and energy.¹⁸² Those who succeeded in opening a business within six months would earn bonus payments. About half the funding for the prizes came from venture capital firms; another \$100 million came from the city government.

In 2016, the Shenzhen Human Resources and Social Security Bureau organized additional funding for tech start-ups.¹⁸³ The city continued some older measures like rent assistance, and loans and subsidies; and added new incentives, like technical fairs and publicity. Under the “interest subsidy loan policy, the bank will loan you funds to do R&D while the state helps pay the interest,” clarifies Nan Jie of the China Development Institute.

Districts and institutes. To give the newly-arrived professionals places to work, the city also got into the business of planning and operating dedicated high-tech industrial districts. On January 17, 2017, Shenzhen Party chief and Mayor Xu Qin announced detailed plans to build 10 research institutes by 2020 in such fields as mathematics, medicine, and clean energy. The city also funded 10 IT and life science laboratories led by Nobel prizewinners, as well as 10 overseas innovation centers.¹⁸⁴ “Under the new demand of global markets, we must readjust our development direction and aim high in order to help China become influential in the world in terms of technology, manufacturing and innovation,” Mayor Xu said at a press conference. That month, for example, Shenzhen signed a memorandum of understanding with Hong Kong to develop an 87-hectare innovation and technology park at the Lok Ma Chau Loop, a piece of land owned by Hong Kong but intended for both Shenzhen and Hong Kong companies.¹⁸⁵

Maturing Market Economy

As it grew, Shenzhen became a magnet for venture capital. In 2016, the 100 top Shenzhen venture capital funds invested a total CNY58 billion (\$8.3 billion),

up 40 percent from 2015.¹⁸⁶ Government at both the national and city level decided to get into the game, and stakes in several VC funds. As early as 2007, the city had created the Shenzhen Venture Capital Services Platform as part of the Shenzhen High-Tech Industrial Park (SHIP).¹⁸⁷ Then came the State Venture Fund, founded in August 2016 with \$30 billion.¹⁸⁸ In February 2017, the national Ministry of Finance, together with the National Development and Reform Commission, launched a Shenzhen venture capital firm for emerging industries, funded at CNY10 billion (\$1.5 billion) and supervised by the state-owned private equity and venture firm Infotech Capital.¹⁸⁹

Social goods. The city also continued to invest in social goods such as education, electric buses (as of December 2017, all city buses were electric), a fast rail connection to Hong Kong, parks, and culture. One global consulting firm reported that Shenzhen led the country in smart transport (intelligent traffic lights, grids, etc.). Its imaging technology identified traffic violators with 95 percent accuracy. The city hoped its parking management system would remove 330,000 vehicles a day from the roads.¹⁹⁰

“We hope to become the benchmark for the country’s new smart cities and raise our smart capabilities to a world class level by 2020,” said Wu You, deputy secretary general of the Shenzhen municipal government, in June 2018.¹⁹¹ Hu Xiaoqing, deputy director of Shenzhen’s Economy, Trade and Information Commission, predicted that by 2020 the city would offer one-stop shopping for business-related government services, while individuals would be able to interact with government exclusively online.

Shenzhen spent generously to make itself alluring to qualified professionals. But city leaders also recognized and tried to redress its enormous and growing income gap. Officially, its 2017 population stood at 12.53 million.¹⁹² But unofficially, it was nearly 23 million, especially during the pre-winter holidays high-production season. Even with reform, only 25 percent held a *hukou*; some 6 million unregistered residents continued to live in teeming urban villages.¹⁹³ Institute of Administration Professor Gong Jianhua notes that Shenzhen “is a young city, but it already has a huge wealth gap and income inequality. So the government is trying to solve conflict between economic classes by providing

more and more public benefits. On the other hand, the amount of benefits depends on GDP.”

Incubators. Shenzhen also continued to promote accelerators and incubators like H@xlr8r (HAX), Shenzhen Open Innovation Lab, and Chaihuo.¹⁹⁴ By November 2017, HAX—which provided technical and financial support to hardware companies—had fostered 118 start-ups.¹⁹⁵ In 2018, the city hosted some 1,000 accelerators.¹⁹⁶

IPR redux. Shenzhen companies had also learned the value of protecting intellectual property. More and more turned to the courts to defend their own inventions. In 2016, the Shenzhen Intermediate People’s Court heard 14,887 IPR cases, 63 percent more than in 2015. The public prosecutor arrested 669 criminal suspects and prosecuted 682 suspected of infringing on trademark and copyright. “We have strengthened the judicial protection of the core rights of the parties engaged in scientific and technological innovation, trying to smooth out their worries in that respect,” said Wang Yanlin, chief procurator of the Shenzhen Procuratorate (public prosecutor).¹⁹⁷ In a strike at corruption, the procuratorate also investigated six officials for “meddling in the approval of applications for high-tech funds or the granting of fiscal subsidies.”¹⁹⁸

CDI lawyer Nan Jie calls Shenzhen “a pioneer city” in protecting ideas. “Chinese courts spent two to three decades neglecting and being impotent when it came to intellectual property protection,” she notes. “But now they are getting much stricter Shenzhen was the first in China to punish intellectual rights infringement as a crime.” In December 2017, Shenzhen set up both its own intellectual property court and a financial court.¹⁹⁹ “Nowadays, the younger generation always takes care of intellectual property as a priority when they initiate any high-tech project,” says Nan Jie. “Ten years ago, nobody would have even thought of that.”

The city’s 2017 GDP was CNY¥2.2 trillion (US\$318 billion). In October 2018, President Xi Jinping visited Guangdong and reaffirmed the government’s commitment to small businesses. “China’s reform and opening up will never stop,” he said.²⁰⁰

The Path Ahead

As of early 2019, Shenzhen appeared well positioned as a global hub for digital entrepreneurs. It had the leadership, the infrastructure, and the track record to compete internationally. The dynamism of its entrepreneurial community, its youthful population, and the willingness of local government to support and encourage private industry in the context of wider regional growth all suggested it would remain a 21st-century center for experimentation.

That was not to minimize the challenges. Many could be traced back to the same frenzied population growth that had fueled its prosperity. The city, for example, had China’s highest property prices. Guo Wanda, vice president of the China Development Institute, noted in 2016 that soaring land and housing prices resulted in higher costs of doing business. “If Shenzhen cannot find ways to solve these problems, it will soon enter a bottleneck period in its development,” he said.²⁰¹ The World Bank warned as early as 2010 that “the conflicts between social development and economic development, between income generation and environmental degradation, and between economic growth and unequal income distribution are becoming more severe than ever.”²⁰² The same might have been written in 2018.

The city also, as it would be the first to acknowledge, remained desperate for high-caliber professionals. Despite opening new universities and research institutes, one estimate put the number of unfilled high-skilled jobs in 2015 at 300,000.²⁰³ Nor could new laboratories and facilities alone guarantee that innovation would follow. “Unfortunately, the rote learning and examination-oriented education model in [Chinese] colleges and universities is not conducive to creative thinking,” judged a World Economic Forum report in 2016. “China has yet to create a dynamic culture that encourages innovation and tolerates failure.”

Too often, noted Liu Xielin, associate dean of the School of Management at the Chinese Academy of Sciences’ Graduate University in Beijing, “there’s a lot of government money for R&D that goes into universities and institutes, but the research that is done is far away from real industrial needs.”²⁰⁴ What’s more, a mismatch persisted between graduates’ skills and job market needs; as of 2016, nearly 40 percent of graduates could not find suitable jobs.²⁰⁵

But the question that went to the heart of Shenzhen was whether intellectual risk-taking remained safe and rewarding. That applied to government officials as well as business leaders. Zhou Luming, who left government in 2015 to found an incubator, yearns for a return to the “problem-solving oriented style of management that government practiced in the 1990s, an ability that has been weakened immensely in recent years.” He continues:

The central government’s restrictions on government officials’ power in Shenzhen is now at the same level as in any other part of China. In the past, you had permission to experiment and take wrong steps, but now only one wrong step will cost you so much more than it possibly could in the past. There is much more risk in making mistakes On the one hand, Shenzhen is a large city, which demands standardized and regulated management. On the other hand, you can hardly innovate in an environment that has no flexibility The key is to find a new balance between the two.

Then there was the fading venture capital market. In early 2018, it slowed markedly, raising less than two-thirds of the previous year and making only half the investment. “Many investors in private equity and venture capital funds want to take their money back” said Zheng Kaixing, founder and CEO of the Shenzhen-based online asset management company Jinfuzi.²⁰⁶ The central government still controlled Chinese banks, foreign exchange rates, and the media, so it might be able to arrest the slide. But a high debt level and a 2019 nascent trade war with the United States limited its options.

The city’s emphasis on incubators and accelerators also had its skeptics. Kai-fu Lee, who in 2009 founded Innovation Works, one of the earliest incubators, doubted that government could run them effectively. “There are very few successful examples of government-run incubators around the world,” he said in a 2016 interview.²⁰⁷ David Li notes that half the accelerators, makerspaces and incubators started in 2015 had closed by 2019. Moreover, it remained challenging for small to medium-size businesses to secure bank loans. State-owned enterprises had no trouble, but entrepreneurs were consistently obliged to turn to private sources of funding.

Finally, questions had emerged about the staying power of Reform and Opening in general, especially after Xi Jinping in February 2018 abolished term limits, in effect becoming president for life. “Reform and Opening has already failed, but no one dares to say it,” said historian Zhan Lifan. “The current system has created severe social and economic segregation.”²⁰⁸ In a climate of intensified surveillance (facial recognition, security cameras), Internet walls, and trade wars, such critics questioned whether a city like Shenzhen—founded on principles of creativity and innovation—could thrive.

But as its history demonstrated, Shenzhen had long confounded expectations. Chances were it could do so again. In 2018, the city spent CN¥100 billion, or 4.16 percent of GDP, on research and development, with plans to increase that number steadily.²⁰⁹ In May 2019, it renewed tax breaks for high-level technology professionals. At a Future Forum innovation summit, Deputy Mayor Wang Lixin announced income tax reductions from a rate of 45 percent to as low as 15 percent for some categories of overseas and local innovators.²¹⁰ The city’s Commerce Bureau started training for exporters on how best to comply with U.S. intellectual property law.

Above all, Shenzhen was ideally positioned to demonstrate whether government by central plan, pre-set goals, and administrative changes could sustain an innovation economy in the long term. December 2018 marked the 40th anniversary of China’s Open Door Policy. Shenzhen, notes one report, was a “huge social experiment in transforming a centrally planned economy into one with market mechanisms through plans and pilot reform measures.”²¹¹ In the view of Shenzhen scholar Jonathan Bach:

. . . the staggering growth that made Shenzhen synonymous with the rise of ‘Made in China’ must be regarded as much as the result of massive improvisation as of master planning. And today, what started as a city of exception is a site of an ongoing struggle to define the rule.²¹²

Appendix 1

FDI and Other Investment in Shenzhen 1981–2006

Total and Foreign Direct Investment in the City of Shenzhen 1981-2006

Year	Total Investment (RMB Billion)	Total Investment (US\$ Billion)	FDI in the City (US\$ Billion)	FDI Share of Total Investment (%)
1981	0.30	0.17	0.09	49.61
1985	3.33	1.13	0.18	15.85
1986	2.49	0.72	0.36	50.64
1990	6.23	1.30	0.39	29.92
1995	27.58	3.30	1.31	39.66
1996	32.75	3.94	2.05	52.06
1997	39.31	4.74	1.66	35.03
2000	61.97	7.49	1.96	26.20
2005	118.11	14.42	2.97	20.59
2006	127.37	15.98	3.27	20.46

Source: calculation by the author and also [14, 53].

From Jianfa Shen, “Urban Growth and Sustainable Development in Shenzhen City 1980–2006,” *Open Environmental Sciences*, November 2008. See: www.researchgate.net/profile/Jianfa_Shen/publication/49466901_Urban_Growth_and_Sustainable_Development_in_Shenzhen_City_1980-2006/links/549a42d70cf2b803713591ff/Urban-Growth-and-Sustainable-Development-in-Shenzhen-City-1980-2006.pdf

Shenzhen Five-Year Plans and Master Layout Plans

Socioeconomic and Spatial Plans in Shenzhen

Phase 1: 1980–1985

- Rapid development of domestic economic linkages
- Outward processing industrial activities

1980	Draft Master Layout Plan
1981–1985	Sixth Five-Year Plan
1982	Shenzhen Socioeconomic Outline Plan (SSEOP)
1982	The First Master Layout Plan

Phase 2: Mid-1980s to mid-1990s

- Export-oriented economy through attracting foreign direct investment
- Economic restructuring toward high-tech and tertiary-sector development

1986–1990	Seventh Five-Year Plan
1986	Second Master Layout Plan
1989	The Comprehensive Report on Modifications of the Second Master Layout Plan
1991–1995	Eighth Five-Year Plan and the Shenzhen Socioeconomic 10-Year Development Plan

Phase 3: Mid-1990s onward

- Planning control extended as Longgan and Bao'an Counties were turned into Districts within the Shenzhen Municipality in 1993
- A need to reinvent Shenzhen in the face of mounting competition within China and in the global economy

1993	Review of Master Layout Plan started.
1995	Municipal Government approved the Outline for Modifying the Shenzhen Master Layout Plan
1996–2000	Ninth Five-Year Plan
1996	Draft Third Master Layout Plan
2000	Third Master Layout Plan approved by the State Council
2001–2005	Tenth Five-Year Plan

Source: Authors.

From Mee Kam Ng and Wing-Shing Tang, “The Role of Planning in the Development of Shenzhen, China,” *Eurasian Geography and Economics*, 2004. See: www.tandfonline.com/doi/abs/10.2747/1538-7216.45.3.190

Appendix 3

Planned vs. Actual Socioeconomic Metrics in Shenzhen

Planning Targets of the Socioeconomic Plans in Shenzhen

Indicators	SSEZ	SSEOP & 6th FYP ¹	SSEZ	7th FYP	SSEZ	8th FYP & SSE10YDP ²	SSEZ	9th FYP	10th FYP	SSEZ	
	(actual)	(target)	(actual)	(target)	(actual)	(target)	(actual)	(target)	(target)	(actual)	
	1980	1985	1985	1990	1990	1995	2000	1995	2000	2005	2000
Total population (million)	0.33	1.00 by 2000	0.88	0.6	2.02	2.5	3.0	3.45	4.0	4.8	4.33
Temporary pop. (million)	0.01		0.40	0.2	1.33	1.6	1.9	2.46	n.a.	n.a.	3.08
Pct. temporary pop.	3		45.50	33.3	65.80	62.8	61.7	76.5	n.a.	n.a.	71.10
Pop. with permanent household registration (million)	0.32		0.48	0.40	0.69	0.9	1.15	0.99	n.a.	n.a.	1.25
GOVI ³ (mill. RMB)	106.30	1,200.00 by end of 20th century	2,466.60	5,600	22,022	30,000		122,648.9	175,000	500,000	267,241.80
GDP (mill. RMB)	270.10		3,902.20	5,000	17,167	25,000	45,000	79,569.5	165,000	300,000	166,546.50
Per capita GDP	835		4,809	6,800	8,724	10,000	15,000	23,381	41,000	63,100	39,745
Export value (mill. \$)	11.20		563.40	1,000 ⁴	8,152	5,000	8,000	20,527.4	28,000	48,500	34,563.3
Import and export	17.50		1,306.30		15,701			38,769.6	63,900	85,500	63,939.80
Foreign direct investment actually used	32.60		329.30		518.60			1,735	n.a.	4,800	2,968

1. SSEOP = Shenzhen Socioeconomic Outline Plan; FYP = Five-Year Plan.
2. SSE10YDP = Shenzhen Socioeconomic 10-Year Development Plan.
3. GOVI = Gross output value of industry.
4. For entire city.

Source: Figures for Five-Year Plan targets are for SDPB, 2002, various pages; actual data are from SSB, 2002, pp. 44-47.

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Shenzhen Per Capita GDP Growth 1980–2006

GDP Per Capita in China, Guangdong, Pearl River Delta and the City of Shenzhen 1980–2006

Year	China	Guangdong	Pearl River Delta	City of Shenzhen
1980 (RMB)	463	481	500	835
1985 (RMB)	858	1,026	n.a.	4,809
1990 (RMB)	1,644	2,484	3,148	8,724
1995 (RMB)	5,046	8,129	18,242	19,550
2000 (RMB)	7,858	12,736	18,094	32,800
2005 (RMB)	14,040	24,438	41,990	60,801
2006 (RMB)	15,973	28,332	49,153	69,450
2006 (US\$)	2,004	3,554	6,166	8,712

Note: US\$1=RMB7.9718 in 2006 [53]. GDP per capita in Pearl River Delta in 1980–95 was based on hukou population and would be smaller than the figure if large total population was used.

From Jianfa Shen, “Urban Growth and Sustainable Development in Shenzhen City 1980–2006”

Appendix 5

Shenzhen Population Growth 1979–2006

Population Growth in the City of Shenzhen 1979–2006

Year	Total Population (mil)	Hukou Population (mil)	Share of Hukou Population in Total Population (%)	Temporary Population (mil)	Share of Temporary Population in Total Population (%)	Population Growth in the Year (mil)	Share of Migration in Population Growth (%)
1979	0.31	0.31	99.52	0.00	0.48	n.a.	n.a.
1980	0.33	0.32	96.40	0.01	3.60	0.02	73.39
1981	0.37	0.33	91.01	0.03	8.99	0.03	82.91
1985	0.88	0.48	54.29	0.40	45.71	0.14	97.09
1986	0.94	0.51	54.99	0.42	45.01	0.05	91.96
1990	1.68	0.69	40.92	0.99	59.08	0.26	96.60
1991	2.27	0.73	32.29	1.54	67.71	0.59	98.34
1995	4.49	0.99	22.08	3.50	77.92	0.36	96.97
1997	5.28	1.09	20.74	4.18	79.26	0.45	97.51
2000	7.01	1.25	17.81	5.76	82.19	0.69	97.84
2005	8.28	1.82	21.98	6.46	78.02	0.27	91.95
2006	8.46	1.97	23.25	6.50	76.75	0.19	87.10

From Jianfa Shen, “Urban Growth and Sustainable Development in Shenzhen City 1980–2006”

Shenzhen Government Subsidies and Financing for High-Technology Enterprises

Subsidy	Amount	Eligibility
Start-up subsidy	¥5,000 (\$785) per founder, with a maximum allowance of ¥50,000 (\$7,850)	Startups in operation for at least 6 months; can apply only once
Rental subsidy	Year 1, at least 80% of annual rent; Year 2, at least 50% of annual rent; Year 3, at least 20% of annual rent; maximum allowance of ¥6,000 (\$942) a year for 3 years	Certified startups (based in the Entrepreneurship Incubator Zone), technology-related startups, and overseas students can apply
Social security subsidy	100% of social security payments for a maximum 3 years	Any startup can apply
Employment subsidy	\$314-\$417 per head for a team, maximum \$4,170	Any startup can apply
Micro-financing	A loan of ¥200,000 (\$31,400) per founder, with a maximum per firm of ¥2 million (\$314,000)	Any startup can apply
Peacock Campaign	¥800,000-¥1.5 million (\$125,628-\$235,552) for overseas talent, with a maximum ¥80 million (\$12.56 million) per team	High-achieving professionals, (e.g., Nobel prize winners); top management in government-recognized technology; and innovation companies can apply

Table composed by Sally Qiu, SIPA, Columbia University, from public sources.

Government-Owned Venture Funds in Shenzhen

Fund	Amount	Sponsors and Shareholders	Focus
State Venture Fund ²¹³ (August 2016)	US\$30 billion	China Reform Holding Corp Ltd. (Main Sponsor); China Postal Savings Banks; China Construction Bank Corp; Shenzhen Investment Holdings	Support innovation and industrial technology upgrades
China Internet Investment Fund ²¹⁴ (January 2017)	RMB 100 billion (US\$15.7 billion)	State-owned banks and companies, with oversight by the Cyberspace Administration of China and Ministry of Finance	Invest in equity of Chinese Internet companies
Premier Ventures ²¹⁵ (March 2018)	US\$160 million	HTC (Taiwan phone maker) and Shenzhen Municipal People's Government	Virtual Reality technology innovation in China
Shenzhen Blockchain Fund ²¹⁶ (April 2018)	RMB 500 million (US\$79.2 million)	Shenzhen Angel Capital Guiding Fund, a Shenzhen government-backed early-stage government guidance fund, will provide 40% of the capital. It will be managed by Donghai Capital and Hengxing Capital, both controlled by State-owned Assets Supervision and Administration Commission in Shenzhen.	Firms and start-ups using blockchain technology
Shenzhen Angel Investment Guidance Fund ²¹⁷ (March 2018)	RMB 5 billion (US\$780 million)	Set up by Shenzhen Government Investment Guidance Fund; overseer Shenzhen Investment Holdings Co., Ltd. and Shenzhen Innovation Investment Group Co., Ltd. To be jointly managed by two Shenzhen SOEs	Transformation, industrial upgrades, and innovation

Table composed by Sally Qiu, SIPA, Columbia University, from public sources.

Representative Shenzhen Incubators/Accelerators

Incubator/Accelerator	Theme	Year Launched
Haxlr8r	Hardware	2011
Weiyouthui Incubation Park	Tech (software, app, information system development)	2014
3W	Tech/general business	2010
Entrepreneurial Magic Cube	General business	2015
Chaihuo Maker Space	Hardware	2008

Table composed by Sally Qiu, SIPA, Columbia University, from public sources.

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