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Working Paper

Global entanglements in digital territories.

The Huaqiangbei district in Shenzhen

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Global entanglements in digital territories. The Huaqiangbei district in Shenzhen

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Abstract

This paper consider the recent history of personal computing as seen from the district of *Huaqiangbei* (华强北) in the city of Shenzhen, China. Part of the original design of China's first Special Economic Zone, this area stands at the crossroad of two major global transformations : the raise of digital technology worldwide and the return of China at a main actor of the global economy. The paper provides an overview of the spatial history, industry and culture in the area known today as Huaqiangbei by following successive generations of consumer electronics such as whitebox computers of the 1990s/2000s, the mobile phones of 2000s/2010s and the integration of Internet into numerous objects around 2010s, often known as the Internet of Things. From an original state-owned factory, to a central hub in global electronics manufacturing to one of the flagship of China's innovation policy today, the spatial history of this district demonstrates the prominent role played by local actors such as China policy makers or factory workers in shaping the digital world as we know it.

Keywords: Shenzhen, Huaqiangbei, cultural practices, computer culture, computer history, electronics manufacturing, DIY movement, spatial analysis, urban policy

Cover image: the Huaqiangbei street in 2019 - source: Wikipedia / (this page) A reseller in her shop - source: Disnovation

Introduction

In the history of the personal computer, the Californian garage stands as the first mythical place. However, a second one stands out : the factory dormitory of the Pearl River Delta. Indeed, for computers to reach the entire world, they had to be produced somewhere. For the most part in the last three decade, that place has been China. Still, in the origin story of how the computer came to our world, the assembly line seems too often to be missing. Of all reasons, two can be mentioned here. First, our modern society perceive invention as a product of the mind, a glorious mental activity, the establishment of a path from matter to object - that we often call "design". Second, the claim on who invented what acts as a territorial assertion. Computers are the basic weapons of the global village, and their history its foundation. Indeniably, US state actors and multinational corporations have greatly benefited from casting the Silicon Valley as the central territory of the digital realm.

This paper attempts to take a step aside from this US-centric narrative by reconsidering the recent history of computing as seen from the district of *Huaqiangbei* (华强北) in the city of Shenzhen, China. With a total surface of 2.9 km2 (1.1 sq mi), the district started in the 1980s as a state-owned manufacturing area specialized in electronics. During the next decades, it transitioned into a central hub for the assembly and sub-assembly of global electronics. The uniform landscape of factory and dormitories was gradually replaced by a diverse and complex fabric of mixed-use buildings and retail that hosts thousands of small and larger shops of electronics, electronic components and accessories. Nowadays, the district has become a vast open-air mall for geeks and a touristic attaction to recall the path walked from the Made in China era to its most recent hi-tech iteration.

Looking from Huaqiangbei, a myriad of lesser-known actors appear on the family picture of the "inventors" of computing. From women factory workers to Chinese governement officials, all have occupied non-trivial roles in the shaping of digital technology during the last decades. The history of this district embodies the encounter of two of the most significant drivers of recent tranformations of our world: China's successive 5-year plans and the Moore Law[1]. Both shares an apparently infinite appetite for growth, an accute feeling of urgency, and an unconditionnal love for insanely ambitious industrial goals. The city of Shenzhen was concevied as a venue to host the nascent romance between industrialists and engineers from both sides of the Pacific ocean. Over time, this union settled here and gave birth to the most formidable production apparatus ever created on Earth, for the purpose of developing always more advanced forms of computing in all places and areas of life.

The underlying hypothesis of this paper is as follow : without China's historical momentum since the end of the cultural revolution, computers will not exist as we know it. The throughput of China's industry in the last thirty years has been unprecedented in human history. While original capital and blueprints have been provided by US and EU-lead efforts and firms, China's manufacturing capacity has been central in shaping what we call a

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[1] Formulated by Intel's founder Gordon Moore, this (man-made) law states that the number of transistors in an integrated circuit has to double every two years.

computer today. The thirst of the Chinese people for an always faster and bigger industrial development at this specific period in history allowed digital equipments to reach even the furthest corners of the planet. More than a simple recipient of foreign ideas, the Chinese local reality defined in many ways the shape, size, qualities, quantity and "design" of our digital objects and infrastructure.

To unpack this story, we will consider the reorganization of spatial, socio-economic and symbolic features of the area, from being the Shangbu industrial new town of the 80s to the current urban district known as Huaqiangbei. The paper roughly follows a chronological order and is organized to offer a parallel between urban restructuration and successive generations of technology: whitebox computers of the 1990s/2000s, the mobile phones of 2000s/2010s and the integration of Internet into numerous objects around 2010s, often known as the Internet of Things. Each of these technological waves was subject to considerable exports and uses around the world, while impacting significantly the spatial organization of the area. By considering together the local changes in Shenzhen and the evolution of the products globally, we provide an account of the entanglements between the local Chinese story and the larger one.

The first part of the paper gives background about the city's history, industry and culture, followed by a short discussion about how technological and territorial narratives are closely tied. We then present the district of Huaqiangbei itself following generations of consumer electronics. We then discuss how their co-evolution demonstrate the important role of Shenzhen in shaping the present - and possibly future - practices of digital technology worldwide.

Figure: Pages from The Essentials Guide to Electronics in Shenzhen by Andrew "Bunnie" Huang (2015)

Planning Shenzhen

The Great Experiment

In December 1978, the Chinese economic reform (改革开放) was launched to rebuild a country devastated by decades of disastrous policies and domestic instability. At the time, the economy was entirely in the State's hands. To manage the new income of foreign capital, the State Council of China drawn on a map several zones that could act as buffers for China's integration in the global market economy. The goal was to get as close as possible to foreign capital. The simplest economic policy decision was to pick the region bordering Hong Kong, which was already undergoing intense financial activity under British colonization.

Painting showing Xi Zhongxun (middle) with Deng Xiaoping and other architects of the SEZ in front of a map of Shenzhen - source: China's National Museum of Art, Beijing.

On July 20 1979, the blast of an explosion resonated across the Shenzhen Bay. The construction of the Shekou harbour had begun and with it the Special Economic Zones (经济特区) of Shenzhen was born [2]. In 1980, the Shenzhen SEZ opened its doors to welcome foreign investments. Tactics inherited from maoist guerrilla were converted and applied to urban and industrial management. The entirety of all local and national administration was mobilised to raise fund and bring capital home (Ang, 2016). The Shenzhen experiment

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[2] CCTV http://m.news.cctv.com/2018/07/20/ARTIS3VzYYWr4i3YV8Wf3LDV180720.shtml

progressed quickly through trials and errors - by *"Feeling Stones to Cross the River"* (摸着石过河)[3] as famously stated. In a typical mix of military discipline, Soviet Gosplan and total improvisation, Shenzhen was set to achieve its heroic mission to show China and the world a new model for success. The work was happening 24/7, achievements (*yeji*) were carefully measured and evaluated, promotion was restricted within the ranks, and the money was starting to show up.

In the 80s, Shenzhen was still considered a *"sleepy border town"* (Vogel, 1989). The city had to become attractive in itself, as numerous people were fleeing to Hong Kong daily. Benefiting from tax incentives and cheap labor, factories from Hong Kong started to relocate their facilities on the other side of the border (Chan et al., 1991). In the span of a decade, thousands of factories had relocated in Shenzhen SEZ, bringing the first economic boom to the region after a century (Huasheng, 1991). Most foreign capital was funneled through Hong-Kongese and Taiwanese factory owners, greatly helped by their mastery of Chinese language and local dialects, and often times family connections in the region (Hsing, 1998). China experiments with market economy was taking off in Shenzhen.

The industry in Shenzhen was mostly centered around the manufacturing of low-cost goods, like toys or garments. For electronics assembly, the bulk of the production was plastic pieces dials for TV sets or domestic appliances. By the end of the 1980s, the demand for video-game sets was growing steadily, and traditional plastic moulding was becoming more sophisticated to include cables and connectors. In 1988, the Taiwanese contract manufacturer *Hon Hai Electronics* opened its first plant in the district of Longhua to start producing Atari joysticks in prevision of the very high demand for Christmas 1988 in Europe and the US. That factory will grow to become the largest in the world under the name of *Foxconn* with more then 300 000 employees today.

Urban Migrations And The Making Of A New Urban Culture

The location of Shenzhen, along the Hong-Kong border, reflects the duality in the city's *raison d'être* : inwards for the mainland and outwards for the rest of the world. Pulled on from this two directions, Shenzhen's urban development has stretched along Hong Kong, swallowing the pre-existing villages one after another. The myth of the city originating in a "*fishing village*" is now firmly anchored in popular imagination, despite bearing only very partial historical weight. First, there were numerous villages along the coast, mostly agricultural. Only for a few was fishing significant for their economy. Second, this common image ignores conveniently the proximity of Hong Kong, a very busy colonial British harbour at the time of Shenzhen's foundation.

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[3] Quote by Chen Yen, Working Conference of the CPC Central Committee in December 1980. In January 1992, the Chinese head of state and architect of the SEZs Deng Xiaoping (1993, p. 364) also famously said: "*We should dare to experiment and break a new path. That is the important lesson to be learned from Shenzhen.*"

In many regards, "*Shenzhen's urban emergence must be understood as a coevolution of the villages*" (Bach, 2012, p. 423). With more than 10 millions of people arriving over two decades (Ng, 2003), the Shenzhen region transitioned from scattered rural villages into a dense urban area, in one of the fastest urbanization and economic development in the history of humanity to date (Bie & al., 2015). Pre-existing rural areas surrounded by the growing city were requalified into "urban villages" (城中村), constantly under threat of real-estate redevelopment (Wang 2016).

Until today, Shenzhen's spatial organization and landscape strikes by the integration of informal developments into its master plan (Ng & Xu, 2013). The absence of previous land rights led to many unplanned situations in the city's urban and industrial development (O'Donnell, 2017). The gradual extensions and updates of the 5 and 10-year masterplans by the central and municipal governments shows clearly the mixed of planned and unplanned spatial evolution of the SEZ. The pace of urbanization forced the original designs to include unexpected developments that were taking place in the city, largely informed by constant industrial dealmaking and waves of investments (Wang & Meng, 2004). The resulting landscape is contrasted, with skyscrappers next to enclaves of pre-existing villages, highways, high-end condos - and some giant phone factories.

Beyond the physical settings, entirely new cultural phenomenons emerged in the city. For the most part, manufacturing jobs are seasonal and follow product releases and marketing events (Halloween, Black Friday, etc). In the 1990s, more than 66% of the Shenzhen population was considered "*temporary workers*" (Clark, 1998). During her studies, Ngai (2004) relates that up to 90% of the labour force in light manufacturing industries she observed (garment, toys and electronics) was female, and under 25 years of age. For them, the experience of the daily work in a factory (*dagong*) was transformative. Many were leaving the rural life and prospects of arranged marriage to discover new hardships, social habits and sometimes new freedom and leisure (Chang, 2009).

The "Big Bro Phone" (大哥大) was featured in many Hongkongese TV serials as a success symbol in the 90s. Source : TVB

The Hong Kong media industry, which was peaking at that time, was broadcasting an image of a new Chinese modernity through numerous TV serials and movies. Shenzhen, with its porous border, was the incarnation of this new model in the mainland. At the forefront of China's new socio-economic development, Shenzhen workers became models for the rest of the country (Florence, 2017) - and icons of harsh labour conditions in Eastern Asia for the entire world (Chan & al, 2013). At the same time, the digital/hi-tech was becoming omnipresent in popular culture as both the symbol and the vector of this image of modernity. The fate of Shenzhen, the new Eldorado, the pinnacle of a coming era, was already tied to electronics.

Territorial Narratives of Computers

Going past the inventors

As such, the history of the Shenzhen region attests of the encounter of an original grand design, vast exogen influences, unplanned events and unexpected encounters in its making. Indeed, few will pretend that a city can be "invented". But for some reasons it seems reasonable to hold similar claims about complex and multifaceted objects such as computers. The anthropologist Tim Ingold (2014) shows how the act of making is still often considered as the imposition of a mental form or project to inert matter (also called *hylomorphism* in philosophy). In contrast, the adjustments required by material reality always alter the initial design and produce a totally different outcome that what was first imagined. Any significant technology emerge through entanglements of multiple cultural, socio-economic and political circumstances - what Edouard Glissant calls "*creolization*"[4].

In the history of computers and electronics, the hylomorphic model of design is translated through figures of inventors such as Jobs, Gates or Musk as well as mythical places such as the Xerox PARC in Silicon Valley (Hiltzik, 2000). This hagiography of Silicon Valley occupies a large space in the constitution of the imaginary around computers. The common history of technology tends to over-emphasize the role of inventions and innovation in their research (Edgerton, 1999), despite numerous works showing how technology evolves from slow improvement of craft and technics over centuries (Leroi-Gourhan, 1964) and societal or political decisions that shapes societies in return (Feenberg, 1991).

Recent researchs in spatial history of technology (Harris, 2023) have contributed to complexify this narrative, trying to resurface forgotten actors (Rakin, 2018). Historians have also shown how early inception of computers have been shaped locally by political discourses and imaginaries (Peters, 2016) as well as communities of users (Kline & Pinch,

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[4] The *"meeting of multiple cultures, or at least of multiple elements from distinct cultures, in a single place in the world, resulting in the emergence of something new and totally unforeseeable when considered only as the sum or synthesis of its elements."* (quoted in Nova & Vacheron, 2015)

1996). The role of designers have also been subject to numerous inquiries (Steenson, 2017). Still most works are US-centric or focus on a single nation or experiment.

Manufacturing Global IT Infrastructures

Despite being canonnically framed in opposition, the China and US approach to technology share similar ideological beliefs about the central role of technology in shaping society and the future. As early as the 1980s, the Silicon Valley narrative was already very influential on key members of China's Communist Parti Politburo. In 1983, the Prime Minister Zhao Ziyang met with Californian futurist Adam Toffler, who was at the time one of the greatest prophet of the "*New Technological Revolution*" in the US (Gewirtz, 2019). The President Jiang Zemin - trained as an electronic engineer - shared the enthusiasm and sent his own son to study computer science in the US and later lead the charge in the coming national *informatization* (信息化) campaign in China.

At that time, digital infrastructures were coming out of the ground on both sides of the Pacific. In 1991, the Clinton Administration with its Vice-President Al Gore launched a gigantic telecommunications program called *National Information Infrastructure (NII)* also known as the *Information Highway* (Griffith & Smith, 1994). A year later, the Chinese government was launching the *Golden Projects*, a set of major infrastructural investment plans introducing digital technologies at multiple levels of the country's administration (Boulton & al, 2000).

These two main initiatives would drive the demand for computer infrastructure and telecommunication equipment for years. At the same time, China was on its path to become the "workshop of the world". The increasing production of computers marketed from the Silicon Valley largely relied on the outsourcing of electronics assembly in the SEZ (Lüthje & Hürtgen, 2013). Nationally, the Chinese government invested massively in the development of communication networks in the country, with private companies from Shenzhen - such as Huawei or ZTE - at the forefront of the domestic telecommunication infrastructure building (Harwit, 2007).

The standardization of electronics allowed local manufacturers in Shenzhen to proceed with the assembly or subassembly of products while high-value pieces (such as CPUs) were still manufactured elsewhere (Gefferi, 2014). In 2004, China surpassed the U.S. to become the world's largest producer of computer hardware with US$81 billion in output (Yang, 2006) with most of its production in sub-assembly for international brands (Koopman et al., 2008). For a long time, China captured little economic value despite providing the largest workforce, with only $6.54 retained in the process of assembling an iPhone 4 (Gereffi, 2014). However, these transnational processes of technological production radically transformed the local urban, industrial and economic landscape (Liu, 2008).

Around the SEZ, thousands of smaller assembly units started operations to take advantage of standardization and a growing demand for electronics both domestically and abroad. They specialized in the use and reuse of standardized modules (turn-key), making them accessible directly to Chinese and global consumers in the form of "no-brand" electronics. These

brandless products made newly available and affordable supported the appropriation of computing technologies worldwide.

The Personal Computer

A key piece in Shenzhen original design

The place where the Huaqiangbei district stands today was originally part of a larger area named *Shangbu* (上步). Historically people travelling from the Hong Kong border (Luohu) to Guangzhou will cross the Shenzhen river there. As one of the two disctricts in the original design of the Shenzhen SEZ, Shangbu hosted an entirely new town that included administrative and residential buildings, as well as two main factory districts to host state-owned factories. One square kilometer was specifically allocated to the Ministry of Electronic Industry for the development of electronics manufacturing (Ng & Tang, 2005).

During the cold war, the eventuality of an armed conflict with the Soviet Union or the US was growing. Coastal regions were deemed unsafe in case of airstrikes. The central government initiated a vast campaign of relocation for military and industrial facilities towards China's inner regions. Known as the Third Front Movement (三线建设), massive investments and millions of workers were sent during the 60s and 70s towards China's inner provinces. The Third Front factories became some of the most advanced the nation possessed at the time. The Reform and Opening of the 80s put a stop to this dynamic, directing the country's energy back towards coastal regions to get closer to investment sources. Many of these military sites were displaced or disgarded.

In 1979, the Engineering Corps was created to recast millions of soldiers of the People Liberation Army into infrastructure builders. The first mission of the 1st Pioneer Division of the Engineer Corps was to build the now iconic *Shenzhen Electronics Building* (电子大厦) in Shennan Middle Road near the new Shenzhen's governement office. From the 20,000 Engineer Corps troops sent to Shenzhen, many will transition into positions at Shenzhen Municipality or in State-Owned Enterprises - the most notable of these soldier being Ren Zhefei, founder and CEO of Huawei (Zhou, 2022).

The same year, three Third Front factories from Northern Guangdong were reorganized as a provincial SOE (State-Owned Enterprise) named *Hua Qiang Electronics* (华强). The first years of activity were dedicated to build a joint-venture factory with the Japanese firm SANYO to produce tape recorders in the Shangbu industrial park. The large plant extended on several roads. The higher part of the street was known as *Huaqiang Bei* (literally North of the Huaqiang factory district) and gaves its name to the district today. The prefix *hua* (华), used in Mandarin as a shorthand for "China", is usually reserved for military and national matters. *Huaqiang*, meaning "*strong China*", express all the ambition the military and administration was putting into the production of electronics at the time.

Location of Shangbu Industrial Zone (SIZ) in Shenzhen (source: author).

The birth of computer retail in Shenzhen

The mind of Shenzhen planners was so occupied by industrial development that almost no commercial land was included in the original 327.5 km2 of the SEZ (Wang & Xu, 2002). Successive tweaks in the original plan and loosening of SEZ regulations on land occupations allowed commercial entities to use land previously reserved for factories (Bruton & al., 2005). The new availability of commercial land led to the implantation of retail shops at the borders of industrial areas.

In 1984, a supermarket managed to sublet an entire floor of a manufacturing building, becoming the first privately-owned shop to open in the vicinity of the Huaqiang factory. Rapidly, the number of stores expanded, selling clothes, toys and increasingly computers under the influence of the manufacturing facility nearby. The Huaqiang Electronics SOE that owned the land. During the 1980s, it gradually vacated the factory spaces and started to rent them out. Malls and shops for computer parts and electronics retail started to flourish, creating a whole ecosystem of suppliers gradually replacing the the old factory. The Shenzhen Electronic Group (SEG) was set up in 1985 and become in a few years one of the largest manufacturer in the zone, accounting for 15 per cent of Shenzhen's industrial productivity by 1991 (SCMP, 1993). In 1997, the construction of the iconic SEG Plaza (赛格广场) skyscraper started. The first floors still occupied today by the most famous electronics market of the area.

In 2000, almost half a million persons were coming on weekends for shopping (Zacharias & Bliek, 2008). In 2004 the Luo Bao subway line opened, bringing even more foot traffic in the area. To serve these suppliers and retailers was showing to be much more profitable than

the old manufacturing model. Originally fully owned by the state, the Huaqiang group was then privatized[5] to become a real estate developer specialized in electronics retail malls, exporting the Huaqiang model to cities all over China (Chen, 2017).

A map of the Shangbu aera and the Huaqiangbei cluster (source: author)

The "whitebox" computers

In the 1990s, the volume of electronics sales in Huaqiangbei was increasing rapidly with the expanding consumer market. The PC revolution was taking over the world and with all electronic parts openly available in the markets of Huaqiangbei, entrepreneurs flocked to set office in the district. Small manufacturers were setting shops to supply larger factories around Shenzhen in electronics parts, assembly and sub-assembly. Most deals could be settled directly in the few streets around Huaqiangbei. The dotcom era was around the

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[5] Since 1994, the company has been restructured into Shenzhen Huaqiang Holdings Group with a market capitalization estimated of $6.7B (Forbes, 2017).

corner. Tencent has started to rent an office space there to distribute their web chat solution [6].

Microsoft Windows has taken over the personal computer (PC) market, propelled by Intel CPUs. New motherboards, chips and components were hitting the market constantly and the constructors were having a hard time following the pace. PC chassis lacked proper design specifications and integrating the various pieces of a computer proved to be a tedious task for asemblers. Still, the demand in the market was so intense that by the time a shipment of computer cases has arrived by boat from Chinese factories and was assembled by a US constructor, the chips and motherboard had already significantly lost in values. Under the pressure of US constructors, Intel released in 1995 the ATX standard "*which provided a complete mechanical form-factor specification for a desktop PC or server*" (Chien & Wang, 2015).

A typical whitebox computer from the 1990-2000s - credits: (CC0 - public domain)

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[6] Tencent's first office :
https://baike.baidu.com/item/%E8%B5%9B%E6%A0%BC%E7%A7%91%E6%8A%80%E5%9B%AD/5879392

In the Shenzhen SEZ, a large number of manufacturers recently installed started to mass produce basic computer cases with power units following these ATX recommendations. The freshly released Ninth Five-Year National Development Plan (1996-2000) aimed at expanding China's telecommunications market and support electronic manufacturers. Benefited from government grants and tax breaks, the constructors of whitebox computers quickly increase in their production capacity (Kraemer & Dedrick, 2002).

Coined "white boxes", these no-brand computers became a major Chinese export to the US and Canada. Millions of people worldwide were getting into Personal Computers (PCs). While brands like Dell or IBM were dominating the office market (Dedrick & Kraemer, 2007), the *whitebox* machines allowed retailers to build custom computers (Yoffie & Kim, 2010). In 2001, the white-boxes accounted for more than 40% share of the home computers worldwide market, equiping many households and small offices. (Morris & Morris, 2002).

A post on *Urban Dictionary* from 2003 offers the following definition of white boxex: "*Computer goods sold without any added extras (i.e. packaging, unnecessary software, etc.), thus making them less expensive.*"[7]. Another web page from 2004 states : " *A "white box" computer (...) give you control over what components go into your new system* " (Dern, 2004). The new availability of these computers parts enabled gamers, designers, developers and other power users to start assemble they own machines, learning and experimenting in the process.

A screenshot (detail) from the home page of MyWhiteBox.com on May 28, 2003 - via Archive.org

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[7] Urban Dictionary, http://white-box.urbanup.com/308923, consulted on July 18th, 2019.

The Mobile phone

Mintong Electronics market

Over the years, the Huaqiangbei cluster had transformed into a large retail area with more than a million square feet. A large variety of products, spanning from fashion to restaurants have opened. In 2002, computer hardware occupied a bit less than 10% of the total area (Wang & Xu, 2002). Still, the activity was centered around electronics industry. The companies that were originally build to service the state-owned factories and their workers have been converted to office spaces and business centers. Factory and business owners from all around Shenzhen and China were coming there to source parts, make deals and be in close contact with the booming manufacturing industry. The foot traffic had increased continuously to reach more than 10'000 person per hour in the main street on an average late afternoon (Zacharis & Bliek, 2008). For anyone who wanted to assemble electronics, everything was available at hand in the vicinity.

The mobile phone craze has started to take over the world since the early 2000s. Iconic products such as Nokia 3310 has sold millions of units worldwide and the commoditization of mobile phone was on its way. For many people, mobile phones were still an expensive item. Building on the experience of the computer whiteboxes, a Taiwanese company called Mediatek (MTK) started in 2003 to release blueprints with parts and instructions to assemble phones (Fang et al., 2017). Known as "*turn-keys*", these new chipset architectures had built-in support for the latest tech (mp3, bluetooth, etc) requiring no additional chip design or electronic engineering, except the addition of peripherals (microphone, speaker, screen, keyboards, etc). The kits allowed to assemble a working phone in no time, providing opportunity for firms to fully focus on sourcing, microsuldering and phone overall design. MTK relied on an organized network of resellers in Shenzhen and the PRD region (Chang, 2010) to distribute its kits to hundreds of small factories. Rapidly, the local makers assembled batches of phones of all forms and shapes using parts already available on the local market with custom plastic-molded cases.

Mobiles Phones from Shenzhen. (source: Shanzhai Archeology, Disnovation - Maigret & al, 2017)

Around 2004, many small phone manufacturers decided to set store in the Mintong Electronics Market in HQB to sell their products. The mall will become known as the "shanzhai headquarters". Most of these people were from the county of Chaozhou (also known as Chaoshan or Teochow) on the eastern part of Guangdong (Lee & Hung, 2014). Famous for their unique dialect, the people from Chaozhou have not only very typical foods and "*gongfu*" tea drinking habits, but are also famous for their adventurous and entrepreneurial nature (Cheng, 1997).

These newly arrived players in the world of electronics manufacturing organized their mobile supply directly in the malls of HQB, provoking a surge of phone electronics-related businesses in the area (Murphree & al., 2016). Their aggressive business style based on speed and secrecy became dominant in large chunks of Huaqiangbei, redefining its business environment (Schulz, 2017). Usually based on family households, Chaozhouse factories were relying on a family network of small manufacturing units located around Shenzhen or further in the Pearl River Delta. The disctrict was becoming the main hub for phone part sourcing and international sales, coupled with direct access to factories able to assemble new product in a record amount of time.

The "Shanzhai" phones

In Chinese, *shanzhai* (山寨) is a derogatory term used to describe products of very low quality or counterfeited. In Chinese classics such as *Outlaws of the Marsh*, a *shan-zhai* depicts a "*mountainous stronghold*" of bandits. The word was employed as a joke to qualify remote or illegal factories in the outskirts of PRD cities. To differentiate in a very competitive market, factories tried all sorts of mobile phones alterations. Called *shanzhaiji*, these unique designs had sometimes the shape of strawberries or cars, wacky accessories such as a lamp or an electric shaver or unusual features like multiple speakers or bigger keypad.

The apparition of these mobile phones was driven by the will to address local and international niches ignored by main phone constructors (rural areas, elderly people, kids, etc). Usually with a cheaper price tag, they were somehow answering the growing social and spatial inequalities created by mobile technologies (Wallis & Qiu, 2012). Chinese migrant workers were arriving by millions into cities from rural areas. For them, the mobile phone has become the required "*first urban purchase*" (Wallis, 2013). Still, brand models were inaffordable. The spread of the *turn-key* phones lead to the apparition of a lower price range that urban newcomers could easily own and appropriate.

The *shanzhai* mobile phones were produced not only for mainland China but also to be exported across the world, typically outside Northern America or the Euro zone (Mathews, 2015). Despite their absence[8] from what is usually considered the main destination markets for mobiles, *shanzhai* constructors built up over the years not only manufacturing knowledge, but also large brands focused on specific national or niche markets. Companies like Transsion, Tecno or X-Tigi are today leaders in several African markets way ahead of Samsung, Apple and other high-end brands. All have in common to operate from Hong Kong with factories based in Shenzhen and the PRD region.

Besides lowering the price tag, all brands made extra efforts to adapt to the local reality in various African markets, with multiple SIM slots for different operators, larger batteries to face power cuts, camera with better exposure for darker skins, etc. These hardware improvements, while entirely consumer or business-driven, have allowed a large portion of the world to gain access to modern communication devices.

Later in the 2010s, the arrival of the smart phone lead to a vast restructuration of the market around a few major brands such as Huawei, ZTE or Xiaomi. As the phone were growing in complexity, small manufacturers had to team up or disappear, while the big Chinese mobile brands were going agressively after their market segments. Most small brands and

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[8] The mobile phone brand Wiko is an interesting exception. Two French guys went to Shenzhen and discovered that they could source very cheap white-label mobiles. Back then, the French market lacked middle-entry level phones. They bought the no-brand phones and rebranded them under the name Wiko. Three years later, they were the second most sold items on mobile market in France. Today, they are leading in many different countries in Africa and Middle East as well. The funny part of this story is that the company were ultimately bought by the phone manufacturer, so the factory went from producing whitelabel to owning its own brand.

manufacturers were swallowed or forced out of business by economy of scale of large Chinese brands. Today, the big brands and constructors occupy the top of most smart phone markets globally.

The Internet of Things

A New Paradise for the "Makers"

After 2010, rising rents and the consolidation of the Chinese electronics industry around fewer large players led many shops in Huaqiangbei to close doors or relocate online (Zhao, 2019). The central street was entirely rebuilt to accommodate a new subway line and become a pedestrian-friendly zone, also to cope with an increasing number of visitors reaching up to 500,000 per day on weekends and 800,000 on holidays (Lin and Cheng, 2013). The disctrict has become renowned as a worthy attraction for foreign visitors, part of the city legacy's highlights (see Figure 5, e.g).

Tinkerers and enthusiasts of electronics from all over the world, known as "*makers*" have quite logically chosen Huaqiangbei as a favorite place of villegiature into the world of electronics, with latest generations of components, LEDs and drones on display to buy. Several spaces and incubators dedicated to host international product teams have also opened around HQB (Xie & al., 2015). Success stories of local entrepreneurs have blossomed through blogs, documentaries (Future Cities, 2016) and books (Huang, 2015) to anchor the historical legitimacy of the place in the international maker community.


A free promotional map, featuring a detailed plan of the Huaqiangbei area published by the Shenzhen International Designers Association (SZIDA) for the FAB12 conference in Shenzhen.

This shift in appreciation was fostered by major national and municipal policies for modernization of the industrial apparatus as part of the *Made in China 2025* plan. Following large investment programs such as the *Mass Makerspaces* sponsoring thousands of incubators and makerspaces across the country, the prominent figure of the *maker-entrepreneur* (创客) both socially-engaged and business-minded, Chinese and global, has emerged as a new driver for the transformation of the national economy (Wang, 2015). Huaqiangbei was clearly identified as one of its headquarters and was entirely renovated to be reframed as a new "*maker heaven*" (SZIDA, 2015), or even "*an international (...) three-dimensional shopping paradise that includes makerspaces*" as a top officials stated during the reopening ceremony (Ti, 2017).

The open-source micro-controllers

Shenzhen local IT industry was meant to become an important stakeholder in the field of open-source electronics. Years of white-labelling, intense cooperation and fierce competition between factories has built up the capacity to host iterative and distributed product development approaches. In many regards, what was later framed as *open-source manufacturing* (Diez & Posada, 2013) has emerged in Shenzhen a decade earlier by the means of necessity. Circulation of electronic blueprints and shared factories floors were already common practices when the first discussions about open-source hardware and fablabs arrived in Shenzhen (Lindtner et al, 2015).

Local actors such as Seeed Studio or Cubieboard launched their own assembly chains to facilitate others' products built on open-source hardware. They addressed a niche market in manufacturing by helping to produce small batches from prototypes - Seeed Studio slogan used to be "*from 1 to 10'000 units*". With facilities and manufacturing resources available at hand, they developed supply chains for Internet of Things (IoT), sensors and other "smart" products. The local expertise in manufacturing and export regulations drove the cost of product development low enough to be covered by fundraising through online pre-sales. Several incubators located in Huaqiangbei started to develop their own methodology to increase likelihood of success for crowdfunding campaigns of electronic products (Xie & al., 2015). Like previously with whitebox computers or *shanzhai* mobiles, most relied on existing kits and parts that were assembled to create a new product.
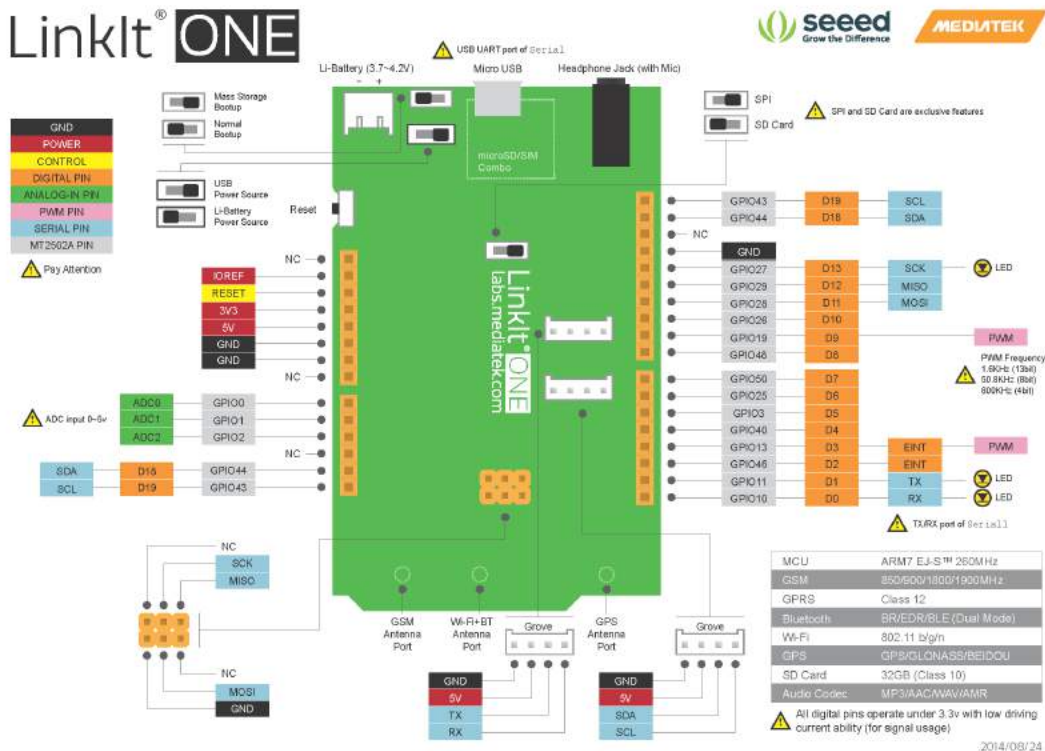
Schematic Diagram of the LinkIt ONE an IoT development board produced by Seeed Studio in cooperation with Mediatek[9]

Local open-source manufacturers have contributed to actively create links with the international open-source hardware movement. In Shenzhen, Seeed Studio has become an important community organizer by opening offices abroad, the Chaihuo makerspace in Shenzhen and hosting the yearly Shenzhen Maker Faire to promote its services - and the city. The practices of factory networks in Shenzhen has been extensively studied as emerging models for fast and iterative product development. The progressive reframing of the concept of *shanzhai* from a casual Chinese term into a fashionable design concept happened mostly via an international audience of design agencies (Wu & Taniguchi, 2012) and academics (Keane & Zhao, 2012; Yang, 2015). This contributed to assert the lineage between the city's less glorious episodes of manufacturing and the growing open-source hardware movement (Lindtner et al, 2015), which culminated in a feature film from WIRED named The Silicon Valley of Hardware (Future Cities, 2016).

This overall reframing of Shenzhen's local culture as the epitom of innovation happened in accordance to the municipal and national agenda. Chinese authorities have been looking for ways to revamp the country's image from *Made in China* (中国制造) into *Created in China* (中国创造) for at least a decade (Keane, 2007). The municipality of Shenzhen has supported

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these moves by providing subsidies to local actors such as Shenzhen Open Innovation Lab to represent the city in maker communities abroad. The development of the maker culture in China has contributed to erase the stigma of cheap industrial labor. The transformation of the area from an electronic wholesale market for labor-intensive assembly lines into a pedestrian-friendly area with leisure shopping and incubators exists as the spatial expression of a larger political will for change in China's industrial narrative.

Future Technologies

Heritagization and Regional Integration

In 2022, the Huaqiangbei Museum opened to provide an overlook of urban and industrial transformations of the district over the last few decades. The malls in the era itself has been restored, trees planted and an elevated platform has even been added to offer a point of view for sightseeing and photo of the entire street. The consolidation of the Huaqiangbei narrative intervenes as a way for the city to assert its new position of technological leadership not only nationally, but also on the global scene. Real estate prices have pushed factories into further areas of the Pearl River Delta. Shenzhen now remains as the technological decision center, with sieges from many prominents financial and tech companies. Moreover, the heritagization of the Shangbu-Huaqiangbei area helps to strengthen the narrative of Shenzhen as a cornerstone of technological innovation worldwide and the flagship tech city in China.

During successive Chinese dynasties, the Pearl River Delta region has been a major international trade and financial center, increasing in the 19th century with the presence of colonial empires (Johnson, 1992). This historical legacy remains and, as today, the PRD counts no less than four different legal and fiscal systems (Hong Kong Special Administrative Region, Macau Special Administrative Region, Shenzhen Special Economic Zone, Guangdong province), two stock exchanges (Shenzhen and Hong Kong) and three of the ten largest container ports in the world[10]. The mega region is equipped with a gigantic network of infrastructure (see Figure 6). For China's central government, the goal is to build the largest industrial and urban region in the world by connecting 56000 km^2, 9 cities and more than 100 millions people.

The new name of the administrative region, the *Greater Bay Area*, shows how central the technogocial competition with the US has become. The "*spillovers*" from foreign investments contributed to build up the industrial capacity in the Pearl River Delta. Today, it stands as one of the leading manufacturing region in the world, hub for "future" technologies such as drones, genomics, renewable energies, micro-payment, etc (Grumbach & Renaud, 2019). The goals, largely industrial, are set for growth of specific tech sectors such as solar panels, electric vehicles, etc. Many companies originated from the PRD already dominates these sectors by raw industrial ouptuts.

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[10] According to Lloyd's List 2017: *Top 100 Container Ports 2017*

Still, the development of a more sustainable urban culture in the region is a challenging issue. The pace of infrastructure building has been hectic for the last decades but no unifying discourse have clearly emerged. The constant injonction to innovate and projection into newness doesn't facilitate the anchoring of such gigantic project into the very long-term projection that are announced. The need for a deeper sense of belonging in this newly formed region is pressant. Here, HQB is politically reframed as an heritage site to carry a foundational story for this new local culture to emerge.
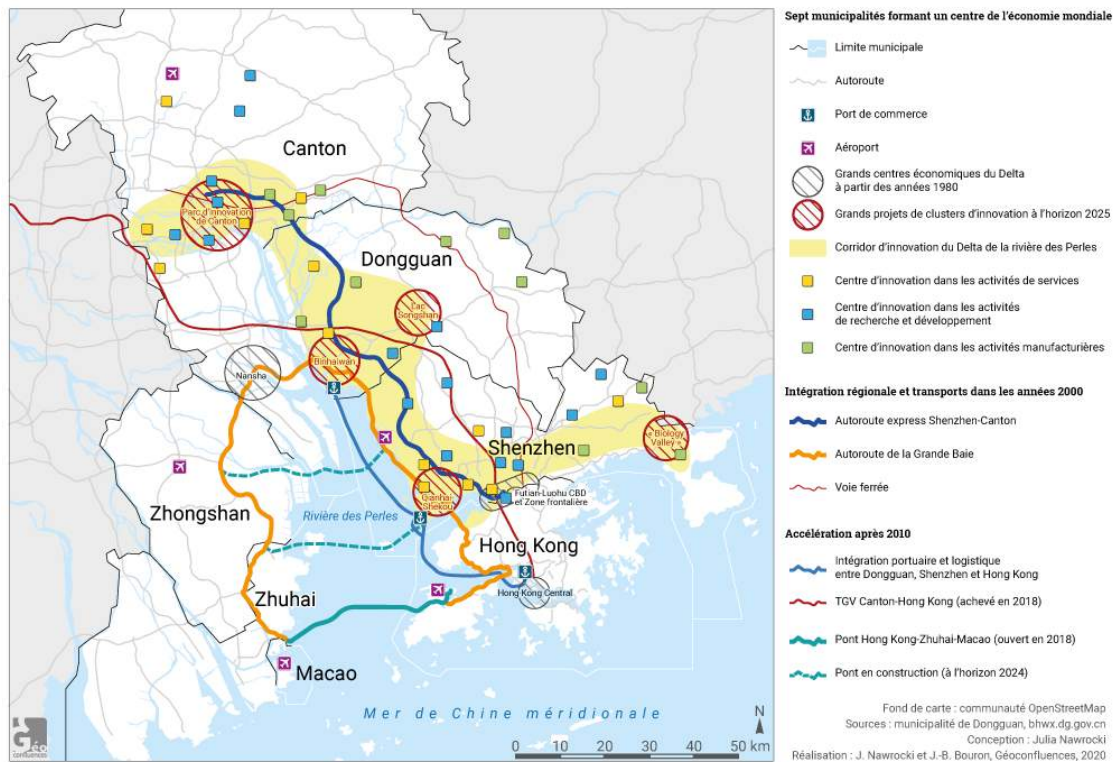
The production system of the PRD - (source : Nawrocki, 2020).

Achieving Global Ambitions

While the '*backyard furnaces*' of the Great Leap Forward aimed at overtaking Britain's steel thoughput, the current industrial discourse in China has largely been reframed as a competition with the United States on digital technology. In this quest, Shenzhen exists as a cornerstone. Proof being that Huawei, one of the most prominent local company was first targeted by US sanctions. The strategic design of the SEZ has been centered on the creation of a complementarity between China and foreign actors. For decades, the explicit goal was to fulfill foreign needs in exchange to access to financial investments and knowledge transfer. This original design is now challenged by the recent evolutions in the global political landscapes.

Years (approx)	1990-2000	2000-2010	2010-2020	2020-now
Tech				
	White Boxes	*Shanzhai*	*Open-Source*	*Future tech*
Flagship consumer tech	Personal computers	Mobile / smart phones	Internet of Things	Electric Vehicles
Industrial context	Motherboard form factor standardization (Intel ATX 1995)	"Turn-key" mobile development platform (MTK 2004)	Micro-controllers' commoditization	"Green" tech
Product design example	/ Intel PR440FX	MTK MT6577	Atmel ATmega328P (Arduino Uno)	BYD Qin Plus
City-Level				
Five-year plan	9th /10th	10th / 11th	12th/13th (MIC 2025)	14th
Regional plan	SEZ	SZ-HK channeling	Pearl River Delta	Greater Bay Area
Huaqiangbei	Transition from electronics manufacturing area to retail cluster	Massive arrival of small resellers and increasing foot traffic	Pedestrian-friendly zone and international retail	Key attraction for visitors and Museum

Table 1. Summary of the findings - The timeframe given in this are approximatively with the main purpose to help the reader to get a sense of the co-evolution of digital technology and spatial settings in Shenzhen and the Huqiangbei area

However, the global outreach of China's tech sector is larger than it ever was. Some key patents and IPs have been developed and are owned entirely by Chinese companies - e.g. Huawei and 5G. The industrial fabric of Pearl River Delta supplies the world with uniquely needed products: Huizhou produces batteries, Dongguan furnitures, etc. The overall plan relies on a traditional sectorial approach by zoning and specialized cluster for each sub-region, integrated together by massive network infrastructure, highways, bridges, high-speed trains, etc.

International projects such as the Belt & Road Initiative or the Asian Infrastructure Bank aim directly at creating new markets and destinations for Chinese products and infrastructure. As the high-tech hub for production, the Pearl River Delta acts as a major showcase for

China's indutrial and innovation capacity. Shenzhen, the "model city", continue to be at the center of the experiments but its role has now moved from industrial to cultural center. The successive rebranding of the city, exemplified in this article with the case of Huaqiangbei, have positioned the city has the carrier of a new culture that emerged through technological innovation. The city has evolved with the technology it produced. This co-evolution translated into the export of local features all across the globe through digital artefacts, radically transforming the way we now live.

Global capital exchanges are currently slowing down, with the US undertaking a political strategy of direct competition with China - instead of a previous one more oriented on partnering. In a similar fashion, the Covid episode and Parti Central focus on nationalism has lead China's tech sector executives to redirect priorities towards a China-first approach. The effects of this "decoupling" on the development of technological development globally remain to be seen.

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