

Evolving scales and spaces of mission-oriented innovation policy in the digital age: digital transition of makerspace innovation in Shenzhen, China

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This paper explores the under-researched actors in Mission-Oriented Innovation Policy (MOIP) research, specifically the transformative roles of makerspaces in the MOIP implementation in response to the widespread application of digital technologies. We develop a multi-scalar and spatially sensitive analytical framework to examine the evolution of makerspace-based innovation policies in China's "Silicon Valley", i.e. Shenzhen, through the case of Huaqiangbei (HQB), which has evolved from a local cluster of consumer electronics distribution to a specialised makerspace for digital innovation. The study argues that makerspace innovation in HQB has been articulated through top-down and bottom-up directionality of China's MOIP and, particularly, the digital transition of makerspaces in Shenzhen. The findings elucidate that makerspaces have turned into hybrid spaces for digital fabrication and grassroots innovation. This research enriches MOIP literature by highlighting the evolving scales and spaces of China's innovation policies in the digital era.

Keywords: makerspace innovation, mission-oriented innovation policy, scales and spaces, digital transition, Shenzhen, China

JEL Classifications: O38, O31, P25

Introduction

Grand societal challenges, particularly the economic and social transformation brought about by the widespread application of digital technologies, have created new dynamics of innovation policies. This trend is reflected by an increasing advocacy for a directed and collaborative approach to Mission-Oriented Innovation Policy (MOIP) (Mazzucato, 2011, 2018), which encourages the public sector to take on an active role in driving innovation-led development (Hekkert et al., 2020). Existing research has made efforts to understand mission-led growth and innovation directed towards grand societal challenges such as climate change (Janssen et al., 2023; Liefner et al., 2025; Wanzenböck et al., 2020). However, little attention has been paid to the transformation of MOIP in response to the pro-

found dynamics in the digital and platform economy. Compared with numerous national-level MOIP studies mainly in Western countries, digital transition of innovation in the evolving "geographies of MOIP" (Uyarra et al., 2025) to tackle disruptive technological challenges remains under-explored, particularly in subnational city-regions in the Global South. Recent studies have examined China's stated mission-oriented initiatives, particularly in green industries (Liu et al., 2024; Zhang et al., 2024), which highlight the multi-scalar coordination of China's innovation policy characterised by the establishment of designated zones for experimenting in specific technological domains (Liefner et al., 2025). The evolution of China's MOIP and its implementation at local levels demonstrate distinctive patterns compared to the Western MOIP and warrant comprehensive investigation.

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This study examines the transformation of the grassroots makerspace-based MOIP initiated since the mid-2010s in China, particularly in Shenzhen, one of the most innovative cities, in response to the widespread adoption of digital technologies in strategic industrial transformation. This ongoing state-led innovation initiative demonstrates both commonalities and unique features in dimensions such as strategic orientation, policy directionality and coordination when compared to Weces can contribute to bottom-up solutions tailored to local challenges (Fressoli et al., 2014) and address spatial inequities in MOIP. Particular emphasis is placed on the dual directionality of MOIP in terms of top-down policy design and bottom-up implementation in the makerspaces in Shenzhen, which echoes recent calls for attention to context-specific missions and translation of grand missions into locally relevant goals (Clifton et al., 2024; Priebe and Herberg, 2024). While the role of makerspaces in democratising digital technology and production (particularly boosting post-pandemic regional resilience) has been acknowledged (Beltagui et al., 2021; Langlely et al., 2017; World Economic Forum, 2021; Zakoth et al., 2024), little research has been conducted to explore the transformative role of makerspace innovation in the changing dynamics of MOIP in the digital era. Existing research on makerspaces has predominantly focused on advanced Western economies and was mainly conducted in the pre-digital era. The implementation of MOIP at the grassroots scale of makerspaces in the digital age lacks adequate conceptualisation and comprehensive empirical investigation, especially in China, which has a broader community support network (Fu et al., 2022a; Zhao and Zou, 2021).

The overarching objective of this study is to examine the implementation and efficiency of MOIP in the digital transition of makerspace innovation at the subnational metropolitan region in China. To do so, we developed an analytical framework that incorporates the scalar and spatial dimensions of MOIP for examining digital transition of makerspace innovation. By focusing on makerspace as a key site of implementing the state-led innovation mission, this study intends to track how various actors interact within the multi-scalar innovation systems in China. Our main research questions are: how and in what ways have makerspaces become an integral mission of the innovation policies in China, particularly in Shenzhen? How has mission-oriented makerspace innovation been implemented by local governments? How and in what ways have makerspaces in Shenzhen developed into hybrid spaces for physical and digital innovation? What are the subsequent effects on the transformation of the mission-oriented innovation systems in response to the opportunities and challenges brought about by the widespread application of digital and platform technologies?

Conceptually, this study goes beyond the static analysis of MOIP by decoding the evolving vertical and horizon-

tal directions of state-led MOIP implementation in grassroots makerspace innovation in the digital era, which has been overlooked in existing MOIP literature. Empirically, Huaqiangbei (“HQB” hereafter), a specialised makerspace in Shenzhen’s consumer electronics industry, is selected as a case to examine the implementation of state-led MOIP at local and grassroots levels in the digital era. HQB is known as the birthplace of “shanzhai”, an imitation innovation for manufacturing inexpensive mobile phones (Keane and Zhao, 2012). With the widespread use of digital platforms, makerspace innovation has become a location where many indigenous large tech enterprises, such as Tencent, DJI and various “unicorn companies” in digital hardware, are born or incubated. This study enriches MOIP research, which is often dominated by national or supra-national levels of analysis, by providing a vivid investigation of the changing dynamics of MOIP implementation in a metropolitan region in China.

The remainder of this paper is organised as follows. After this introduction, we critically review the literature on the evolving scales and spaces of MOIP and the mission-oriented values of makerspace innovation in a turbulent digital era. We then outline the research context and methods adopted. The empirical analysis is divided into two parts. The first part examines how makerspaces function as interactional arenas mediated by top-down policy design and bottom-up policy implementation. The second part investigates the mission-driven transition of makerspace innovation through an in-depth case study of HQB. The final section concludes with the main findings, discusses conceptual and empirical implications and proposes avenues for future research.

Mission-oriented makerspace innovation in the digital age

The evolving scales and spaces of MOIP

Global challenges and particularly widespread disruptive digital technologies are accompanied by a paradigm transition in national innovation policies. The increasing focus on MOIP represents a shift in the rationale of policy intervention in innovation. It moves away from investment solely in research and development (R&D) towards addressing barriers within the national innovation system, ultimately leading to targeted innovation in response to societal challenges (Coenen and Morgan, 2020; Schot and Steinmueller, 2018). This trend confirms that policymakers and academics seek coordinated innovation policies with clearly defined missions to stimulate directed innovation and systemic transformation (Hekkert et al., 2020; Larrue, 2021; Mazzucato, 2016).

Extant research has addressed diverse features of missions (Mazzucato, 2018; Wanzenböck et al., 2020), policy design (Larrue, 2021), implementation networks (Hekkert et al., 2020; Janssen et al., 2023) and impact evaluation

approaches (Deleidi and Mazzucato, 2021). Hekkert et al. (2020) and Mazzucato (2018) highlight the complexity of missions aimed at guiding R&D efforts and social innovation approaches. Based on a review of policy landscapes in Organisation for Economic Co-operation and Development (OECD) countries, Larrue (2021) identified four main types of mission-oriented initiatives of innovation: overarching, challenge-based, thematic and ecosystem-based mission programmes. Similarly, Laatsit et al. (2025) clarified that experimentation, reflexivity and evaluation are the key MOIP traits, especially in transformative innovation policies for sustainability transition (Andersson et al., 2021, 110; Haddad et al., 2022; Kirchherr et al., 2023). However, existing MOIP literature has largely overlooked the multi-scalar dimensions of MOIP implementation. MOIP research tends to focus primarily on national and supra-national initiatives, while underplaying the importance of regional and local levels in designing and implementing MOIPs (Coenen and Morgan, 2020; Fastenrath et al., 2023; Priebe and Herberg, 2024).

As stated by Deleidi and Mazzucato (2021), although innovation mission itself has a top-down vision, such directionality does not originate solely from the top. Rather, it emerges through a decentralised group of public agencies (Mazzucato, 2016). Moreover, the directionality in MOIPs is shaped through a dynamic process linking activities across multiple scales, embodying a collective agency in shaping future trajectories (Grillitsch et al., 2019). In a functional innovation system addressing complex societal problems, “directionality” is essential for long-term systemic change and translating these challenges into actionable plans (Hekkert et al., 2020). Through a distinctive place-based case study of the circular economy in Wales, Clifton et al. (2024) investigate how top-down policy direction is interpreted and implemented within horizontal networks of practice that nurture missions to expand their scale and scope. The dynamic directionality in MOIPs across multiple scales of innovation activities remains under-explored.

The early call for a multi-scalar and systematic approach (Bunnel and Coe, 2001) has become particularly evident in recent attempts at exploring the geographies of MOIP (Uyarra, 2025). Tödtling et al. (2022) developed “challenge-oriented regional innovation system” (CoRIS) framework to capture changes of directionality, involving actors at various scales, emphasise practical application and scale-up of innovation within and beyond regions. Similarly, Trippel et al. (2024) elaborated pre-shock conditions and core processes in building regional transformative resilience by drawing on the CoRIS perspective. This augmented CoRIS concept complies with inclusive growth, directionality, multi-faceted interventions and broader actor involvement (Bailey et al., 2019; Haddad et al., 2022). Additionally, empowering regional innovation systems (RIS) with mission dynamics highlights the significance of regional-specific context and local knowledge in

policy development. Such research underscores the place-based characteristics of MOIP design in response to regional innovation specificities (Morisson and Doussineau, 2019). The attempt at place sensibility can enhance the mission approach by emphasising the importance of localised collaboration at subnational cities (Henderson et al., 2024) and “regioning” of MOIP between federal and regional arenas (Priebe and Herberg, 2024). This approach is influenced not only by regional dynamics but also by non-local processes and the integration of regions into national policy structures (Trippel et al., 2024).

In the context of policy practice, the European Union (EU) and OECD countries are primary advocates, as shown by such initiatives as “Horizon Europe”, Germany’s High-Tech Strategy 2025, Japan’s Moon Program and e-Estonia (Larrue, 2021). A growing body of research has turned to assess MOIPs in the Global South, including China (Liefner et al., 2025), and implications for firm strategies of indigenous innovation (Liu et al., 2024). Zhang et al. (2024) examine China’s MOIP in transitioning to a green industry. While China employs MOIPs to promote industrial innovation and technological advancement within its unique institutional context, it has not been as thoroughly theorised as in Western economies. The East Asian innovation bureaucratic system relies on “centralisation” and “politicisation” (Karo, 2018), and the closed top-down process gives MOIPs unique characteristics (Kuittinen et al., 2018; Zhang et al., 2024). There lacks adequate investigation into the effectiveness of MOIPs and the entrepreneurial role of the state in China. China’s entrepreneurial state is prominent in strategic industries like high-speed rail (Sun, 2015), cultural industries (Keane and Chen, 2019) and urban entrepreneurship in local governance, including high-tech parks (Wu, 2020). As Zhu et al. (2024, 4) pinpoint, “China’s state entrepreneurship ... encompasses both central direction and local responses, highlighting the continuous (re)territorialization of the state and its instrumental market usage resulting from multi-scalar politics.” Thus, it is essential to decode the entrepreneurial state for local MOIP implementation and technology-driven transformation of innovation. Additionally, it should be noted that in some cases, China is more effective in translating national goals into specific policies and implementing them through clearly regulated local governance processes (Liefner et al., 2025, 9).

Transition of mission-oriented makerspace innovation in the digital age: towards a multi-scalar analytical framework

Existing research on MOIP mainly focuses on the transformation of innovation policies in key technologies of established industries (Caliari and Ferreira, 2023; Robinson and Mazzucato, 2019) and territorial sustainability (Trippel et al., 2024). Comprehensive exploration of transforma-

tional technology capabilities at grassroots sites, such as makerspaces, is lacking in the Global South. The value and role of makerspaces in MOIP implementation to address societal challenges brought about by disruptive digital technologies have been overlooked. Besides its potential for entrepreneurship culture and job creation in maker communities (Fiorentino, 2024; Zakothe et al., 2024), it is noteworthy that makerspaces served as community-level digital fabrication hubs to support local supply chains during lockdowns of the COVID-19 pandemic (Moore et al., 2023). According to the *World Economic Forum* (2021), makerspaces produced critical equipment like personal protective equipment (PPE), diagnostics and clinical tools, with an estimated 48.3 million PPE items created globally worth \$271 million in 2020. It is imperative to examine how makerspaces integrate into local innovation transformation and subsequent effects on the reconfiguration of challenge-induced innovation systems.

In Western economies, where makerspaces originated from the do-it-yourself (DIY) and open-source maker movements, these spaces have seen ongoing endeavours to promote knowledge collaboration and the inclusive utilisation of digital manufacturing technologies (Schrock and Wolf-Powers, 2019). These makerspaces originated in the West due to advancements in digital manufacturing technologies (e.g. 3D printers and small-scale manufacturing), key social (DIY spirit, open-source movement) and economic trends (post-industrial society, small-scale manufacturing) (Dougherty, 2012) and exhibit great variability in their features and business models. Known by different names such as FabLabs, hackerspaces and tech shops, they provide access to a range of tools, including 3D printers, laser cutters, milling machines, wood and metalworking machinery, sewing machines and electronics benches. Notably, some makerspaces offer remote access to digital fabrication technologies via online platforms such as “Shapeways” or “i.materialize” (van Holm, 2017).

A growing body of research has turned to examine the impact of makerspaces on the innovation process in the digital era. First, makerspaces democratise the accessibility of digital technologies and innovation resources. Makerspaces increase the availability of digital technologies, such as 3D printing and computer numerically controlled (CNC) machines, in community-organised non-profit spaces (including virtual spaces), where like-minded hobbyists, entrepreneurs and researchers (Langley et al., 2017) engage in bricolage with their limited resources to achieve democratisation and openness in innovation (Beltagui et al., 2021). Second, makerspaces often serve as important decentralised “anchor tenants” in RIS and as a place-based strategy to enhance connections between startups, new investors and customers (Colombelli et al., 2019; Schrock and Wolf-Powers, 2019).

The connections between makerspaces and local actors are recognised as important players in generating new employment opportunities, education and skill development (Fiorentino, 2024). Zukin (2021) notes that New York’s makerspaces emerged from disused industrial spaces as a new urban economic engine, but they also risked rising housing and office prices. New regeneration strategies are required for marginal geographies. Lowe and Vinodrai’s (2020) research on the Carolina Textile District demonstrated the maker–manufacturing nexus as a place-connecting strategy and provided examples of how makerspaces can contribute to bottom-up solutions tailored to local challenges (Fressoli et al., 2014) and address spatial inequities.

In the Chinese context, numerous research has emerged on government-led makerspace innovation, particularly since the mid-2010s when the national government launched the “Mass Innovation and Mass Entrepreneurship (MIME, *Dazhong Chuangxin, Wanzhong Chuangye*)” policy. The MIME initiatives have heavily concentrated in FabLabs and DIY labs in major cities such as Shenzhen and Shanghai, transforming them into “massive innovation spaces” (Keane and Chen, 2019). Labelled as Chinese version of the “maker movement”, China’s makerspace innovation is government-led, reflecting the state’s intention to leverage grassroots innovation to upgrade its economy by building makerspaces based on digital platforms. Bolli (2020) explored the evolution of maker culture in China’s urban environment and its impact on the success of fostering innovation. Zhao and Zou (2021) conducted a qualitative study on the government-supported makerspace named Hangzhou Dream Town, finding that proximity to universities and a strong regional industrial structure creates an ideal environment for makerspaces. Du et al.’s (2018) work is a valuable attempt to explore the emergence of a Digital Entrepreneurial Ecosystem (DEE) through the lens of meta-organisation theory, focusing on the case study of Zhongguancun (an electronic market and entrepreneurial cluster in Beijing), China’s budding DEE. The analysis reveals that DEE functions as a meta-organisation, contributing to digital entrepreneurship by offering a community perspective. Existing studies on policy-designed makerspaces have mainly focused on the cultural and value dimensions or configurational elements of independent spaces (Fu et al., 2022b; Wen, 2017), while little research has been conducted to investigate their innovation transformation in the digital era and subsequent impact on regional and national innovation systems.

Against the above theoretical and empirical backdrops, this study provides an analytical framework for examining the evolution of China’s MOIP in the digital age, with particular emphasis on the multi-scalar interactions and spatial dimensions that have been overlooked in existing literature. This framework has three major elements (Figure

1). First, it postulates digital technologies and state initiatives, such as MIME, as the transformative mission and emerging policy mission of the Global South city-regions in the digital era, which differ from the missions focusing on brand technological breakthroughs and green transitions, especially in Western countries. Second, the framework sheds light on the role of makerspaces as arenas mediated by top-down directionality and bottom-up processes, driven by the co-evolution of digitalisation and policy missions, across different scales at national, regional and community levels in innovation systems. Third, it helps to delineate the diverse outcomes of digital transitions of makerspace innovation while also posing the risk of “mission drift” (Brown, 2021) that may arise during the implementation of MOIPs. The scalar and spatially sensitive analytical framework facilitates the investigation of the digital transition of makerspace innovation in Shenzhen, which are exemplified in the following sections.

Research context and methods

Study area: digital transition of Huaqiangbei (HQB) makerspace in Shenzhen

Shenzhen, known as China’s “Silicon Valley” and one of the most innovative cities in southern China (Yang, 2015), provides a vivid case to examine state-led makerspace innovation and experimental space for China’s MOIP practices. Shenzhen is selected as a case for this paper due to the fact that it has developed the earliest and cultivated the largest number and variety of makerspaces nationwide (Table 1). In particular, makerspaces in Shenzhen have focused on the specific districts in the southwest of the city, particularly Nanshan and Futian districts, which accounted for 60% of total makerspaces of the whole city. The geographical concentration of makerspaces in Shenzhen is depicted in Figure 2, which incorporates the data of the 190 municipal and national-level specialised makerspaces.

This study is conducted in the two districts of Shenzhen, i.e. Nanshan and Futian Districts, where the MIME initiatives have been implemented. Nanshan District has emerged as a significant hub for technological innovation in Shenzhen, serving as the location for the headquarters of several leading technology enterprises, such as Huawei, Tencent and DJI. Whereas, Futian District has turned into a hub for electronic information industry where large companies and mature industrial chains seek transformation and upgrading through the incubation and innovative business of makerspaces. Collectively, the two districts in Shenzhen are designated as China’s MIME demonstration bases: Nanshan District as the first batch (2016) and Futian District as the second (2017) of MIME bases. Moreover, over 88% of the makerspaces in Shenzhen are developed by

startup firms in the information and communication technology (ICT) industry, as reflected by the firm-level data (Table 2). The investigation of makerspace in Futian and Nanshan districts facilitates our study on the digital transition of makerspace innovation in the mission-oriented innovation policies in the widespread application of digital and platform technologies.

Huaqiangbei has been selected to examine the digital transition of the specialised makerspace cluster in Shenzhen. HQB hosts thousands of sellers of digital devices, electronic parts, gadgets and peripherals (Zhao et al., 2019). It has nurtured successful indigenous technology companies like Tencent, which began in a modest office within the HQB Science and Technology Entrepreneurship Park, and is the birthplace of BYD, China’s largest battery and new energy vehicle manufacturer, highlighting the region’s role in fostering innovation and entrepreneurship in the digital and platform economy. The development trajectory of HQB reflects the ongoing shift towards high-tech industries and innovation-driven urban growth in Shenzhen. As noted in the HQB museum’s Preface, “HQB always practices innovation in its development. The dazzling innovative products in the electronic market and the creator teams from HQB all embody the dream of upgrading from ‘Made in China’ to ‘Created in China’ and the dream of a technological power.” Initially, it was a state-led industrial electronic zone. However, due to the city’s vision of indigenous innovation, the HQB has undergone multiple transformations. HQB, historically a retail market for consumer electronics and a centre for “shanzhai” innovation (rapid, cost-effective prototyping of existing products) (Keane and Zhao, 2012, 226), has evolved into a specialised makerspace for collaborative innovation. This transition addresses rising production costs and declining innovation capabilities, a topic often overlooked in existing literature. This case study aims to explore HQB’s transition and its role in promoting digital innovation and fabrication in China.

Methods

This study is developed primarily based on first-hand data collection through comprehensive on-site investigations between 2018 and 2024, covering periods before and after the COVID-19 pandemic. Our research draws upon three main sources of data. First, we conducted field investigations, which included participant observations at sharing sessions and workshops, as well as active memberships in Maker Communities’ social networks. Additionally, we carried out 15 in-depth interviews (see Table 3) with a diverse range of stakeholders, including founders, makers, managers from various makerspaces, officials and experts. Sample interview questions addressed: (i) the place-specific innovation endowments of Shenzhen; (ii) the entrepreneurial services provided by makerspaces and the roles of public sectors; and (iii) recent transformations and

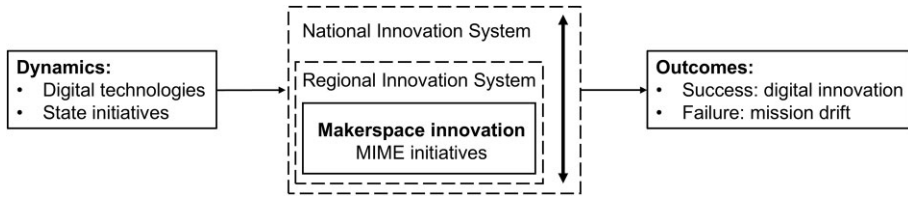


Figure 1. Analytical framework for examining the MOIP-driven digital transition of makerspace innovation.
Source: Compiled by the authors.

Table 1. Number of makerspaces in selected Chinese cities, 2017–2022.

City	2017	2018	2019	2020	2021	2022
Shenzhen	180	235	147	325	316	329
Beijing	133	185	147	245	232	250
Shanghai	111	172	152	146	144	162
Total in China	4298	5739	6959	8000	8507	9062

Source: Compiled based on the China Torch Statistical Yearbook, 2017–2022.

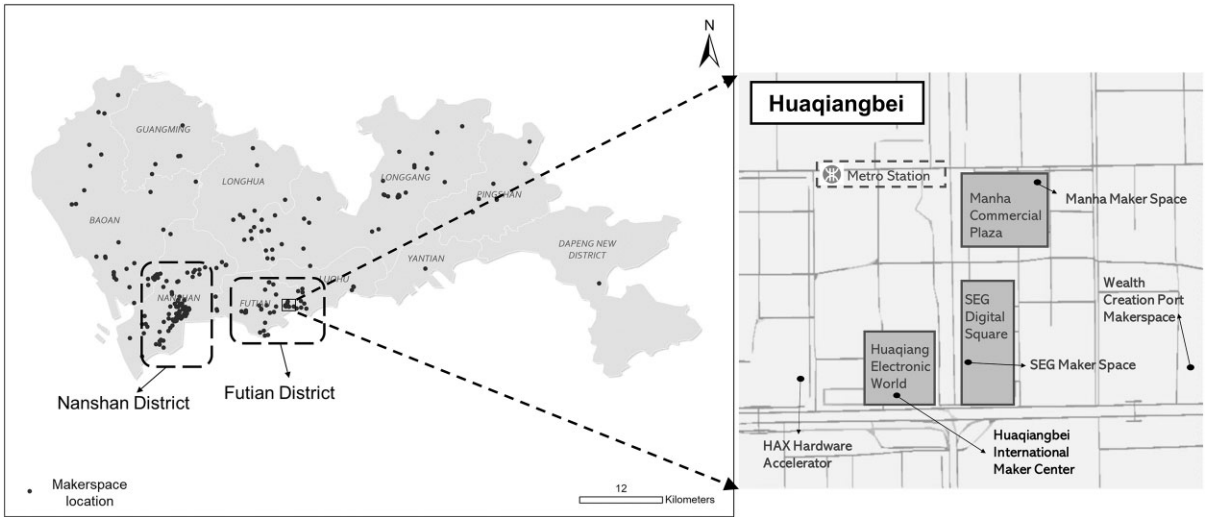


Figure 2. Concentrations of the makerspaces in HQB, Shenzhen, 2023.
Source: Location information obtained from the Shenzhen government.

Table 2. Industrial composition of makerspaces in Shenzhen (2023).

Incubation field	Number	Share (%)
Information technology and digital hardware	257	88.6
Biology and medicine	7	2.4
Modern agriculture	2	0.7
Cultural creativity (cultural communication, e-commerce, clothing, jewellery design, etc.)	13	4.5
College entrepreneurship training and research	11	3.8
Total	290	100

Note: The industry types refer to the “Statistical Report on the Operation of Makerspaces” by the Ministry of Science and Technology of China, which we obtained during our survey. We collected business operating data from the enterprise information tool “Qichacha” to identify the industrial orientation targeted by these makerspaces for startup incubation.
Source: Based on the authors’ own survey.

Table 3. Overview of fieldwork.

No.	Interviewee	Date
1	Maker from SZDIY, Electronic DIY enthusiast	December 2023
2	Maker from SZDIY, Software engineer	December 2023
3	Maker from SZDIY, R&D engineer for lithium battery protection	December 2023
4	Market Manager of Shenzhen Maker Union	January 2024
5	Secretary General of Shenzhen Maker Union	January 2024
6	Staff, Huaqiangbei International Maker Center, Shenzhen	January 2024
7	Staff, Huaqiangbei International Maker Center, Shenzhen	January 2024
8	Official, Center for Entrepreneurial Services in Taiyuan, Shanxi	January 2024
9	Operator of makerspace (Acom Co-working Space)	January 2024
10	Operator of makerspace (U-Union)	April 2024
11	Operator of makerspace (SEG)	June 2024
12	Operator of makerspace (Manhan)	June 2024
13	Operator of makerspace (CEC i-valley)	June 2024
14	Administrator, Huaqiangbei Digital Museum	June 2024
15	Staff of District Neighbourhood Office	June 2024
Additional documented fieldwork		Number
Visits to Huaqiangbei		4
Visits to various makerspaces		7

barriers in innovation models, particularly in the context of the COVID-19 pandemic.

Second, we supplemented the first-hand information with temporal and spatial data on makerspaces obtained from national and municipal databases. We utilised data from the *China Torch Statistical Yearbook*, published by the Torch High Technology Industry Development Center (THID) under the Ministry of Science and Technology, covering the years 2017–2023. This yearbook compiles the operational status of makerspaces across various regions based on self-reported information from registered entities. Furthermore, we obtained a list of 190 officially recognised makerspaces in 2023 from the Shenzhen Science and Technology Innovation Committee.

Third, we compiled and analysed government policies and reports to examine the scope and evolution of policy missions. The selection criteria for policy texts were as follows: (i) sources included documents from the State Council, various ministries and the official websites of the Shenzhen local government and (ii) we focused on documents dated after March 2015, when the State Council first introduced the concept of “makerspaces”, while excluding general innovation-supporting and outdated policies.

For our sampling steps regarding interviews and data analysis methods, we initially employed mapping and visualisation techniques to analyse the temporal and spatial patterns of quantitative data on makerspaces in Shenzhen. This analysis led to the identification of the HQB cluster, which is focused on the consumer electronics industry. We then engaged with nearly all the makerspaces in HQB through snowball sampling facilitated by infor-

mants (Interviewees 1 and 7), conducting in-depth interviews with key members and participating in their workshops and weekly gatherings. This process allowed us to collect additional qualitative notes and observational materials.

To analyse the qualitative data from policy texts and field observations, we utilised interpretation-focused coding with the aid of NVivo software (Adu, 2019). Specifically, for the policy analysis, we selected texts exceeding 20,000 Chinese characters to examine how various policy tools were allocated to different government departments, thereby identifying horizontal cross-departmental coordination in makerspace innovation (see Table 5). For the interview transcripts, we recorded the sessions in their entirety and transcribed them. To ensure the validity of our findings, we cross-verified key statements from interviewees (e.g. annual income and innovation outcomes of makerspaces, conditions for obtaining government subsidies and details of their business models) with supplementary materials from policy texts, quantitative indicators from the *Torch Statistical Yearbook* and actual innovative products (e.g. the robots fabricated in HQB makerspace in Figure 5).

This mixed-method approach highlights the originality and significance of our first-hand data collection, while the supplementary secondary data serve to validate and enhance the accuracy of our findings. Through this approach, we aim to illuminate the challenges and opportunities inherent in the makerspace-centric digital innovation paradigm, particularly in the context of the HQB case in Shenzhen.

Evolution of MOIP-led makerspace innovation in Shenzhen in the digital age

State-led makerspace innovation and China's MOIP implementation in Shenzhen

In this section, we examined the design and implementation of the mission-oriented innovation initiative in China, i.e. MIME, proposed by the central government since the early 2010s. This initiative arose from a strategic choice to leverage entrepreneurship and innovation to address economic and social transformation challenges, as well as technological nationalism (Fu et al., 2022a), in response to the global societal challenges driven by advancements in digital technologies. Through the MIME initiatives, the central government encourages individuals to engage in extensive indigenous innovation to address employment issues and coincidentally fosters the creation of pioneering technological enterprises to gain advantages in international competition. Additionally, the central government provided strong backing measures for the development of makerspaces, viewing them as active “catalysts” for upgrading from traditional manufacturing to digital fabrication driven by technological advancement. Key measures of this initiative include direct investment and the encouragement of state-owned enterprises, technology companies, universities and other entities to establish diverse, locally tailored makerspaces. In 2022, China officially registered 9026 makerspaces, assisting approximately 20,000 startups, which obtained financing totalling around 90 billion yuan (about USD 12.8 billion) and created about 1.06 million jobs, according to the 2023 *China Torch Statistical Yearbook*.

In effect, this state-led makerspace innovation encompasses traditional industrial policy goals, as well as ambitious social targets, a timeline for detailed policy practices and diverse policy instruments (Fu et al., 2022b; Wang and Tan, 2020), highlighting the distinctive features of MOIP. The central government aims to “fully utilize the Internet and open-source technology to build an open innovation and entrepreneurship platform” (State Council, 2015), implement an innovation-driven strategy and integrate rural labour, university graduates and veterans into the maker concept, to achieve economic structural adjustments and industrial transformation, thereby promoting employment and social mobility.

To identify the commonalities and uniqueness of China's MOIP, we conducted a comparative study of the design and implementation of MOIP in China and Western countries, focusing on Shenzhen's state-led makerspace innovation. This analysis illustrates how this national initiative aligns with the recognised criteria established by Mazzucato (2018) and Larrue (2021), while also exploring the characteristics that emerge within China's unique institutional context (for details see Table 4). Across its

major dimensions, the MIME initiative meets the key criteria for identifying “grand societal missions” proposed by Mazzucato (2018). In terms of strategic orientation, China's MIME has an overarching transformative mission, and in terms of direction, it includes long-term plans with intermediate goals and clear policy guidelines for makerspaces. Overall, it is appropriate to examine the evolution of MOIP-led makerspace innovation in Shenzhen as a prominent policy case, especially by viewing makerspaces as an interactional arena, to reveal its unique dual track of MOIP in top-down policymaking and bottom-up implementation. In 2015, Shenzhen launched the “Three-Year Action Plan to Promote Maker Development (2015–2017)” in response to the State Council's support for MIME. Shenzhen's makerspace innovation has consistently been framed as addressing a global challenge while aligning with a national strategy. The city has continually embraced an innovation-driven development approach and taken on the role of an experimental pioneer, witnessing a paradigm shift in innovation priorities in China. Since the 2008 international financial crisis, Shenzhen has continuously transformed from imitative to indigenous innovation. The evolution of urban innovation in Shenzhen's five-year plans shows an expansion of its innovation ambitions from national to international and global influences (Table 5).

The multi-scalar governance of state-led makerspace innovation in Shenzhen has integrated national strategies with local coordination. The MIME is primarily a top-down initiative that seeks to shift elite-driven innovation from research institutions and enterprises to a model of distributed innovation with mass participation. The Torch Center is the primary agency for makerspace-based innovation in China. The name “Torch” symbolises this institution's role in advancing China's vision of high-tech industrialisation and innovation-oriented national development since the 1980s, characterising it as a mission-oriented agency. The MIME initiative exemplifies the typical top-down command-and-control coordination and negotiation within China's technology innovation policy. “The central government focuses on comprehensive, fundamental, and long-term functions” (State Council, 2015). At the implementation level, local governments act as administrators and market participants. “Three-tiered makerspace registration” and “One license/platform, multiple roles” illustrate the vertical and horizontal coordination in innovation governance.

First, China has established a three-tiered makerspace system at the national, provincial and municipal levels, each with a comprehensive governance strategy encompassing licensing, establishment, evaluation, phasing out and upgrading of incentives (Figure 3). The basic criteria for government-recognised makerspaces include a minimum service area of 500 square metres, hosting a minimum of 20 startup teams and organising no fewer than 10

Table 4. Comparison of MOIP dimensions in the West, China and Shenzhen in particular.

MOIP dimensions	Western MOIP	China's MOIP	Shenzhen makerspace innovation
Strategic orientation	Bold and inspirational with wide societal challenges	Support strategic industries or transition established sectors to address transformative challenges from new technologies	Aims to foster employment, facilitate economic restructuring and traditional industrial upgrading and cultivate maker culture and social innovation vitality
Policy directionality	1. Clear direction: targeted, measurable and time-bound 2. Multiple, bottom-up solutions	1. Long-term plans with intermediate goals 2. Primarily state-led innovation, incorporating both top-down and bottom-up elements.	1. Top-down approaches and bottom-up implementation 2. Makerspaces democratise digital fabrication technology and serve as intermediaries in innovation systems
Policy scope and coordination	Cross-disciplinary, cross-sectoral and cross-actor innovation	1. National visions and local experiments, implementation and reflexivity 2. Multiministry and multisectoral policy development	1. Shenzhen explicitly plays a role in experimentation and is among the best practices in national makerspace innovation 2. Vertical governance and horizontal coordination 3. Involves stakeholders such as technology companies, universities and research institutes, financial institutions, etc.
Policy implementation	1. Ambitious yet realistic research and innovation actions 2. Co-create and shape the markets	1. Diverse set of policy interventions (technical, financial, regulatory, etc.) 2. Deliberate market creation and market destruction	A three-tiered makerspace system at national, provincial and municipal levels, with governance strategies for licensing, establishment, evaluation, phasing out and upgrading incentives
Scale and space	1. Brand initiatives at national or supranational level (e.g. EU) 2. Criticised for being disconnected from socio-spatial contexts	1. National or subnational initiatives 2. Land-based governance and spatial designation of high-tech zones	1. Massive community/individual-level innovation and entrepreneurship 2. Leverage open-source digital technologies to establish diverse makerspaces as arenas for the contextualisation of national missions.

Source: Adapted by the authors from Mazzucato (2018), Larrue (2021), Zhang et al. (2024) and Liefner et al. (2025).

Table 5. The evolution of innovation missions in Shenzhen's Five-Year Plans.

12th Five-Year Plan (2011–2015)	13th Five-Year Plan (2016–2020)	14th Five-Year Plan (2021–2025)
Take the lead in building a national innovative city 1. Enhance the indigenous innovation capability of core technologies 2. Construct an open regional innovation system 3. Optimise talent development 4. Foster innovation and entrepreneurship	Build an internationally leading innovative city 1. Strengthen the dominant position of enterprises 2. Improve innovation ecosystem and create an international maker centre 3. Enhance innovation efficiency 4. Develop a diverse talent pool	Construct a globally influential hub for technological and industrial innovation 1. Achieve breakthroughs in key technologies 2. Enhance open collaboration in innovation 3. Accelerate strategic emerging industries and modernise industrial chains 4. Build a global digital pioneer city

Source: Compiled by the authors based on Shenzhen's 12th, 13th and 14th Five-Year Plans.

maker events annually. Local governments incentivise the expansion of makerspaces within their regions. For example, national-level makerspaces receive a one-off subsidy of 500,000 yuan (USD 71,000) and provincial-level makerspaces receive 250,000 yuan (USD 35,500) from the Shenzhen municipal government. Additionally, makerspace operators seek upgrades as they can receive significant financial support at the national level, including general sub-

sidies such as rental subsidies, grants for hosting maker events and innovation vouchers, as well as incentives such as exemptions from urban land use tax and value-added tax waivers on startup teams' innovative outputs. Along with positive incentives, dynamic mechanisms exist for phasing out the underperformed makerspaces from the government-recognised list. In 2021, the Torch Center reviewed 2386 national makerspaces and disqualified 135

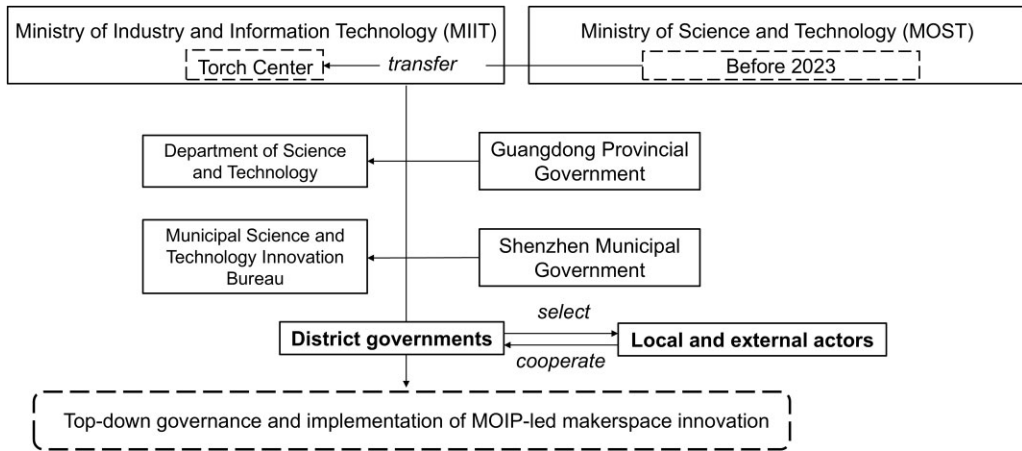


Figure 3. Multi-scalar governance of the MIME-oriented makerspace innovation in China.
 Source: Compiled by the authors.

Table 6. Cross-departmental coordination of makerspace innovation in Shenzhen.

Sector	Main tasks
Science and Technology Innovation Commission Finance Bureau	Oversee the declaration and review of specialised makerspaces, organise special statistics and operational evaluations and allocate maker special funds. Annually spend tens of billions of yuan through financial earmarks, including: (i) maker programme grants, (ii) maker event grants, (iii) incentives and rent reductions for makerspaces and (iv) innovation vouchers.
Planning and Natural Resources Bureau	Promote the transformation of old commercial facilities and industrial plants into makerspaces.
Human Resources and Social Security Bureau Civil Affairs Bureau Education Bureau	Encourage employment and entrepreneurship among key groups, including college students and migrant workers. Establish maker alliances and industry associations. Assist in the incubation and training of university student maker projects and organise international youth maker exchange activities.
Economic, Trade and Information Commission	Enrich open-source software and hardware and promote the accessibility of large scientific instruments to small businesses.

Source: Compiled by the authors, based on various policy documents of the Shenzhen municipal government.

makerspaces, representing for approximately 6% of the total. The dynamic three-tiered system allows specialised makerspaces to be tailored to local conditions, facilitating effective management and oversight. Registered makerspaces meeting these criteria demonstrate strong operational management and profitability and serve as official references for maker teams. Moreover, official registration grants makerspaces to social organisation status. “A formal government license is essential for our inter-enterprise cooperation, funding applications, and project promotion” (Interviewee 4).

Second, our on-site investigation revealed that various types of makerspaces established under policy advocacy are supervised and incentivised by multiple departments and their operators (enterprises, real estate com-

panies, investment firms, universities, etc.). Table 6 outlines the specific responsibilities of various departments in Shenzhen for promoting makerspaces. The Central Government’s “Guidelines” have traversed a vertical bureaucracy to create a “policy mix” in Shenzhen. In the “one license/platform, multiple roles” model, makerspaces have turned into an integrated active arena for implementing state initiatives and enterprise innovation strategies. Makerspace acts as a convergence point for governance across various urban departments. For instance, technology departments regard makerspaces as an “innovation platform”, the human resources and social security bureau sees them as an “entrepreneurial base” and education departments view them as a “practical training base”. Simultaneously, enterprises perceive the establishment of mak-

erspaces “to extend their business value chain and access formal and informal resources from the government” (Interviewees 5 and 8).

Bottom-up transformation of mission-oriented makerspace innovation

The multi-level governance of makerspace innovation is currently undergoing significant transitions after several years of experimentation and bottom-up restructuring, along with the evolution of makerspace functions and roles. First and foremost, the restructuring of state power occurred in May 2023, when the supervisory agent of national makerspaces, the “Torch Center”, was transferred from the Ministry of Science and Technology (MOST) to the Ministry of Industry and Information Technology (MIIT) (Figure 3). This change reflects the fact that makerspaces can provide specialised technical and technological services to the public. Some commentators have suggested that “MOST’s restructuring is designed to adapt more completely to the mission-driven, national-security-imperative nature of current science and technology policy” (Naughton et al., 2023, 14).

This bottom-up transformation is also reflected in the expanded participation of regional actors. First, it is characterised by the rising role of the district government. The various district governments in Shenzhen actively participate in the makerspace-based innovation movement rather than remotely controlling entrepreneurial and innovative activities. They have transformed into “market agencies”. In a supportive institutional environment, district governments are granted administrative power and engage in the innovation market through direct investment or by actively selecting collaborators. For example, Futian District introduced an internationally leading hardware incubation company to establish a first-maker project cultivation platform for seed investment and crowdfunding in Shenzhen. Additionally, it collaborates with leading state-owned electronics enterprises in the region to expand their innovation incubation business.

The second aspect is the mobilisation and participation of local entrepreneurs and startup teams, among other innovation actors. As indicated in our analysis of the special funding lists for maker projects in Shenzhen since 2016, the evolution of maker projects confirms the megatrend of specialised digitalisation. In 2016, projects were primarily focused on automotive assistance systems and smart home devices by individuals and student teams. By 2023, the focus had shifted to advanced technologies such as deep learning and AI, driving innovations in smart cities, healthcare and manufacturing. This transition reflects a more diversified approach to makerspace-centric digital innovation that enhances societal impact and commercial viability. Funding support for maker projects in Shenzhen has also increased, with the number of funded projects

rising from 92 totalling 12.41 million yuan in 2016 to 218 projects receiving 118.65 million yuan in 2023. Another example is innovation in robot manufacturing; YouiBot, a makerspace-based company in the HQB, adapted during the pandemic by shifting from autonomous robots to developing a disinfection device. Located in the CEC i-valley, YouiBot specialises in robots for industrial logistics and inspections. Their Disinfection Robot, which features contactless temperature checks, has been deployed in hospitals, particularly in Wuhan. By 2021, YouiBot became one of the “top 20 most competitive robot companies globally” (Interviewee 13).

Mission-driven digital innovation in HQB makerspace Challenges and opportunities of makerspace innovation in the digital age

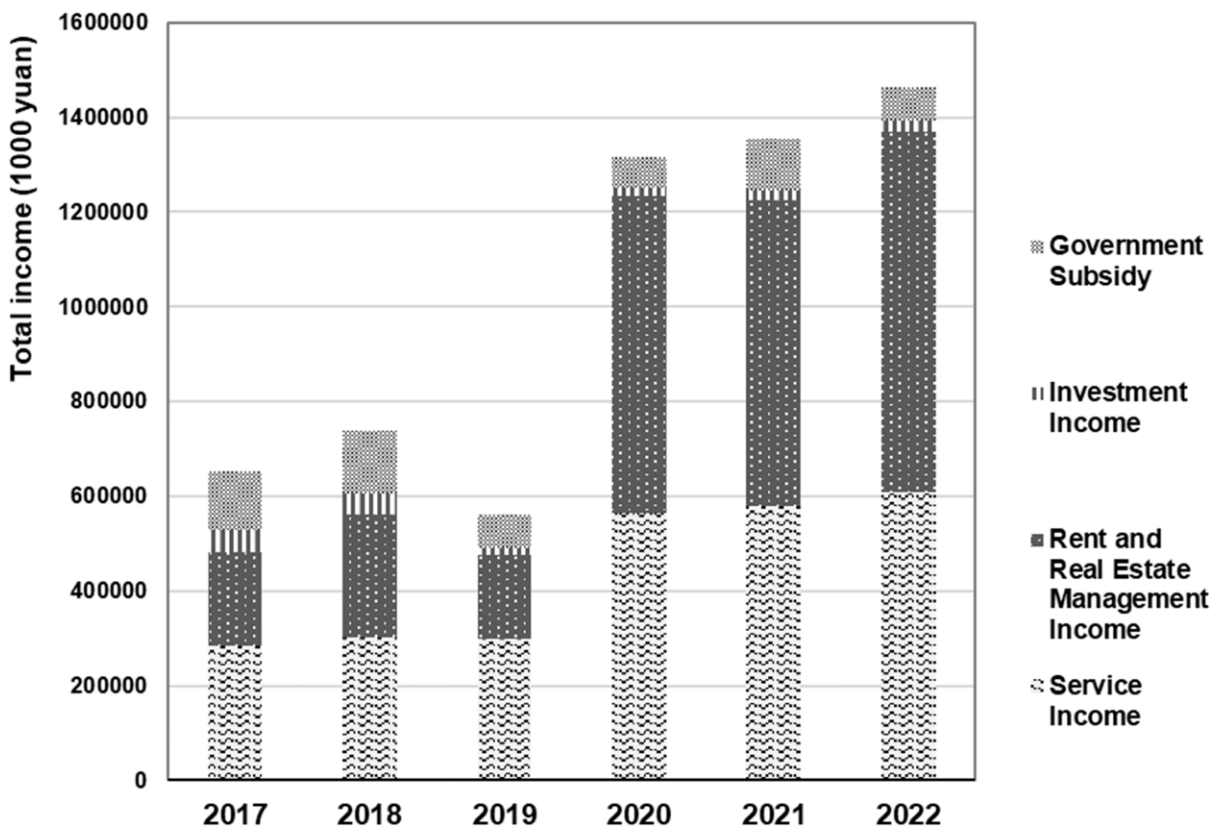
Evolving governance processes are accompanied by declining efficiency and speculative behaviours due to the excessive proliferation of generic makerspaces. First, makerspaces’ ability to foster innovation and create job opportunities is diminishing. We observed a reduction in the capacity of various types of makerspaces to integrate employment and improve innovation outcomes. Despite the ongoing increase in the number of makerspaces, the employment opportunities and patents they generate are declining (Table 7). Second, “mission drift” is occurring due to real estate speculation, which arises from a lack of robust business models and best practices. Similar to the observations made by Zuki (2021) and Schrock and Wolf-Powers (2019) regarding maker-focused local industrial policy in New York City, the optimistic revenue generated from leased office space and estate management attracted real estate companies to develop new commercial models (Interviewees 9 and 6). As illustrated in Figure 4, in a supportive institutional environment, both the number of makerspaces in Shenzhen and their total income grew significantly, while direct government investment decreased. Most makerspaces are increasingly relying on leasing spaces and providing incubation services to generate income. In 2022, 42% of makerspaces’ revenue were derived from real estate operations. On average, each makerspace in Shenzhen earned approximately 1.86 million yuan (about USD 260,000) per year from renting office space and property management. For example, the SEG makerspace that we visited, which has been downgraded into a co-working space, is occupied by firms that focus on express logistics and e-commerce. They tend to register pseudo-addresses in makerspaces to meet compliance requirements for business operations. This drifts away from the expected role of a national-level makerspace (Interviewee 11).

The COVID-19 pandemic, as an opportunity window, has further accelerated the evolution of makerspace innova-

Table 7. Innovation and entrepreneurship indicators of makerspaces in Shenzhen, 2017–2022.

Year	Number of makerspaces	Number of startup teams	Number of teams funded	Number of jobs created	Number of college graduates employed	Number of patents produced
2017	180	8770	719	37,210	8313	1081
2018	235	12,499	829	46,599	11,542	1800
2019	147	8024	369	13,878	2704	863
2020	325	13,483	564	18,557	2791	690
2021	316	12,641	509	17,462	2251	616
2022	329	14,141	620	18,812	2962	692

Source: Compiled by the authors according to the *China Torch Statistical Yearbook*, 2017–2022.

**Figure 4.** Overview of the income of the 290 registered makerspaces in Shenzhen, 2017–2022.

Source: Compiled by the authors according to the *China Torch Statistical Yearbook*, 2017–2022.

tion, as closures of manufacturing plants and specialised electronics markets have prompted a shift away from traditional on-site digital tools. The HQB model, described by the makers as “downstairs tools, upstairs innovation”, has evolved to incorporate teleworking tools, enabling remote and flexible development workflows. This shift has allowed makerspaces to adapt their roles and capabilities in response to the pandemic both locally and across regions. An example of distributed local manufacturing addressing complex challenges is the reliance on HQB’s

supply of Microcontroller Units (MCUs) and infrared temperature sensors for thermometer guns. Notably, 90% of global thermometer guns depend on the electronic components produced in the HQB, and one SEG electronic market sells 20,000 units per month, with prices increasing 5-fold (Interviewee 11), primarily targeting the domestic market and Southeast Asian countries through online cross-border e-commerce platforms. As a result of these, HQB are specifically shifting from traditional electronic components and LEDs to smart wearables, robotics and

drones to meet market demands (Figure 5). Comprehensive makerspaces are evolving into hybrid innovation spaces that focus on specific industries and are driven by sustained government initiatives and opportunities created by COVID-19.

The emergence of hybrid spaces of makerspace innovation

The synergy of policy support from multi-level mission-driven agencies, the evolving digital platform economy and opportunities from the COVID-19 have allowed distributed makerspaces within the HQB consumer electronics industry to emerge as hybrid innovation spaces. These platforms are essential for sourcing electronic components and innovative technologies, thereby strengthening the resilience of the HQB and Shenzhen's innovation system in three key aspects: technology, platforms and both physical and digital spaces. The availability of the latest digital manufacturing technologies and the rapid prototyping (Schrock and Wolf-Powers, 2019) based on the established consumer electronics supply chain make it easier for makers to engage in product development and fabrication. The comprehensive and low-cost components of HQBs, as well as assembly and labour-intensive production processes, are prerequisites for the local government and consumer electronics industrial chain to collaborate in establishing numerous makerspaces. "HQB has the most complete electronic industry chain in the world" (Interview 2). "The software and hardware technologies needed to manufacture the product that the startup team wants can be found in this community in just a few days" (Interviewee 6).

The sample makerspaces investigated provide diverse and integrated digital resources for individual entrepreneurs and startups, facilitating their participation in an open innovation process. One notable example is the Shenzhen DIY Community (SZDIY), founded in 2009 by Linux enthusiasts, making it the first self-organised makerspace in Shenzhen. Despite its modest size of less than 10 square metres, SZDIY is equipped with 3D printers, digital oscilloscopes and MCU boards for member use. The topics of the sharing sessions that the authors attend illustrate the maker community's commitment to knowledge-sharing and technology exploration (Table 8). This evolution reflects a shift from on-site open-source tools to the exchange of innovative ideas and business opportunities, leveraging advanced digital technologies, such as big data models, cloud computing and new materials.

Digital technological advancements in the specialised makerspaces in HQB have fuelled innovation and collaboration. Unlike traditional makerspaces, those in the HQB are more closely aligned with the industrial chain and increasingly commercialised. All investigated makerspaces reported having digital hardware laboratories, offering electronic component procurement, small-batch

prototype production and testing and certification services. They fulfil a government-defined role by providing updated, shared digital manufacturing technologies for individual entrepreneurs and startup teams through internet-based platforms.

Grassroots digital manufacturing is thriving in the HQB and reflecting the ongoing transformation of the local electronics industry. Unlike generic makerspaces that serve all small electronic firms and provide low-rent shared spaces such as startup cafes or home offices, various makerspaces in HQB increasingly target teams engaged in digital hardware manufacturing. For instance, the CEC i-valley focuses on incubating intelligent hardware enterprises and has established the "Specialisation, Refinement, Differential and Innovation (SRDI)" standards for the inclusion of small- and medium-sized enterprises, providing them with flexible office space, small-batch production, financial investment and other entrepreneurial empowerment services. The emphasis has been placed on nurturing digital hardware enterprises throughout their lifecycle, such as robotics and semiconductor chip companies. Our on-site research shows that companies occupying the seven-story makerspace primarily include robotics, biotechnology and chip design companies.

Another related aspect of makerspace transformation in Shenzhen is the platform functionality of the makerspace's business model. The digital platform attributes of China's state-led makerspaces can be traced back to 2015, when the central government defined these spaces as utilising the internet and open-source technology for innovation. In 2018, MOST, MIIT and other agencies called for the establishment of specialised makerspaces to support small- and medium-sized science and technology enterprises. These makerspaces are expected to provide services, such as inspection and testing, R&D design, small-batch production and technology transfer. A prominent example is the HQB International Maker Center. This makerspace adapts to local networks while also establishing connections to local trans-networks. Initially a traditional incubator, it provided low-cost shared workspaces transformed from standardised factories or retail markets for startups. The centre formed alliances with investment companies, consulting firms, local banks, intellectual property management companies and law firms. The national-level makerspace aims to assist potential startup teams through its operator Huaqiang Group, a provincial state-owned enterprise with physical assets and abundant supply chain and production resources. Several issues have been identified, highlighting some drawbacks of traditional comprehensive makerspaces: "the time to incubate a successful business case is too long, and the success rate is too low" (Interviewee 7).

In the post-pandemic period, especially after 2023, this makerspace will gradually transition from leasing on-site offices to becoming an intermediary organisation based



Figure 5. Left: “One-meter counters” in the consumer electronics retail market in HQB. Right: robotic products manufactured in HQB makerspaces.

Source: Pictured by the authors, September 2024.

Table 8. Weekly topics shared by SZDIY members.

Date	Topics	Presenter
21 December 2023	History of Embedded Storage Devices and Abnormal Explanations in Extreme Conditions	Martin, embedded software engineer
26 December 2023	Introduction to Battery Packaging Technology and Battery Management System (BMS)	Minge, R&D engineer for lithium battery protection board
4 January 2024	Prospects of Gene Editing in Microorganisms and Its Applications in New Materials	Mr. Birdie, venture capitalist
11 January 2024	New Skill Requirements in the Age of AI	Kevin, computer engineer
27 June 2024	From Making to Innovation	Peng, computer science faculty lecturer

Source: Based on the authors' own survey.

on digital sales and service platforms. This provides digital transformation solutions for small- and medium-sized enterprises and government agencies. Figure 6 illustrates the platform-based business model and its outputs. First, the makerspace boasts the largest professional market for electronic components in the country and an internet trading platform. This is equal to creating a virtual HQB in the online space where customers can find and purchase the products they need. This digital platform provides specialised global procurement and comprehensive information services. Furthermore, it offers integrated services along the industrial chain (technology transfer), expert consultation, technology testing, industry planning and brand operations for government and enterprise customers. Successful cases include designing an academic system for a municipal public university for older adults,

and designing an industrial monitoring and transportation cloud platform for a drinking water factory in Dongguan City. Furthermore, the leader of this makerspace, having previously served in the Shenzhen Municipal Organization Department, leveraged this political experience to facilitate cooperation with various levels of government. For example, a team of experts from this makerspace participated in a report on the development of Shenzhen's integrated circuit and electronic component industries, providing insights for the Shenzhen Science and Technology Commission. Our interviews indicate that the primary goal of this transformation is to “reduce operating costs for small and medium-sized enterprises and responding to government calls” (Interviewee 6).

Furthermore, the operational and land costs for small- and medium-sized enterprises, coupled with challenges

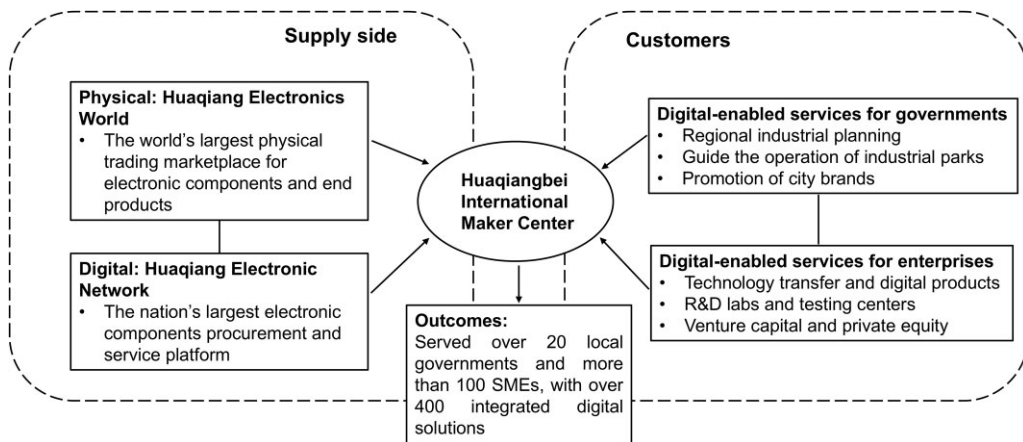


Figure 6. Digital platform-centred innovation of HQB International Maker Center.
Source: Compiled based on this study's survey.

like the COVID-19 pandemic, have accelerated the emergence of HQB hybrid innovation spaces through both government initiatives and firm-driven responses. While makerspaces and embedded communities were traditionally location-bound, COVID-19 prompted a shift to hybrid (digital/physical) environments. During the pandemic, most maker gatherings became virtual (online) events. Furthermore, District government has launched a virtual park via the "i-Futian" WeChat applet, featuring nearly 10 government "service centres" in the HQB area. These centres provide policy interpretation, governmental assistance, intellectual property services, device testing, free shared offices and other support. They have also established a "virtual HQB", integrating information on locations, property ownership, building areas and leasing requirements, enabling startups to find affordable workspaces efficiently. According to operational staff, businesses using this platform can reduce production and tax costs by an average of 30% (Interviewee 15). As of August 2024, the platform has integrated information on 26 spaces available for lease, totalling 713,000 square metres. In addition to government initiatives, firm-driven digital spaces have emerged, including digital open-source platforms, e-commerce sites and social media-based entrepreneurial ecosystems. The rise of digital open-source platforms, such as Application Programming Interfaces (APIs), has become a key response to remote work and cost reduction in the post-pandemic era. By 2022, China had over 8 million open-source developers, with Tencent's platform hosting 1 million. Our survey indicated that makers actively use these tools to share ideas and projects.

HQB now features comprehensive e-commerce platforms like Taobao and JD.com, alongside a specialised online sales platform for electronic components developed by Huaqiang Group. Many small retailers have also cre-

ated their own "product search" websites and cross-border e-commerce platforms, catering to diverse manufacturing needs. Furthermore, operators of the makerspaces we surveyed utilise instant social media platforms like WeChat to share entrepreneurial information. These virtual networks facilitate rapid information dissemination and trend updates, fostering a more open entrepreneurial culture in HQB. This shift has begun to challenge the relatively closed culture of the local Chaoshan (an ethnic group in east Guangdong province) community, known for its business acumen but also for its insularity. As one interviewee noted, "They are relatively xenophobic, and it is not easy for the later entrepreneurs because they used to dominate the industry chain" (Interviewee 10). Consequently, both market-driven and government-operated makerspaces have emerged as new, distributed hybrid urban innovation spaces, significantly transforming urban innovation systems in spatial configuration, functionality and outcomes.

Conclusions

This paper examines the evolving spaces and scales of China's MOIP, particularly the transition of makerspace-based innovation in Shenzhen in the digital era. The case study of HQB makerspace in Shenzhen reveals the dual-track transformation of China's MOIP in terms of top-down policy design and bottom-up implementation in the widespread application of digital technologies. This empirical study demonstrates that China's MOIPs have evolved through cross-sectoral innovation mission design and transformative practices of grassroots innovation and digital fabrication engaged by local maker communities. The findings elucidate the context-specific innovation approach, allowing numerous specialised makerspaces to address both opportunities and challenges brought by

the widespread digital technologies. The emergence of platform-centred innovation in makerspaces offers diverse digital capabilities and enhances the resilience of RIS under societal challenges, such as disruptive technologies and the COVID-19 pandemic.

This study enriches the MOIP and makerspace innovation research by highlighting that both of mission-oriented innovation policies and makerspaces have undergone unprecedented transformation in the digital age. First, we expand the research scope of MOIP in the Global South through examining the evident transition of makerspace-based innovation in China driven by digital platforms. Unlike previous research focusing on exploring the national-level analysis of environmental challenges on MOIPs in the Western advanced countries (Andersson et al., 2021, 110; Haddad et al., 2022; Kirchherr et al., 2023), this paper sheds light on the digital technology-driven transformation of local and community-level innovation in makerspaces, an overlooked arena for MOIP implementation. Moreover, this study resonates with today's MOIP, which needs to address not only the challenges of broader societal transformation, but also the opportunities of replacing established technologies with new ones engendered by disruptive technological advancement (Wanzenböck et al., 2020).

Second, the paper contributes to the place-based approach in MOIP research by conceptualising the evolving scales and spaces of innovation systems in the digital era. This study sheds light on the role of directionality at the regional and grassroots innovation. Furthermore, by recognising makerspaces as active arenas shaped by both top-down mission design and bottom-up local practices of MOIPs, we emphasise the spatial interactions of multi-scalar innovation systems. As Bunnell and Coe (2001, 570) mentioned, there is a need to give more credence to the relationships operating between and across different scales in innovation studies. The dual track pattern of implementation in China's MOIPs demonstrates a potentially more effective way of translating national goals into concrete plans within the salient institutional context of China (Liefner et al., 2025).

Third, by examining the digital transition of makerspaces in China, which are often overlooked in MOIP literature, this paper moves beyond the prevailed decentralised characteristics of makerspaces and highlights their democratised access to digital technologies. Particular attention has been paid to the transformative role of makerspaces in the emerging hybrid space of innovation paradigms in China. The case of HQB highlights the additive value of makerspaces in the digital transitions of MOIP and subsequent effects on the evolution of innovation systems.

The findings of this study have profound policy implications. The digital transition of makerspace innovation demonstrates promising attempts at directed, place-based and inclusive innovation driven by MOIP, as well as regional

resilience in the digital era. Beyond the grand technological objectives of industrial innovation policy, grassroots maker communities and flexible manufacturing hubs also need to be recognised and supported by innovation policy makers and practitioners. The case study in China and particularly Shenzhen echoes that there is no one-size-fits-all approach to missions and mission-driven innovation (Uyarra et al., 2025). It highlights the necessity of taking multiple scales and spatial contexts into account throughout the beginning of policy design to implementation of innovation missions. Despite the uniqueness of the Chinese approach to MOIPs, such as top-down decision-making leading to political bias and a lack of stakeholder diversity, as highlighted by earlier research (Liefner et al., 2025; Zhang et al., 2024), our study demonstrates the significant reflexive nature of China's MOIPs in response to profound societal transformation induced by technological advancement. Further research is needed to investigate whether this model is applicable for enhancing urban and regional resilience in other developing economies facing societal challenges. As digital technologies continue to evolve, the place-based approach of MOIPs developed in this study warrants further verification through comparative research on MOIP implementation and governance across diverse scales and spaces of innovation under variegated dynamics of disruptive technologies, such as artificial intelligence.

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