



# Manufacturing space: Hypergrowth and the Underwater City in Singapore



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## ABSTRACT

This paper illustrates how rapid economic growth results in a new method of space production. Focusing on the city-state Singapore, the paper highlights one technological innovation, namely “the Underwater City”, which embodies a futuristic infrastructure meant to expand the city-state’s limited land by creating useable space underwater. This paper offers the notion of “space manufacturing” to characterize the relation between technology and space production in this particular context. A brief account of Singapore’s economic expansion and its implication on space is presented. Following, the paper discusses the technical specifications of the underwater infrastructure to show how the new technology is designed to respond to space scarcity. Lastly, the paper examines how space manufacturing of the Underwater City reflects technocratic urbanism in Singapore as a rising global city.

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## 1. Introduction

What happens when an advanced economy with extremely limited space keeps growing and growing? This article seeks to show how space production takes a distinct form in response to the socio-economic forces. Specifically, it highlights the interplay between space creation and technological advancement situated in Singapore which is considerably the most advanced economy in Southeast Asia.

Singapore is a story of progress; a narrative that is expressed no stronger than in the book by the founding Prime Minister Lee Kuan Yew entitled *From the Third World to First* (Lee, 2012). This city-state has constantly transformed from time to time and is progressively embracing the market economy and cosmopolitan culture (Lim, 1983; Soh & Yuen, 2010). Ever since Singapore became an independent state from Malaysia in 1965, it has continued to exhibit impressive achievements, which turned the country into one of the richest in the world in terms of per capita income (Chen, 1979; Mauzy & Milne, 2002). Singapore’s rapid rise to an Asian economic powerhouse is a source of amazement to many, considering the island has nearly no natural resources to exploit for production. As an emerging global city, which increasingly integrates into the international circuits of finance and trade (Heng, 2013), Singapore is able to absorb and retrieve large amounts of basic resources such as energy, food, labor, and water from neighboring countries and all over the world to fulfill local demands

(OECD, 2010). However, Singapore lacks one sort of resource that is highly unlikely to import from foreign sources, namely space. This resource is constantly needed for the continuation of growth and well-being of Singapore as a developed nation (Goh, 2005).

Occupying an area of 714 km<sup>2</sup> flanked by two Muslim-majority giants, Malaysia and Indonesia, Singapore seems to have little option to expand its territory, in spite of the geographical advantages from its strategic location at the southern tip of the Malay Peninsula (Chia, 1998). As the economy has been rapidly progressing, the lack of space inevitably becomes a crisis that the Singapore government continuously seeks to resolve (Savage & Lye, 2011). Conventional approaches including land reclamation, high-rise development, and underground expansion have been undertaken (Lui & Tan, 2001; Wong, 2004). Indeed, these common methods have allowed Singapore to extend its limited space significantly but they are by no means without limitation. After all, the acceleration of economic and population growth exceed the production of space from these conventional techniques (Lui & Tan, 2001). Consequently, the call to develop alternative approaches to catch up with the expanding economy and population remains a strong necessity.

Against the backdrop of space scarcity, this article examines one new approach being developed for space creation in Singapore. It specifically focuses on the development of “The Underwater City”, a unique infrastructure meant to expand Singapore’s limited space into the sea. It is a research project carried out by a team of civil engineers at Nanyang Technological University. Funded by Singapore’s National Research Foundation, the NTU team seeks to offer an unusual method of space creation with more advantages

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compared to what have been done in the past. Relying on intensive research on marine and civil engineering, the construction of the infrastructure is proposed to be offshore the Singapore island, yet it stays connected with the urban systems at the mainland. We will refer this practice<sup>1</sup> as “space manufacturing”. It is “manufacturing” because the fundamental technique applies the logic of industrial system where space is treated similarly to industrial products manufactured through systematic processes. The meaning of manufacturing space is to produce space in such a standardized fashion in which all physical components embodying the artificial space are made in modular, thus industrially producible. Following the Lefebvrian analysis which asserts that space expands only when social forces create circumstances for its production (Lefebvre, 1991), the notion of space manufacturing in this paper links capital production—considered as the primary social force in globalized cities, to state-supported technological advancement. In this light, space manufacturing manifests what Lefebvre refers to as “the conceived space”, which entails an extensive use of scientific and technical knowledge by engineering experts to define material and physical structures for the production of space (Lefebvre, 1991, p. 222). As a practice, space manufacturing is deeply characterized by the realization that space is not merely a commodity, but also a strategic resource for the vulnerable economy of the city-state. Hence, we argue that the foundation of space manufacturing in this context lies in the state ideology of survivalism. In this light, the Underwater City of Singapore as a space manufacturing practice embodies the state’s ideological vision and technological advancement, resulting in the city progress.

To examine the unique method of space creation developed in this large-scale project, this article is divided into three sections. First, it discusses the socio-economic progress of Singapore and its direct implication on space demands. Second, it presents the conceptual and technical specifications of the Underwater City and how the infrastructure is designed to respond to the growing demands for space in Singapore. The last section examines the dominant role of engineering experts in shaping the urban culture and landscape of Singapore through the practice of space manufacturing.

## 2. Expanding economy, shrinking space

Much of Singapore’s meteoric rise to a first-world metropolis can be traced to its highly developed market-based economy, which is historically rooted in its strategic geographical position for extended entrepôt trade. Its unique geographical location has long been a key advantage in making Singapore a bustling trading port attracting droves of people to its shores (Economic Development Board, 2012).

Since independence, the Singapore government’s developmental ideology has always been growth-driven, purely pragmatic, adaptable to changing circumstances, and centered on economic progress (Abeyasinghe & Choy, 2007; Huff, 1995). While governmental intervention in its ‘free market’ economy is kept at a minimum, the state controls and owns firms that comprise at least 60% of its GDP through government-linked companies (GLCs) such as SingTel, Singapore Airlines, SMRT Corporation, ComfortDelGro, ST Engineering, Singapore Press Holdings, and MediaCorp under the umbrella holding corporation, Temasek Holdings. As such, many of Singapore’s modern infrastructures – which symbolize and encapsulate the developmental process (and stage) of the nation – are regulated, controlled and owned by the state (Ang & Ding, 2006; Hamilton-Hart, 2000).

In the 1960s, with a GNP per capita of less than US\$320, Singapore was largely part of the Third World suffering from poor

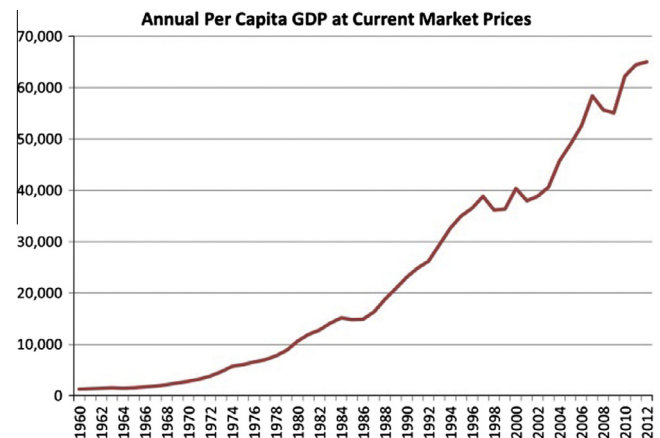


Fig. 1. Per capita GDP growth of Singapore. (This data is available online at [www.singstat.gov.sg](http://www.singstat.gov.sg).) Source: Singapore Department of Statistics.

infrastructure and limited capital. Entrepôt trade remained the main source of income and alone accounted for more than one-third of the country’s GDP (Siddiqui, 2010). The 1970s saw a shift in focus to further enhance Singapore’s business resources, as a solid manufacturing base had been established. More factories were built, skilled manpower was developed, and industries became diversified. Before long, manufacturing evolved to become more sophisticated: computer parts, peripherals, software packages, and silicon wafers were manufactured (Tsao, 1995). This, in turn, has particularly led to new investments, in the electronics sector and product diversification, which greatly enhanced export performance in spite of a global recession. During the 1980s, Singapore’s Economic Development Board (EDB) co-established institutions of technology with industrially developed economies to meet the demands of high-technology industries for specialized labor. Coupled with the Skills Development Fund, these institutions of learning provided Singaporeans with specialized training for the manufacturing sectors (Zhao et al., 2005). Fundamental transformations took place in the 1990s when the service sector became the engine for growth as it flourished to form one of the pillars of Singapore’s economy, along with the field of biomedical sciences and other key emerging industries (Schein, 1996). The growing importance of the service sector, which included transport, communications, businesses and finance, resonated with the country’s aforementioned move toward becoming a global financial centre (Siddiqui, 2010). At the turn of the century, Singapore increased its emphasis on knowledge and innovation-intensive activities, which placed research and development (R&D) at the cornerstone of its economic development (Wong, 2003).

Singapore is heavily reliant on refining imported goods and exports, particularly in consumer electronics, information technology products, and pharmaceuticals. The oil industry makes up 5% of Singapore’s GDP, rendering the country one of the top three export refining centres in the world. This is a remarkable achievement considering the country’s lack of natural resources. A growing financial services sector adds to this list. Overall, manufacturing and financial business services account for most Singapore’s GDP. Underpinned by these modern sectors, Singapore’s economic superiority is apparent and leads the country to be the world leader in several economic areas. As a result of these economic feats, Singapore’s GDP per capita (see Fig. 1) has increased by more than twofold from US\$27,800 in 1999 to US\$60,500 in 2011, which is one of the highest in the world presently. As Chua Beng Huat explains, all of these achievements were attributed to “an economically entrepreneurial state that adopts

<sup>1</sup> The term “practice” follows the definition by Lave and Wenger (1991).

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