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Constant and Sustained Innovation  
as the Imperative for  
**HONG KONG'S  
LOW EARTH ORBIT ECONOMY**

持續創新是  
發展低軌經濟的最佳路徑





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Hong Kong's Low Earth Orbit Economy**

**POD Research Institute**

Cheung Tat Ming Martin, Principal Researcher

Ip Chun Sang, Sam, Community Officer

**March 2026**

**持續創新是發展低軌經濟的最佳路徑**

**民思政策研究所**

張達明, 首席研究員

葉浚生, 地區專員

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## Contents 目錄

<b>Executive Summary</b> .....	<b>5</b>
<b>執行摘要</b> .....	<b>8</b>
<b>Chapter 1: Introduction</b> .....	<b>11</b>
1.1 Research Background: Hong Kong's Late Entry, and Why the Downstream Matters .....	11
1.2 The Downstream Dominance: Not Less Than 90% of Space Economy Revenue Is Generated Beyond Manufacturing and Launch .....	11
1.3 Policy Guiding Questions.....	14
1.4 Research Objectives .....	15
1.5 Research Methodology .....	15
<b>Chapter 2: The LEO Economy and China's National Strategy: What Stakeholders Should Know</b> .....	<b>15</b>
2.1 Technical Pre-conditions for the Formation of the LEO Economy.....	15
2.2 China's Accumulated Experience in LEO Development .....	17
2.3 China's LEO Industrial Geography: Spatial Division of Labour, Manufacturing Concentration, and Domestic Market Orientation .....	18
2.4 Sino-American Rivalry in the LEO Domain .....	20
2.5 Geopolitical Considerations and Their Importance for the LEO Economy .....	21
2.6 Chapter Conclusion: Hong Kong's Opportunity Within the National Enterprise.....	22
<b>Chapter 3: Economics at Work: Business Models and the China–Hong Kong Industrial Chain</b> .....	<b>23</b>
3.1 Reframing the LEO Economy: From Technology Sector to Economic Infrastructure .....	23
3.2 Four Defining Characteristics of the LEO Economy.....	23
3.3 Two-Market Classification and the Four Commercialization Constraints .....	24
3.4 Business Model I: Space-Based Communications and Connectivity Leasing .....	24
3.5 Business Model II: Space-Based Data Reporting and Analytics Services .....	25
3.6 Business Model III: Consumer-Oriented Satellite Services.....	25
3.7 The China-Hong Kong LEO Industrial Chain.....	25
3.8 Overseas Market Strategies for Hong Kong-Based LEO Firms .....	26
3.9 Chapter Conclusion .....	26
<b>Chapter 4: The Three Business Models — Comparative Matrix and Policy Sequencing</b> .....	<b>27</b>
4.1 Comparative Model Matrix .....	27
4.2 Model I: Key Policy Sequencing Points .....	27

4.3 Model II: Key Policy Sequencing Points .....	28
4.4 Model III: Policy Sequencing Points .....	28
4.5 Synthesis Overview: Near-, Medium-, and Long-Term Priorities .....	28
4.6 Synthesizing the Three Models: Sequencing Logic .....	30
4.7 Chapter Conclusion .....	31
<b>Chapter 5: Strategies That Make Hong Kong Tick in the LEO Economy .....</b>	<b>31</b>
5.1 Introduction: Four Layers of the Strategic Argument .....	31
5.2 The Innovation Imperative: Unexpected Applications as the True Engine of LEO Value .....	31
5.3 The Global Competitive Landscape: Where the Highest Margins Are, and Whether Hong Kong Can Capture Them .....	33
5.4 Learning from Singapore — and Going Beyond .....	34
5.5 Catch-Up Proposals: Drawing on UK and Luxembourg Experience .....	35
5.6 Critical Assumptions Requiring Policy Confirmation .....	36
5.7 Chapter Conclusion: Late Entry, Long Vision, and Tolerance for Failure .....	37
<b>Chapter 6: Consolidated Conclusion and a 5-10 Year Plan for Hong Kong's LEO Economy .....</b>	<b>38</b>
6.1 Answers to the Four Policy Guiding Questions .....	38
6.2 Why Constant and Continual Innovation Must Sit at the Centre .....	39
6.3 A 5-10 Year Timeline for LEO Development .....	40
6.4: Leo Economy KPI Framework .....	40
6.5 Synthesis: One Integrated Conclusion .....	41
<b>第一章：引言 .....</b>	<b>42</b>
1.1 研究背景：香港的晚起步，以及下游領域的重要性 .....	42
1.2 下游主導：太空經濟產業逾 90% 的收入來源於製造與發射環節之外 .....	42
1.3 政策指導問題 .....	44
1.4 研究目標 .....	45
1.5 研究方法 .....	45
<b>第二章：低軌經濟與國家戰略：利益相關方須知 .....</b>	<b>45</b>
2.1 LEO 經濟形成的技術前提條件 .....	45
2.2 中國在 LEO 發展的長期積累 .....	47
2.3 國家 LEO 產業地理：空間分工、製造集中與內需導向 .....	47

2.4 中美在低軌領域的競爭 .....	50
2.5 地緣政治考量及其對 LEO 經濟的重要性 .....	50
2.6 本章結論：香港在國家戰略中的發展機遇 .....	51
<b>第三章：產業經濟邏輯：商業模式與中港產業鏈協同 .....</b>	<b>52</b>
3.1 重新框定 LEO 經濟：從技術部門轉向經濟基礎設施 .....	52
3.2 LEO 經濟的四項定義特徵 .....	52
3.3 雙市場分類與四項商業化約束 .....	53
3.4 商業模式 I：基於太空的通訊與連接租賃 .....	53
3.5 商業模式 II：基於太空的數據報告與分析服務 .....	54
3.6 商業模式 III：面向消費者的衛星服務 .....	54
3.7 內港低軌產業鏈協同 .....	54
3.8 香港 LEO 企業的海外市場策略 .....	55
3.9 本章結論 .....	55
<b>第四章：三大商業模式 —— 對比與政策時序 .....</b>	<b>56</b>
4.1 商業模式比較 .....	56
4.2 模式 I：核心政策排序要點 .....	56
4.3 模式 II：核心政策排序要點 .....	56
4.4 模式 III：政策排序要點 .....	56
4.5 整合總覽：短、中、長期重點任務 .....	57
4.6 三大模式整合：時序邏輯總結 .....	58
4.7 本章結論 .....	59
<b>第五章：香港低軌經濟的核心發展策略 .....</b>	<b>59</b>
5.1 引言：戰略論述的四大層級 .....	59
5.2 創新的必然要求：不可能預知的應用是低軌價值的真正引擎 .....	59
5.3 全球競爭格局：最高利潤所在及香港能否捕捉機遇 .....	61
5.4 借鑒新加坡經驗並實現超越 .....	62
5.5 追趕型建議：借鑒英國及盧森堡經驗 .....	62
5.6 需政策確認的關鍵假設 .....	63
5.7 本章結論：後發入場、長遠視野與對失敗的容忍 .....	65
<b>第六章：整合結論及香港低軌經濟的 5 至 10 年規劃 .....</b>	<b>65</b>

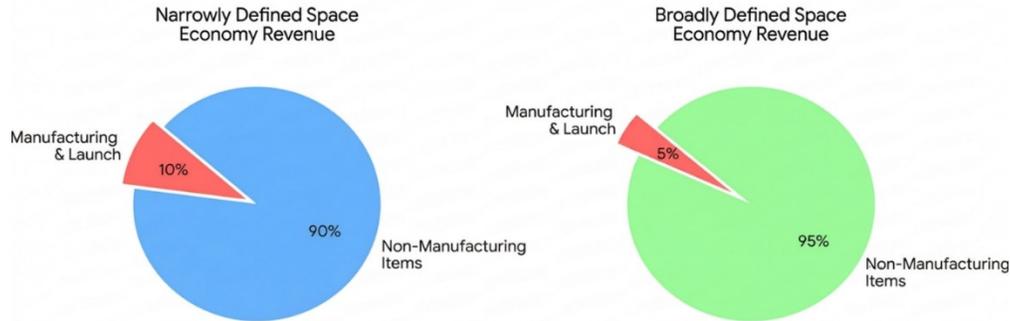
6.1 四項政策指導問題的答案 .....	65
6.2 為何持續創新必須置於核心地位.....	66
6.3 低軌發展的 5 至 10 年時間表 .....	66
6.4 低軌經濟關鍵績效指標 (KPI) 框架.....	67
6.5 綜合結論 .....	68
<b>Appendix (English Only) .....</b>	<b>68</b>
Appendix A.....	68
Appendix B.....	69
Appendix C.....	69
Appendix D .....	70
Appendix E .....	70
Appendix F .....	71
Appendix G.....	71

# Executive Summary

## Overview

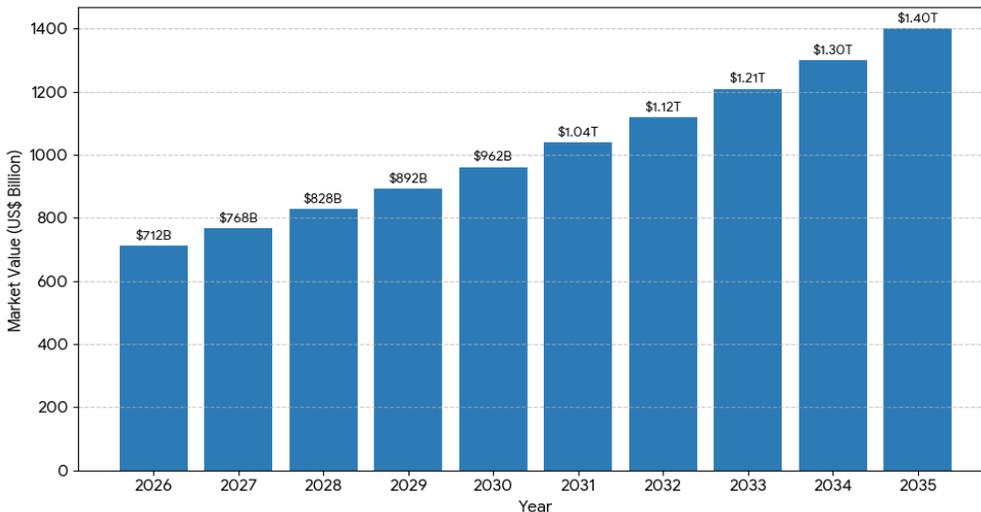
This report explores Hong Kong's exciting opportunity in the global low Earth orbit (LEO) satellite economy. LEO satellites orbit close to Earth, delivering internet, data, and services. Hong Kong won't focus on building satellites or launching rockets—those areas are led by giants like the US and China's national programs. Instead, it should target the "downstream" side: converting satellite data into practical services and products, where not less than 90% of the space industry's revenue comes from. The report provides a detailed three-phase roadmap over 5 to 10 years, based on economic data, lessons from other countries, and Hong Kong's strengths in finance and law.

### Global Proportional Revenue Distribution in 2024 [1]



Source: Industry Revenue Distribution Analysis (Updated Terminology)

### Global Space Economy Projection (2026-2035)



## The Global Space Economy Landscape

The global space economy will hit about US\$712 billion in 2026 and is set to reach US\$1.4 trillion by early 2035.<sup>2</sup> LEO is a battleground for competition, with SpaceX running over 10,000 Starlink satellites, China applying for around 203,000 orbital slots, and SpaceX is planning one million satellites intended to function as orbital data

[1] Sources: Table 1.2; reasons for using global space economy in lieu of global LEO enabled economy: Detailed ten-year annual records or forecasts for the global LEO-enabled economy are not presently well established in the public literature. Existing projections usually cover either the broader global space economy or the narrower LEO satellite market, rather than a separately defined and consistently measured global LEO-enabled economy.

<sup>2</sup> The Space Foundation reports the global space economy reached US\$613B in 2024, growing at 7.8% year-on-year. Applying this growth rate consistently, US\$712B by 2026 and US\$1.4 trillion by 2035 follow arithmetically. Actual outcomes will depend on whether this growth rate is sustained. Space Foundation. (2025, July 22). The Space Report 2025 Q2. Space Foundation. <https://www.spacefoundation.org/2025/07/22/the-space-report-2025-q2/>

centers for AI.<sup>3</sup> Building and launching satellites make up just 5-10% of revenue—the bulk comes from services, data analytics, and systems that turn orbital capacity into real-world value.

Hong Kong is entering late, without launch sites, rocket factories, or space engineering history. But that's not a barrier—nations like Germany, the UK, Singapore, and Luxembourg thrive without them by excelling in downstream roles.

### **Hong Kong's Strategic Position**

Hong Kong's sweet spot is downstream: transforming satellite capacity into digitized products, contracts, compliance tools, risk management, and global access. Basic services can come directly from Chinese mainland, but advanced, industry-specific ones need Hong Kong's expertise in finance, law, compliance, dispute resolution, and international bridging.

### **Hong Kong has five key advantages**

1. Under the "One Country, Two Systems" framework, Hong Kong can gain priority access to data from major Chinese satellite constellations (including Qianfan, G60, and Guowang) by hosting mainland LEO satellite firms — a unique advantage unavailable to Singapore.
2. As the world's top offshore RMB hub, it can offer unique RMB-based satellite leasing bonds, insurance products, and investment funds.
3. A complete toolkit of common law, HKIAC arbitration, reinsurance, and HKEX markets in one place.
4. A gateway for Belt and Road, packaging Chinese LEO services under Hong Kong law with trusted dispute handling.
5. Aligning with China's technological advancement: breakthroughs in national satellite systems create more opportunities of service provision in Hong Kong and bring synergies from preferential cooperation.

### **Defining the LEO Economy and Conceptualizing Business Models**

The report defines the LEO economy through four key characteristics: its downstream dominance (where most value is created), market evolution via product-process innovation cycles, readiness gates (checkpoints for commercial viability), and two distinct markets (existing deterministic services vs. innovative indeterminate ones). Using these, it conceptualizes three conspicuous business models to guide strategy:

- **Model 1:** Space-Based Connectivity Leasing – For reliable sectors like aviation, maritime, logistics, and emergencies. Hong Kong adds value through coordination, contracts, financing, and insurance. Target margins: 35–40%.
- **Model 2:** Space-Based Data and Analytics Services – High-value, turning raw data into actionable insights with quality checks, audits, and trust frameworks. Target margins: 70–85% for analytics, 50–65% for IoT.
- **Model 3:** Consumer-Oriented Satellite Services – Emerging direct-to-device and IoT for everyday use. Hong Kong serves as a testing and regulatory hub, prioritized later.

This framework helps prioritize strategies, forming a successful timeline and steps for government action.

### **The Innovation Imperative**

Innovation is essential—not optional—for Hong Kong's LEO success and profitability. Top applications (with 70–85% margins) arise unexpectedly from combining satellite data with real-world needs: for example, tracking dark oil tanker flows via satellite and selling predictive reports to crude oil futures traders, or verifying green loan eligibility and performance using satellite-derived data. The report's second key contribution is showing that Innovation is not merely desirable but a structural requirement for Hong Kong's LEO success — the path to high-margin returns demands continuous development of new applications.: Hong Kong must build an innovation system, anchored by the LEO Economy Innovation Fund (LEIF). The fund has three tiers, providing non-repayable grants to support basic research, prototype development, and startup growth. Through a rigorous approval process, the core principle of non-repayable grants is to treat failure as an inevitable part of innovative exploration. The government must take the lead in bearing early-stage innovation risks.

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<sup>3</sup> BBC News. (n.d.). [Article title unavailable]. Retrieved from <https://www.bbc.com/news/articles/cyv5l24mrjmo>

## **Seven Strategic Proposals**

The report outlines seven linked proposals, timed by readiness:

1. Year 1: Create a LEO Coordination Office in CEDB for 30-day spectrum approvals, a business entry package, and government as first buyer.
2. Years 1–2: Launch a LEO Finance Centre in HKMA/HKEX with RMB products, set up a HK\$2 billion fund LEIF, and grant 200% R&D tax deductions, and low profits tax.
3. Years 1–3: Roll out a maritime-insurance-finance analytics program focusing on insurance triggers, sanctions compliance, and port tracking.
4. Years 2–4: Set up a Space Law Chamber at HKIAC and a Space Law LLM at HKU or CUHK.
5. Years 2–5: Build an Innovation Hub at HKSTP InnoSpace+, co-funded with data API access.
6. Years 2–4: Attract a mainland LEO anchor firm (e.g., GalaxySpace HK) for a 50+ staff HQ.
7. Years 3–7: Position Hong Kong as Asia/Belt and Road gateway with "HK Certified" standards, templates, and marketing.

## **5–10 Year Development Plan**

Organized in three phases:

- Phase 1: Foundations (2026–2027) – Secure licensing, funding, pilots, and data access.
- Phase 2: Commercialization (2028–2030) – Develop enterprise products, secure 10+ contracts, establish analytics lines, and anchor firms.
- Phase 3: Scaling and Internationalization (2031–2035) – Become Asia's LEO hub for commercialization, arbitration, and access, serving Belt and Road.

## **Revealing Economic Prospects**

The report's third contribution is highlighting prospects for investors, entrepreneurs, and scientists (domestic and overseas) to capitalize on LEO's success. By riding this wave, they can tap into high-margin opportunities, national synergies, and global markets.

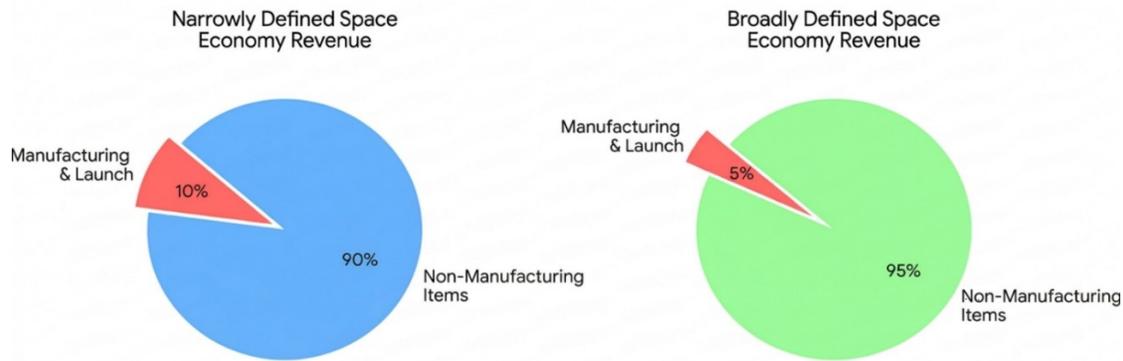
## **Conclusion**

Hong Kong has the potential to secure a significant role in both the national and global LEO economy — but realizing that potential depends on establishing innovation as the defining commitment for long-term development. Without innovation, there is no market; without innovation, there is no margin.. Avoid extremes: don't mimic mainland manufacturing, and don't underestimate downstream potential. Be the ambitious intermediary: Convert China's LEO capacity into trusted, bankable global services. The window is now, with strengthening national hardware and evolving business structures. Build innovation and institutional foundations today for tomorrow's wins.

## 執行摘要

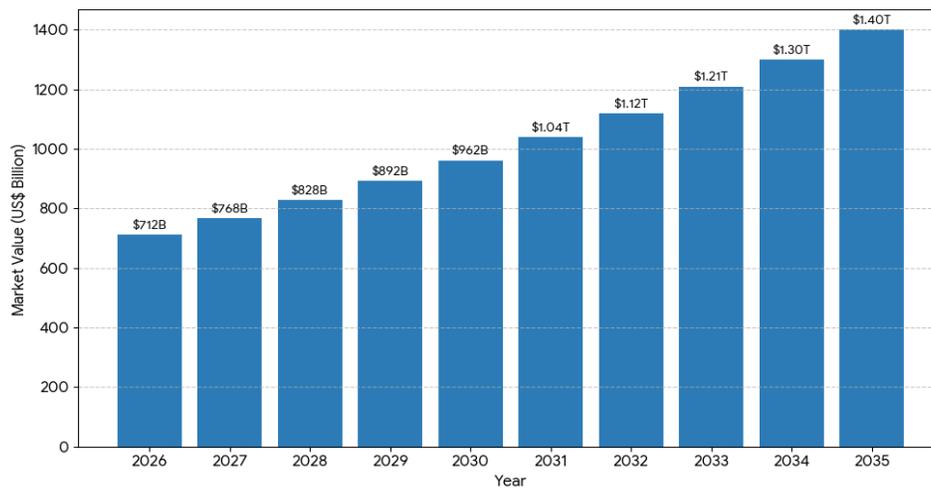
本報告探討香港在全球低軌（LEO）衛星經濟（低軌經濟）中面臨的重大發展機遇。低軌衛星環繞近地軌道運行，為人類提供通訊、數據、定位等相關服務。香港無需聚焦衛星研製或火箭發射領域——此類領域已由美國及中國國家級項目等行業巨頭主導；反之，香港應將發展重心鎖定產業下游環節，將衛星數據轉化為實用的服務與產品，而航天產業不少於 90% 的收益均來自此範疇。本報告基於經濟數據、產業本質、國際經驗，香港在金融、法律領域的核心優勢，制定了為期 5 至 10 年的三期發展路線圖。

### 2024 年全球太空經濟收入結構比例 [4]



Source: Industry Revenue Distribution Analysis (Updated Terminology)

Global Space Economy Projection (2026-2035)



## 全球地球軌道競爭格局

2026 年全球航天經濟總規模達約 7120 億美元，預計到 2035 年初將突破 1.4 萬億美元。[5] 低軌已成為全球產業競爭的核心賽道：SpaceX 旗下「星鏈」衛星系統已部署超過 10000 顆衛星，中國申請的軌道位置多達約 20.3 萬個，而 SpaceX 更計劃為人工智慧領域部署約 100 萬顆衛星。衛星研製與火箭發射僅佔產業收入的 5% 至 10%，絕大部分收入來源於服務、數據分析，以及將軌道資源轉化為實際價值的各

[4] 數據來源：表二；採用全球航天經濟數據替代全球低地球軌道經濟數據的原因：目前公開文獻中尚未形成完善的全球低地球軌道經濟十年年度記錄及預測體系，現有預測數據多覆蓋整體全球航天經濟或狹義低地球軌道衛星市場，尚未形成獨立界定且測量標準統一的全球低地球軌道經濟數據體系。

[5] 美國太空基金會（Space Foundation）報告指出，2024 年全球航天經濟總規模達 6130 億美元，年增長率為 7.8%。若持續維持此增長率，經數學演算可得，2026 年規模將達 7120 億美元、2035 年則上看 1.4 萬億美元。實際發展成果將取決於該增長率能否持續。太空基金會。（2025 年 7 月 22 日）。《2025 年第二季度太空報告》。美國太空基金會。<https://www.spacefoundation.org/2025/07/22/the-space-report-2025-q2/>

類系統開發與運營。香港入局低軌產業較晚，既無發射場地、火箭製造工廠，也缺乏航天工程領域的經驗，但這並非發展障礙——德國、英國、新加坡、盧森堡等國家雖無相關基礎，卻憑藉在產業下游的優異表現實現了產業繁榮。

## 香港的獨特戰略定位

香港的核心發展優勢在於產業下游：將衛星軌道資源轉化為各類產品、商業合同、合規工具、風險管理方案，並實現全球市場布局。基礎衛星服務可直接由中國內地提供，而高階、行業定制化的服務則需要依託香港在金融、法律、合規、爭議解決及國際橋樑的專業能力。

### 香港具備五大核心競爭優勢：

1. 在「一國兩制」框架下，國內低軌衛星公司進駐香港拓展業務，香港便有望優先獲取中國主流衛星星座（如千帆 / G60、國網星座）的數據資源——這是新加坡不具備的獨特優勢；
2. 作為全球頂級離岸人民幣樞紐，香港可推出獨具特色的人民幣計價衛星租賃債券、保險產品及投資基金；
3. 我們匯聚普通法體系、香港國際仲裁中心（HKIAC）的仲裁服務、再保險及香港聯合交易所（HKEX）資本市場等完備的專業服務體系；
4. 作為「一帶一路」建設的重要樞紐，香港可依托本地法律體系承載內地低軌衛星服務，並提供具國際公信力的爭議解決機制，低軌商業營銷可以跨境向世界市場競爭；
5. 與中國科技發展同頻共振：國家衛星系統技術的不斷突破，為香港帶來更多創新服務產品出現，並有望享受優惠合作的協同效應。

## 低軌經濟的內涵界定與商業模式構建

定義低軌經濟的**四大特點**：1)產業價值主要來自下游應用；2)透過產品創新與創新推廣過程的循環發展；3)設有商業化驗證門檻；4)市場和產品可分類為**成熟穩定與創新未知**兩大類別。據此特點推演出**三種民間商業模式**作為策略指引：

- **模式一：衛星通訊租賃服務**—— 聚焦航空、海事、物流、應急救援等對服務穩定性要求高的領域。香港通過協調、合同制定、融資及保險服務實現價值增值，目標毛利率 35% 至 40%；
- **模式二：衛星數據及分析服務**—— 屬高價值領域，通過質量檢驗、審計及信任框架，將原始衛星數據轉化為可指導實際決策的洞察信息，其中數據分析業務目標毛利率 70% 至 85%，物聯網業務目標毛利率 50% 至 65%；
- **模式三：面向消費者的衛星服務**—— 涵蓋新興的直連終端（D2D）及民用物聯網服務。香港將作為該領域的測試與監管樞紐，屬後續重點發展方向。

這一框架有助於明確落實戰略優先次序，為政府制定科學的行業發展時間表與實施步驟提供依據。

## 創新為必然要求

創新是香港低軌產業體現成功與獲取盈利的**核心要素**，而非可選項。產業內毛利率達 70% 至 85% 的頂級應用範圍，均源自衛星數據與現實產業問題的跨界融合，且往往具備不可預估與創新性——例如採用衛星數據偵測「黑運油輪」流向，將此製成報告售給原油期貨投機者作炒賣的第一手資訊、或是利用衛星數據核實綠色貸款的申請資格與執行成效。本報告的第二大核心貢獻在於證明：創新不僅是香港在低軌（LEO）領域取得成功的理想要素，更是一項結構性要求——要實現高毛利回報，就必須持續開發全新應用場景。而**低軌經濟創新基金（LEIF）**則是這一體系的重要手段。該基金分為三個層級，通過非償還性補助資助基礎研究、原型研發及初創企業發展。透過嚴格審批過程，非償還性補助的核心概念是要視失敗為創新探索的必然環節，政府一定要帶頭承擔初創風險。

## **七大戰略建議**

本報告採用產業商業化成熟度，提出七大相互關聯的發展建議，並明確實施時序：

1. **第 1 年：**在商務及經濟發展局（CEDB）設立低軌協調辦公室，實現 30 天內完成頻譜審批、推出企業入園配套服務包，並由政府擔任首批採購方；
2. **第 1-2 年：**在香港金融管理局（HKMA）/ 香港聯合交易所（HKEX）設立低軌金融中心，推出人民幣計價金融產品、設立 20 億港元產業 LEIF 基金、實施 200% 研發稅務扣除及低利得稅政策；
3. **第 1-3 年：**推出海事 - 保險 - 金融數據分析專項計劃，聚焦保險觸發機制、製裁合規及港口跟蹤領域；
4. **第 2-4 年：**在香港國際仲裁中心設立航天法專門委員會，並在香港大學（HKU）或香港中文大學（CUHK）開設航天法碩士（LLM）課程；
5. **第 2-5 年：**在香港科學園 InnoSpace + 打造創新樞紐，由政府與企業聯合出資，並開放數據介面（API）訪問權限；
6. **第 2-4 年：**引進中國內地低軌龍頭企業（如銀河航天香港公司）在港設立區域總部，配備 50 名以上員工；
7. **第 3-7 年：**將香港打造為亞洲及「一帶一路」低軌產業樞紐，制定並推廣「香港認證」標準、標準化合同模板，並開展全球市場推廣。

## **5-10 年發展規劃**

整體發展規劃分為三個階段：

- **第一階段：基礎建設期（2026-2027 年）** —— 落實執照審批、產業融資、試點項目及數據資源訪問權限；
- **第二階段：商業化推進期（2028-2030 年）** —— 開發企業級產品、簽署 10 個以上商業合同、建立穩定的數據分析服務體系、引進龍頭企業落戶；
- **第三階段：規模化與國際化發展期（2031-2035 年）** —— 成為亞洲低軌產業商業化、仲裁及市場接入樞紐，服務「一帶一路」沿線國家和地區。

## **經濟機遇與投資價值**

本報告的第三大核心貢獻是為本地及海外投資者、企業家、科研人員揭示了參與低軌產業發展的重大機遇。把握這一產業浪潮，可助力其切入高毛利率賽道、實現與國家產業的協同發展，並開拓全球市場。

## **結論與政策建議**

香港有望在國家及全球低軌產業中佔據重要地位，但這一目標的實現，有賴於確立創新作為長期發展低軌經濟的目標；沒有創新就沒有市場，沒有創新沒有利潤空間。香港需規避兩種極端傾向：既不盲目模仿內地的製造業模式，也不低估產業下游的發展潛力。香港應致力於成為具有遠大抱負的產業中樞，將中國的低軌資源轉化為受全球認可、具備商業投資價值的服務。當前國家航天硬體技術不斷強化、商業體系持續完善，正是香港布局低軌產業的黃金窗口。唯有今日紮實構建創新與制度基礎，方能贏得未來產業發展的主動權。

# Chapter 1: Introduction

## 1.1 Research Background: Hong Kong's Late Entry, and Why the Downstream Matters

Low Earth orbit (LEO) satellites are increasingly becoming a new layer of economic infrastructure. Their significance lies not only in connectivity or Earth observation as such, but in the growing range of services that can be built on top of those capabilities across logistics, finance, insurance, compliance, mobility, and data-driven decision-making. As LEO systems scale, value creation shifts away from the act of placing hardware in orbit and toward the organization of reliable, trusted, and commercially usable services on the ground.

Globally, the sector has entered a period of intensified competition **Table 1.1** presents a comparative ranking of the world's ten largest space economies by estimated annual revenue for 2024–2025, spanning the full value chain from upstream manufacturing and launch through to downstream satellite services and applications. Revenue ranges and market share figures are derived using a bottom-up triangulation methodology anchored to the Space Foundation's 2024 global baseline of US\$613 billion, supplemented by official government reports, corporate financial disclosures, and verified sectoral growth projections. [6]

National constellations, private operators, and large-scale orbital filings show that LEO is no longer a niche technological field but a major arena of strategic and economic rivalry. Hong Kong's engagement with this sector is therefore taking shape at a moment of both urgency and late entry.

Hong Kong, however, enters the LEO economy without the structural attributes associated with upstream space power. It has no launch territory, no domestic rocket-manufacturing base, and no accumulated institutional history in propulsion or orbital systems engineering. Hong Kong therefore should not define success by upstream imitation; its strategic question is how to occupy profitable positions in the wider ecosystem that surrounds large-scale constellation deployment.

That positioning should not be treated as a fallback. Once the focus shifts from hardware ownership to commercial deployment, Hong Kong's institutional strengths — finance, law, arbitration, insurance, data governance, and international intermediation — become more, not less, important. The core policy question is how Hong Kong can convert mainland-linked LEO capability into high-value services that are trusted, investable, internationally usable, and commercially scalable.

## 1.2 The Downstream Dominance: Not Less Than 90% of Space Economy Revenue Is Generated Beyond Manufacturing and Launch

The global space economy reached approximately US\$613 billion in 2024, growing at around 7.8% annually since 2020 and projected to approach US\$712 billion by 2026, and approximately US\$1.4 trillion by 2035. [7]

A defining feature of the modern space economy is that most commercial value is created beyond manufacturing and launch. As shown in **Table 1.2**, upstream activities account for only a small share of total sectoral revenue (5–10%), while the overwhelming majority is generated in downstream segments, including ground equipment, satellite-enabled services, and wider terrestrial applications. This pattern is even more pronounced under a broader full-space-economy definition, in which the revenue contribution of manufacturing and launch becomes smaller still. [8]

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[6] The table is intended as a strategic framing tool to contextualize Hong Kong's positioning within the global LEO economy, illustrating both the dominance of the United States and China and the demonstrated viability of downstream-focused economies such as Luxembourg and the United Kingdom.

[7] Another widely cited public forecast is the World Economic Forum / McKinsey estimate of US\$1.8 trillion by 2035, up from US\$630 billion in 2023.

[8] Narrow satellite industry: Comprises all revenue generated directly within the satellite sector itself, across four segments: launch services, satellite manufacturing, ground equipment and operations, and satellite services (including connectivity, earth observation, and mobility). This definition is used by the Satellite Industry Association (SIA). Manufacturing and launch together account for approximately 10% of this total; the remaining 90% flows through ground equipment, operations, and service delivery. Full space economy : Encompasses the narrow satellite industry in its entirety, plus a third layer of terrestrial enabled solutions — economic activity generated by businesses and sectors that depend on satellite infrastructure but are not themselves satellite companies. Under this broader measure, manufacturing and launch account for only approximately 4% of total revenue. The ~US\$613 billion figure is sourced from Space Foundation, The Space Report 2025 Q2; the enabled-solutions framing follows Neoh (2025).

For Hong Kong, the significance of this revenue structure lies not only in the scale of downstream value, but also in the way that value is captured. As indicated in **Table 1.3**, part of this downstream revenue comes from the direct provision of satellite-related services and data-based applications. At the same time, **Table 1.4** shows that an important additional layer of value arises indirectly through associated intermediary functions, including structured project finance, common law contracting and international arbitration, and cross-border data governance and compliance. Taken together, these tables suggest that the commercial centre of gravity of the LEO economy lies not in hardware production itself, but in the broader ecosystem of service delivery, integration, and institutional intermediation. This is precisely where Hong Kong holds a distinctive advantage as an interface between mainland operators and global markets under the “One Country, Two Systems” (1C2S) framework.

This downstream dominance is reinforced by falling upstream costs. As launch costs decline and deployment becomes more scalable, hardware and orbital access increasingly function as enabling inputs rather than the primary source of commercial margin. Value therefore shifts toward those who can integrate satellite capabilities into sector-specific solutions, manage legal and commercial risk, structure transactions, and deliver reliable end-use applications.

For Hong Kong, this downstream dominance is the structural foundation of the entire strategy. The city does not need to compete where it lacks scale and comparative advantage; it needs to compete where the industry already concentrates value. That is why the downstream layer — rather than launch or manufacturing — should be treated as Hong Kong's primary field of action.

International comparison reinforces the point. Germany, the United Kingdom, Luxembourg, and Singapore illustrate different ways in which economies without independent launch capability can still participate meaningfully in the LEO economy through industrial systems integration, service ecosystems, finance, law, governance, and regional commercial intermediation (**Table 1.5**).

The policy lesson is not that Hong Kong should copy any single model wholesale, but that launch sovereignty is not a prerequisite for value capture. What matters is whether an economy can occupy profitable and trusted positions in the broader value chain. [9]

**Table 1.1: Global Top 10 Space Economies by Annual Revenue (2024–2025 Estimates)[10]**

Rank	Economy	Estimated Revenue (USD Billions)	Market Share % (Approx.)	Primary Drivers
1	United States	\$375B – \$385B	~62%	SpaceX/Starlink dominance, massive defense budgets (\$77B+), ground segment.
2	China	\$95B – \$110B	~17%	Guowang/G60 LEO constellations, state-backed manufacturing, 10.3% CAGR.
3	Japan	\$30B – \$35B	~5%	Downstream precision hardware, GNSS, advanced robotics.
4	United Kingdom	\$24B – \$27B	~4%	Eutelsat OneWeb, high-value satellite services, maritime telecom.
5	France	\$19B – \$22B	~3%	Airbus/Thales manufacturing, Earth Observation, Ariane 6 launches.
6	Germany	\$14B – \$17B	~2.5%	New Space startup hub (Isar/RFA), high-precision optics and components.
7	India	\$10B – \$12B	~1.8%	Cost-efficient launch (ISRO), expanding commercial ecosystem, 9.5% CAGR.
8	South Korea	\$8B – \$10B	~1.5%	Rapid defense space expansion, KASS (GNSS), maritime communications.
9	Italy	\$7B – \$9B	~1.2%	Orbital logistics (D-Orbit), ISS cargo, manufacturing.
10	Luxembourg	\$5B – \$7B	~1.0%	SES, space finance, highest space-to-GDP ratio in Europe (0.135%).

[9] **Narrow satellite industry**: Comprises all revenue generated directly within the satellite sector itself, across four segments: launch services, satellite manufacturing, ground equipment and operations, and satellite services (including connectivity, earth observation, and mobility). This definition is used by the Satellite Industry Association (SIA). Manufacturing and launch together account for approximately 10% of this total; the remaining 90% flows through ground equipment, operations, and service delivery. **Full space economy**: Encompasses the narrow satellite industry in its entirety, plus a third layer of terrestrial enabled solutions — economic activity generated by businesses and sectors that depend on satellite infrastructure but are not themselves satellite companies. Under this broader measure, manufacturing and launch account for only approximately 4% of total revenue. The ~US\$613 billion figure is sourced from Space Foundation, The Space Report 2025 Q2; the enabled-solutions framing follows Neoh (2025).

[10] Appendix A

**Table 1.2: Global Space Economy Revenue Composition (2024) [11]**

Segment	Revenue (2024, approx.)	% of narrow satellite industry (~\$293b)	% of full space economy (\$613b)
(1) Launch services	~US\$9B	(~3%)	(~1%)
(2) Satellite manufacturing	~US\$20B	(~7%)	(~3%)
<i>(1)+(2) Sub-total</i>	<b>~US\$29B</b>		<b>~5%</b>
(3) Ground equipment and operations	~US\$156B	(~53%)	(~25%)
(4) Satellite services (connectivity, EO, mobility)	~US\$108B	(~37%)	(~18%)
<i>(3)+(4) Sub-total</i>	<b>~US\$263B</b>	<b>~90%</b>	<b>~43%</b>
(5) Terrestrial enabled solutions	~US\$320B	—	~52%
<i>(1)+(2)+ (3)+(4) + (5) Grand Total —</i>	<b>~US\$613B</b>	<b>100%</b>	<b>100%</b>
<b>Full Space Economy</b>			

This downstream dominance is intensifying as upstream unit costs continue to fall. Launch costs dropped from approximately US\$65,000 per kilogram in the early commercial era to approximately US\$2,000-2,500 per kilogram with Falcon 9 reuse — a reduction of more than 95% — and Starship targets a further dramatic reduction. As launch approaches commodity pricing, economic value migrates further downstream to those who design, integrate, and deliver the applications end users will pay for.

The downstream revenue dominance is the structural foundation for Hong Kong's strategic case. Hong Kong has no comparative advantage in rocket propulsion or satellite mass production. However, it does possess institutional depth in precisely the functions through which, according to international experience, the 90%+ of downstream revenue will be intermediated: direct revenue from satellite data-service provisions (Table 1.3), and indirect revenue from associated businesses including structured project finance, common law contracting and international arbitration, cross-border data governance and compliance (Table 1.4), and its unique role as interface between mainland operators and global markets under the 'One Country, Two Systems' (1C2S) framework.

The clearest international evidence comes from Germany, the United Kingdom, and Luxembourg. None currently has independent operational orbital launch capability, yet all remain commercially significant in the LEO economy. Germany captures value through industrial production and systems integration (OHB(a single firm) ~US\$1.11B revenue, 2024). The UK captures value through a broad space-services and satellite business base (~US\$23.38B in sector income). Luxembourg captures value through satellite operations, legal-regulatory positioning, and financial intermediation (SES(a single firm) ~US\$2.32B in 2024 revenue). The policy lesson is that an economy does not need to own rockets to succeed in LEO; what matters is whether it can occupy profitable positions in the wider ecosystem (Table 1.5).

**Table 1.3: LEO Satellite High-Level Business Domains and Corresponding Services [12]**

High-Level Business Domain	Corresponding LEO Satellite Services
Global Connectivity Services	Broadband internet (fixed, enterprise, mobility); backhaul and trunking services; Direct-to-Device (D2D) satellite services; emergency and disaster-response communications; secure government communications
Positioning, Navigation and Timing (PNT)	High-precision navigation and positioning services; precise timing and synchronisation services; GNSS augmentation and resilience
Earth Observation and Intelligence (EO/ISR)	Optical and SAR remote sensing; weather and environmental monitoring; maritime surveillance (AIS, dark vessel detection); aviation tracking (ADS-B); geospatial analytics and change detection
IoT and Machine-to-Machine (M2M) Services	Global IoT connectivity; remote asset tracking and monitoring; industrial sensor data backhaul; data dissemination for distributed systems
Mobility and Vertical Solutions	Maritime connectivity and vessel operations; aviation in-flight connectivity; land mobile (vehicles, trains, remote infrastructure); specialised B2B vertical solutions

[11] Sources: BryceTech, 2024 Global Satellite Industry Revenues (prepared for the Satellite Industry Association), for 2024 satellite-industry segment revenues; Space Foundation, The Space Report 2025 Q2, for the 2024 global space economy total of US\$613 billion. "Terrestrial enabled solutions" is author-calculated as the residual difference between the full space economy and the satellite industry total. Neoh (2025) is used for interpretive framing of the broader enabled-economy concept.

[12] Note: Sources: Compiled by POD research team.

**Table 1.4: Indirect Revenue Sources of Hong Kong's LEO Economy [13]**

Core Associated Business Area	Specific Indirect Revenue Sources
Structured Project Finance	Fees from LEO satellite project financing (loan arrangement, bond issuance, equity financing) by Hong Kong financial institutions; investment income from participation in LEO-related project investment; advisory fees for risk assessment, financial structuring, and capital raising consulting; profits tax revenue from LEO-related financing business
Listing and Capital Markets Services	HKEX fees (initial listing, annual listing, transaction, clearing and settlement, market data licensing); professional intermediary fees (sponsor/underwriting fees, lawyer/accountant/valuer fees); continuous compliance service fees; tax revenue from professional services providers involved in LEO enterprise listings
International Arbitration and Space Law	Legal advisory fees for LEO contract structuring and dispute resolution; HKIAC arbitration fees for satellite service contract disputes; space law consultancy and transactional legal fees; training and certification fees for space law practitioners
Aerospace Insurance and Risk Transfer	Insurance premiums from LEO satellite launch and in-orbit insurance underwritten by Hong Kong-based insurers; parametric insurance product fees; reinsurance intermediation fees; regulatory income from Insurance Authority licensing of space insurance products
Cross-Border Data Governance and Compliance	Consulting fees for LEO cross-border data transmission compliance, data security assessment, and governance scheme design; service fees from data compliance audits for LEO satellite data cross-border flows; training and certification fees for LEO-related data compliance professionals

**Table 1.5: Launch Capability versus LEO Value Capture [14]**

Economy	Independent National Launch Capability	Illustrative Value Capture
<b>United States</b>	Yes	Government space spending: approximately US\$77 billion (2024); around US\$7.3 billion of the global US\$12.4 billion SpaceTech investment originated from the United States (2025).
<b>China</b>	Yes	Approximately 90 launches in 2025; 136 satellites in the Guowang constellation; around 108 satellites in the Qianfan constellation.
<b>Japan</b>	Yes	JAXA's 10-year space strategic fund: approximately US\$6.7 billion; commercial ecosystem continues to expand.
<b>India</b>	Yes	Space budget for 2025–26: approximately US\$1.46 billion; venture capital fund: around US\$109 million.
<b>France</b>	No (shared Ariane/European access)	ESA Ministerial Council commitment: approximately US\$25.9 billion; core participant in IRIS.
<b>Germany</b>	No (shared European access)	OHB's revenue: approximately US\$1.11 billion (2024); one of ESA's largest contributing countries.
<b>United Kingdom</b>	No (limited allied/European access)	Space sector income: approximately US\$23.38 billion; around 48,800 jobs.
<b>Luxembourg</b>	No	SES's revenue: over US\$2.32 billion (2024); a world-leading hub for space finance and law.
<b>Singapore</b>	No	Approximately 70 space enterprises (covering manufacturing, services, and data processing); government investment of SGD270 million (STDP); focuses on Synthetic Aperture Radar, small satellites, and quantum secure communications; Earth observation applications alone are projected to add US\$100 billion to Southeast Asia's GDP by 2030; establishment of the National Space Agency of Singapore (NSAS) in 2026.

### 1.3 Policy Guiding Questions

This report is a policy-oriented analytical proposal. It advances a specific strategic argument: that Hong Kong should compete in the downstream, institutional, and innovation-intensive layers of the LEO economy. The analysis is organized around four guiding questions:

1. What is the present technological maturity, R&D capability, and industrial development level of China's domestic LEO sector, and what downstream opportunities does that create for Hong Kong?
2. What are Hong Kong's comparative advantages, binding constraints, and realistic institutional functions within the national development of the LEO economy?

[13] Sources: Appendix A.

[14] Note: Germany, the UK, and Luxembourg are used as revenue-verified comparators, with concrete aggregate revenue or sector income figures publicly available. Singapore is an illustrative regional comparator: it demonstrates an application-first, hardware-agnostic strategy similar to what this report recommends for Hong Kong, but aggregate captured-value figures comparable to the UK's ~US\$23B or Luxembourg's SES revenue are not yet publicly available. Singapore's inclusion should be read as evidence of strategic direction rather than demonstrated revenue scale. Sources: Appendix A.

3. What strategic framework is most feasible for Hong Kong, and how should it be sequenced given differences in market maturity and institutional readiness?
4. What lessons can be drawn from international experience — especially Luxembourg, the United Kingdom, and Singapore — about how non-launch economies can capture durable value?

## 1.4 Research Objectives

The objective of this study is to build a policy-usable framework for Hong Kong's LEO economy. Specifically, it seeks to:

- Clarify what the LEO economy is in economic rather than purely technological terms, including the distinction between mature service markets and innovation-heavy markets.
- Define three major business models through which LEO capability can be turned into commercial value, and explain how Hong Kong can position itself within them.
- Map Hong Kong's specific intermediation role within the China–Hong Kong LEO industrial chain, identifying the handoffs and interfaces through which mainland capability can be commercialized internationally.
- Identify the four principal commercialization bottlenecks — long-horizon financing, risk transfer, legal enforceability, and trusted data governance — and show how they affect different market types.
- Generate policy-relevant implications on what Hong Kong should do first, what can be piloted, and what institutional capacity must be built for commercialization.

## 1.5 Research Methodology

This research adopts a policy-analytical methodology combining documentary analysis, structured cross-jurisdiction comparison, conceptual framework-building, industrial-chain mapping, and targeted quantitative analysis.

Together, these methods support both diagnosis and prescription: they identify the structural conditions of the sector and use them to derive a feasible strategy for Hong Kong.

## Chapter 2: The LEO Economy and China's National Strategy: What Stakeholders Should Know

The emergence of the Low Earth Orbit (LEO) economy represents one of the most consequential technological and commercial transformations of the twenty-first century. Any stakeholder seeking a role in Hong Kong's future LEO economy should understand that the pathway to meaningful participation does not originate locally, but is fundamentally conditioned by and dependent upon the national policy framework that the People's Republic of China has constructed in response to intensifying strategic competition with the United States. This chapter examines four interconnected dimensions of this context: the technical pre-conditions that must be satisfied before a LEO economy can take shape; China's accumulated experience in building the technological capacities required for LEO development; the dynamics of Sino-American rivalry in the LEO domain and China's effort to close the gap; and the geopolitical considerations that render China's active engagement in the LEO economy a matter of strategic necessity rather than commercial choice alone.

### 2.1 Technical Pre-conditions for the Formation of the LEO Economy

The LEO economy does not emerge spontaneously from demand alone. It requires a set of interlocking technical preconditions — launch access, satellite manufacturing, spectrum governance, and ground infrastructure — without which commercial services cannot be deployed and scaled reliably.

#### 2.1.1 Orbital Access and Launch Economics

Orbital access is **the first technical condition** for the formation of a viable LEO economy. As summarized in Table 2.1, the issue is not simply whether satellites can be launched, but whether launch capacity is available at the necessary cost, frequency, and scale to support constellation deployment, replenishment, and upgrading on a sustained basis. In commercial terms, launch economics determine whether LEO systems can move beyond isolated demonstration projects and become durable infrastructure for communications, data, and service delivery.

The significance of launch economics lies in the relationship between deployment cost and business scalability. If launch remains expensive, infrequent, or operationally uncertain, constellation operators face difficulty achieving continuous coverage, replacing satellites at the end of their life cycle, and expanding network capability in line with market demand. By contrast, when launch services become more regular, lower-cost, and industrialized, they create the material basis for large-scale downstream applications and more predictable commercialization.

For Hong Kong, the importance of orbital access is therefore indirect but decisive. Hong Kong does not itself provide launch sites, launch vehicles, or rocket-manufacturing capability. Rather, its prospects depend on the existence of a sufficiently strong national launch base capable of sustaining large-scale constellation deployment over time. In this sense, **Table 2.1** is relevant not because it describes a function Hong Kong performs directly, but because it identifies the upstream condition that makes Hong Kong’s downstream role possible. The stronger and more scalable the national launch system becomes, the more realistic it is for Hong Kong to position itself as a platform for the financing, legal structuring, service integration, and international commercialization of LEO-enabled applications.

**Table 2.1: Cost Comparison of Representative Rocket Launches — China vs. United States [15]**

Comparison Item	United States (SpaceX Falcon 9)	China (Mainstream Long March Series)
<b>Representative rocket</b>	Falcon 9 Block 5, reusable	Long March series (2C/2D/3B/6/8) — disposable as of table period
<b>Launch cost per kilogram to LEO</b>	14,000–18,000 RMB/kg (bulk/negotiated commercial rate)	28,000–50,000 RMB/kg (mainstream commercial)
<b>Cost ratio vs. Falcon 9</b>	Baseline (1×)	1.6×–3.6× higher
<b>Rocket reusability</b>	Full first-stage reusability.	Reusability programme emerging. No reusable rocket in mainstream commercial service in China as of March 2026
<b>Source of Falcon 9 cost advantage</b>	Reusable first stage eliminates ~60-70% of total vehicle cost; Vertical integration (engines, structure, avionics, software all in-house) eliminates external supplier margins; High launch cadence (158 launches in 2024) amortises fixed costs rapidly	Primarily expendable architecture; state-owned enterprise structure lacks SpaceX’s vertical integration; cost disadvantage is structural but narrowing as LandSpace Zhuque-3 and other reusable vehicles advance
<b>2026 outlook</b>	Starship targeting further dramatic reduction to potentially <US\$100/kg at full reuse	2026 is the decisive year for Zhuque-3 recovery and reuse testing. Success would mark the first commercially viable reusable rocket in China

### 2.1.2 Satellite Manufacturing and Mass Production

The second technical pre-condition is the ability to manufacture satellites at the volume, reliability, and cost that mega-constellation deployment requires. SpaceX’s Starlink production facility in Redmond, Washington, operates at approximately 10 satellites per day (around 70 per week) using a highly automated assembly line with in-house propulsion, avionics, and software, enabling per-satellite costs in the range of US\$500,000 to \$1,000,000.

China’s satellite manufacturing base is expanding rapidly. Galaxy Space (Yinhe Hangtian) has demonstrated batch manufacturing capability with 30+ test satellites and a production facility targeting high-volume output. Shikong Daoyu (Geespace) operates a satellite super-factory model, and commercial satellite manufacturers including Commsat, Spacety, and MinoSpace are scaling production. China’s commercial satellite manufacturing sector remains behind SpaceX in absolute throughput, automated assembly integration, and per-unit cost efficiency, but closing this gap is a stated priority of the current Five-Year Plan period.

### 2.1.3 Spectrum Governance and Ground Infrastructure

A third pre-condition is the governance of radio frequency spectrum and orbital slots through the ITU’s registration and coordination system. Operators who file early and deploy promptly occupy the most favourable orbital shells and frequency bands, creating a first-mover dynamic in resource allocation. China’s filing for approximately

[15] Note: Exchange rate: 1 USD = 7.1 RMB (2024 annual average, People’s Bank of China). Sources verified March 2026. Sources: Appendix B for full references.

203,000 satellite slots between 25 and 31 December 2025 reflects a deliberate strategy to secure spectrum and orbital resources before they become congested.[16]

Ground infrastructure — gateway stations, telemetry, tracking and command (TT&C) facilities, and user terminals — constitutes the fourth pre-condition. The performance of LEO connectivity services depends critically on the density and geographic distribution of ground stations, and on the cost and availability of user terminals. Starlink's self-install phased-array terminals, available for US\$349–600, have dramatically lowered the consumer adoption barrier. China's constellation operators are developing comparable ground terminal solutions. For Hong Kong, the demonstration by Galaxy Space HK of 100Mbps+ bidirectional performance using a PCCW Global demonstration station confirms that the ground infrastructure for national constellation commercial deployments in Hong Kong is advancing.

## **2.2 China's Accumulated Experience in LEO Development**

China's engagement with space development predates the commercial LEO era by decades. Understanding that accumulated institutional and technological experience is essential, because Hong Kong's role can only be understood in relation to a broader national capability-building project.

### **2.2.1 BeiDou as the Template for Catching Up from Behind**

The BeiDou Navigation Satellite System provides the most instructive domestic precedent for China's LEO approach. Launched as a regional system in 2000, when GPS already dominated global navigation, BeiDou faced profound structural disadvantages: the US GPS had more than two decades of operational experience, a large global installed base of user terminals, and de facto standard status in aviation, maritime, and precision agriculture applications. China's response was a deliberate, staged catch-up programme: regional capability first, then global coverage, with each phase building on the technical and institutional knowledge of the previous phase. By 2020, BeiDou Global (BDS-3) had achieved full global coverage with 35 satellites and demonstrated performance comparable to or better than GPS on key indicators.

The BeiDou trajectory illustrates several principles that apply directly to China's LEO programme. First, catching up from behind in critical infrastructure technology is achievable with sustained national commitment — it is a matter of strategic will and institutional organisation, not merely technical possibility. Second, standards and governance matter as much as technical capability: BeiDou's international adoption required not only competitive performance but also ITU recognition, international compatibility standards, and trusted governance of signal integrity. Third, commercial success requires deliberate downstream ecosystem development, not just constellation deployment.

For Hong Kong's LEO strategy, the BeiDou analogy carries a specific implication: just as BeiDou required downstream ecosystem development to translate satellite capability into economic value, China's LEO constellations require an analogous downstream layer — in which Hong Kong is positioned to play a central institutional role — to convert orbital capacity into globally trusted, commercially viable services.

### **2.2.2 National Plans and Industrial Targets**

China has announced three major national LEO constellation programmes. The Qianfan Project (G60), led by Shanghai Spacecom Satellite Technology, plans approximately 15,000 satellites and had approximately 108 in orbit by February 2026. The Guowang (GW) constellation, a state-backed programme, plans approximately 13,000 satellites and had 136 in orbit by late December 2025. Combined, China's publicly disclosed plans amount to nearly 28,000 LEO satellites.

The 14th Five-Year Plan (2021–2025) elevated commercial aerospace and satellite internet to unprecedented strategic priority. This has translated into substantial public investment, preferential land allocation for manufacturing hubs, streamlined licensing for commercial launches, and dedicated industrial parks. The 15th Five-Year Plan period (2026–2030) is expected to mark the transition from infrastructure investment to commercial service deployment — the stage at which Hong Kong's intermediation role becomes most commercially consequential.

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[16] The ~203,000 ITU slot filings represent spectrum reservation strategy; China's current operational deployment plans total approximately 28,000 satellites across Qianfan and Guowang constellations."

## 2.3 China's LEO Industrial Geography: Spatial Division of Labour, Manufacturing Concentration, and Domestic Market Orientation

China's national strategy for the LEO economy is not merely a programme for building satellites — it is a deliberate industrial geography, in which different regions have been assigned specialised roles that together constitute a complete national value chain. As Table 2.2 illustrates, this spatial division of labour is architecturally precise. Wenchang in Hainan serves as the national and commercial launch base, anchoring rocket launch infrastructure and the emerging International Aerospace City. Shanghai functions as the mass manufacturing centre, responsible for high-volume production of rockets and satellites and hosting the core G60 (Qianfan) constellation's industrial cluster. Beijing and Xiong'an anchor the constellation operations and space-air information demonstration layer, where China Satellite Network Group — the state-owned entity managing the Guowang constellation — maintains its headquarters alongside major satellite internet application R&D. Shenzhen, positioned as a new commercial satellite industrial chain hub, contributes satellite core components, phased-array antennas, and ground terminal equipment. Xi'an and Wuhan represent the traditional aerospace research and testing base, supplying satellite platforms, payload R&D, and precision engineering capabilities. Chengdu has been designated for advanced application development, on-orbit computing power, and AI-satellite integration. And Nantong plays a supporting role in ground station operations and data relay, backstopping Shanghai's rocket and satellite manufacturing ecosystem. This functional differentiation — consciously designed across the 14th and 15th Five-Year Plan periods — reflects a national commitment to the vertical and horizontal integration of the LEO industrial system across geographically distributed clusters, rather than concentrating capability in any single location.

Against the background of this strategically organised industrial geography, the 2025 regional revenue data presented in Table 2.3 reveal a structural profile of the Chinese Mainland's LEO economy that diverges markedly from global norms. Across the eight major LEO industrial hubs, manufacturing, launch, and hardware activities together account for approximately 58% of total corresponding industry revenue — ranging from 73.7% in Wuhan and 75.2% in Shenzhen, to 37% in Beijing and Xiong'an. By contrast, as documented in Table 1.2 of this report, the manufacturing and launch segment accounts for only approximately 10% of the global narrow satellite industry's revenue, and roughly 4% of the broader full space economy. The Chinese Mainland's LEO economy is therefore heavily concentrated in the upstream manufacturing layer that the global market has decisively moved beyond. Non-manufacturing revenue — encompassing satellite services, data processing, application development, and ecosystem services — averages only around 42% of Chinese Mainland LEO regional revenues, compared with the global non-manufacturing share of over 90% within the narrow satellite industry. This underperformance in non-manufacturing activities is not confined to secondary regions: even Beijing and Xiong'an, the most analytically and services-oriented hub, generate 37% of their LEO revenues from manufacturing-related activity. The structural implication is clear: China's national LEO economy remains primarily an infrastructure-building economy, not yet a services and applications economy. This gap between China's manufacturing-heavy profile and the global downstream revenue distribution is the very space that Hong Kong is strategically positioned to fill.

The second structural asymmetry visible in Table 2.3 is the overwhelming dependence on domestic demand. Aggregated across the eight regions, revenues from domestic transactions account for approximately 85% of total LEO industry revenue, with overseas transactions contributing only around 15%. This domestic concentration is consistent across the regional landscape: Nantong records zero overseas revenue, as its core function is domestic ground-station and supply-chain support; Wuhan and Xi'an each generate less than 3% overseas revenue; and Beijing and Xiong'an — home to the national constellation's operational headquarters — derive only 5% of their revenues from international transactions. Shenzhen, the most internationally oriented hub by overseas revenue share, achieves approximately 30.9%, reflecting its role as the center of commercial satellite manufacturing and

component exports; Shanghai follows with approximately 27.7%, where hardware export capability developed through its electronics manufacturing heritage drives much of the international revenue. The third largest exporter of LEO economy in China is Wenchang with 16.7% overseas revenue share and attributing it to its role as the national/commercial launch base serving international clients.

Yet even these relatively higher shares are concentrated in ground terminal equipment and satellite components rather than higher-value service and analytics products. This domestic-demand dominance stands in sharp contrast to the inherently global character of the LEO economy: satellite services, orbital capacity, and earth observation data products are, by their nature, transboundary assets capable of serving global markets. The limited overseas revenue penetration of Chinese Mainland LEO enterprises reflects not only the early development stage of the commercial sector but also the regulatory, legal, and institutional friction that constrains cross-border commercialisation of satellite services — precisely the friction that Hong Kong’s institutional toolkit is designed to reduce.

Taken together, Tables 2.2 and 2.3 establish a critical empirical context for Hong Kong’s strategic positioning in the LEO economy. China possesses a deliberately architected and geographically distributed LEO industrial system that is advancing rapidly along the hardware and infrastructure dimension — but that remains at an early stage of the transition from physical infrastructure to commercial services and international market reach. The manufacturing intensity of the mainland LEO economy, and its heavy reliance on domestic demand, confirm that the downstream service, analytics, and internationalization functions which generate the highest global margins remain substantially underdeveloped relative to China’s ultimate constellation-deployment ambitions. The 15% overseas revenue share represents not a ceiling but a baseline from which significant commercial expansion is possible, provided the appropriate intermediation infrastructure is in place. This is precisely the terrain where Hong Kong’s institutional comparative advantages — common law enforceability, international financial infrastructure, trusted data governance, and commercial connectivity with global markets — are most strategically relevant. As China’s 15th Five-Year Plan period (2026–2030) is expected to mark the pivotal transition from infrastructure deployment to commercial application and service scaling, the current moment represents the optimal window for Hong Kong to establish its institutional and innovation architecture as the overseas commercialization layer of China’s growing LEO capacity.

It should be noted that this report focuses on the low Earth orbit (LEO) satellite economy and its upstream and downstream industrial supply chains. While the Jiuquan Satellite Launch Center conducts some medium–low Earth orbit scientific satellite missions, these are only for experimental and research purposes, not for large-scale commercial LEO constellation deployment. Moreover, Jiuquan lacks the low-latitude geographical advantage possessed by launch sites such as Wenchang, which is essential for efficient, large-scale LEO launches. Although recent media and policy discussions have linked Jiuquan to national LEO economic development, this does not alter its core strategic orientation or its limited capacity for commercial LEO constellation deployment. As Jiuquan is mainly dedicated to launch operations rather than the core LEO industrial chain highlighted in this study, it is not included in the analysis of Xi’an’s role in the LEO economy in this section.

**Table 2.2: Overview of Regional Division of Labor in China's Low-Orbit Satellite Industry 2026**

Region	Core Positioning	Key 2026 Focus	Key Indicator	Main Hardware / Manufacturing Role	Main Non-Hardware / Service Role
Wenchang, Hainan	• National / commercial launch base	• Expand launch site • Develop aerospace city	• 700+ aerospace firms • 60+ launches annual capacity	• Launch services • Launch-site hardware • Ground equipment	• Industrial park operation • Enterprise incubation • Data services
Shanghai	• Mass manufacturing hub for rockets and satellites	• Qianfan constellation • G60 industrial cluster	• 324 satellites by mid-2026 • 648 satellites by end-2026 • 600 satellites annual capacity	• Rocket manufacturing • Satellite manufacturing • Core hardware	• Constellation planning • Data relay • Technical consulting
Beijing & Xiong'an	• National constellation operation hub • Space-air information hub	• GW constellation headquarters • Industrial cluster development	• 400+ related institutions • Large-scale satellite internet applications	• Satellite platforms • Core hardware • Testing equipment	• Constellation operations • Platform management • Application development
Shenzhen	• Commercial satellite supply chain hub	• Build components and terminals • Develop application platforms	• One of China's two main satellite internet manufacturing and application centres	• Core components • Phased-array antennas • Terminal hardware	• Application platforms • Technical support • Scenario-based services
Wuhan	• National commercial aerospace base	• Integrated rocket development • Satellite and ground equipment development • Applications development	• Supports national high-density launch demand	• Rocket / satellite components • Ground equipment • Testing instruments	• Testing services • Calibration services • Regional data applications
Xi'an	• Traditional aerospace R&D base	• Satellite platform R&D • Payload R&D for LEO constellations	• Supports mass production of navigation, communications, remote-sensing constellations	• Satellite platforms • Payloads • Precision components	• R&D design • Testing • Certification
Chengdu	• Aerospace applications hub • On-orbit computing hub	• AI + satellite • Remote sensing • Edge computing	• Upgrading on-orbit computing and data-processing capability in 2026	• Supporting hardware • Computing equipment • Electronics	• On-orbit computing services • Data analytics • AI applications
Nantong	• Ground station and data relay support base	• Yangtze River Delta ground station services • Data relay services	• Improves throughput • Coverage for Qianfan • Other constellations	• Supporting parts • Ground station hardware	• Ground station operations • Data relay • Data storage

**Table 2.3: 2025 Chinese Mainland LEO Satellite Industry Regional Revenue (100 Million CNY) [17]**

Region	Total Industry Revenue	Hardware Revenue	Software Revenue	Domestic Revenue	Overseas Revenue
Wenchang, Hainan	19.8 (100%)	11.6 (58.6%)	8.2 (41.4%)	16.5 (83.3%)	3.3 (16.7%)
Shanghai	42.6 (100%)	31.1 (73.0%)	11.5 (27.0%)	30.8 (72.3%)	11.8 (27.7%)
Beijing & Xiongan	58.3 (100%)	21.6 (37.0%)	36.7 (63.0%)	55.4 (95.0%)	2.9 (5.0%)
Shenzhen	37.9 (100%)	28.5 (75.2%)	9.4 (24.8%)	26.2 (69.1%)	11.7 (30.9%)
Wuhan	15.6 (100%)	11.5 (73.7%)	4.1 (26.3%)	15.2 (97.4%)	0.4 (2.6%)
Xi'an	18.5 (100%)	13.2 (71.4%)	5.3 (28.6%)	18.1 (97.8%)	0.4 (2.2%)
Chengdu	12.7 (100%)	5.1 (40.2%)	7.6 (59.8%)	11.9 (93.7%)	0.8 (6.3%)
Nantong	8.9 (100%)	2.1 (23.6%)	6.8 (76.4%)	8.9 (100%)	0.0 (0%)
<b>Total Revenue</b>	<b>214.3 (100%)</b>	<b>124.7 (58.2%)</b>	<b>89.6 (41.8%)</b>	<b>183.0 (85.4%)</b>	<b>31.3 (14.6%)</b>

## 2.4 Sino-American Rivalry in the LEO Domain

The competition between the United States and China in the LEO domain is not a conventional commercial rivalry. It is a strategic contest in which the stakes include national security, military communications, the future

[17] Data explanations and Sources: see Appendix C

architecture of global digital infrastructure, and the terms on which the rest of the world accesses space-enabled services.

#### **2.4.1 Starlink's Strategic Significance and the Incumbent Advantage**

SpaceX's Starlink programme has established a commanding first-mover position in the LEO communications market. With approximately 10,000 satellites already deployed, Starlink has demonstrated the viability of the mega-constellation model, achieved commercial revenues at scale, and accumulated operational experience in spectrum coordination and inter-satellite laser link management. The programme's strategic significance was starkly illustrated during the Russia-Ukraine conflict, where Starlink provided resilient communications infrastructure for Ukrainian military and civilian users after ground-based infrastructure was destroyed, supporting drone operations and battlefield coordination.

China has invested approximately RMB 700-800 billion in 5G base station infrastructure, and there is a strategic concern that if LEO-based global connectivity matures sufficiently, it could render significant portions of that ground-based investment obsolete. The prospect of a US-controlled global communications architecture that can bypass national terrestrial networks raises profound questions about communications sovereignty that no major power can ignore.

#### **2.4.2 The Technology Gap and Its Structural Sources**

The current gap between SpaceX and China in deployed LEO constellation scale has structural origins in launch economics. Falcon 9's reusability, high per-mission satellite carrying capacity, and rapid turnaround capability collectively gave SpaceX the ability to deploy satellites at a pace and cost that Chinese launchers have not yet matched. SpaceX conducted 134–144 launches in 2024; the same booster could be relaunched within as few as 13 days. China's launch costs are approximately 1.6 to 3.6 times higher than SpaceX's on a per-kilogram negotiated-rate basis.

However, this structural cost disadvantage is not permanent. Three-dimensional printing of rocket engine components is advancing rapidly. The Long March 12 and commercial reusable vehicles from LandSpace (Zhuque-3) and Space Pioneer (Tianlong-3) have entered key testing phases. 2026 is the decisive year for verifying the technical feasibility of first-stage vertical recovery and reusability in China's commercial sector. These developments suggest that the gap will narrow materially over the 2026-2030 period.

#### **2.4.3 Orbital and Spectrum Resource Competition**

A particularly acute dimension of the Sino-American rivalry is the race to secure finite orbital and spectrum resources. SpaceX's filing for approximately 42,000 Starlink satellites, combined with filings from Amazon Kuiper, Eutelsat OneWeb, and other operators, represents a large prior claim on planned LEO capacity. China's three national constellation programmes represent not only a commercial investment but a resource-securing exercise: by filing for approximately 30,000 satellites and pursuing rapid deployment, China is staking a claim to orbital and spectrum resources that, once secured, cannot easily be displaced.

#### **2.4.4 The Risk of Standard-Setting and Digital Exclusion**

Beyond resource competition, there is a longer-term concern about the governance of global LEO communications standards. If the United States were to establish a dominant position in LEO and exclude Chinese operators from interoperability agreements, certification arrangements, and standard-setting bodies, China could face technological isolation analogous to the semiconductor chokepoint experience. This risk has reinforced the political imperative to accelerate China's own LEO programme and to develop independent technology stacks. It also directly shapes the kinds of international partnerships that are viable for Hong Kong-based LEO ventures — a consideration that informs the technology sovereignty constraints addressed in Chapter 5.

### **2.5 Geopolitical Considerations and Their Importance for the LEO Economy**

The geopolitical dimensions of the LEO economy are constitutive of its commercial logic, not incidental to it. The decisions that determine who builds LEO infrastructure, on what technological architecture, under whose governance framework, and for whose benefit, are inseparable from the broader competition between major

powers over the terms of the twenty-first-century international order. For Hong Kong, the geopolitical context is a determinant of the specific opportunities available, the constraints under which it operates, and the strategic rationale for investing in LEO-related capabilities.

### **2.5.1 Communications Sovereignty and National Security**

The experience of the Russia-Ukraine conflict demonstrated in concrete operational terms what had previously been understood only in the abstract: control over communications infrastructure in a conflict environment can be decisive. For Hong Kong, which operates under the One Country, Two Systems (1C2S) framework, this national security dimension is not a purely mainland concern. The resilience, security, and integrity of communications infrastructure serving Hong Kong's financial markets, logistics operations, and civil society is a matter of shared interest.

### **2.5.2 Technology Sovereignty and the Risk of Chokepoints**

The semiconductor experience has left a deep imprint on Chinese strategic thinking about technology dependency. The vulnerability exposed when American export controls restricted China's access to advanced chips — constraining Huawei's operations and threatening broader elements of China's technology industry — has made the concept of 'chokepoints' central to Chinese industrial policy. In the LEO domain, potential chokepoints include launch vehicle technology, satellite components dependent on American-designed semiconductors, ground terminal hardware, and the software and standards that govern constellation operations.

China's response has been to pursue indigenous capability across the full LEO value chain. For Hong Kong, this orientation toward technology sovereignty shapes the terms on which LEO collaboration is possible and viable: partnerships or anchor-company strategies that would create dependency on American-controlled technology are unlikely to receive support from the national policy framework. Chapter 5 addresses this constraint directly in designing the anchor-company proposal, endorsing partnerships that strengthen Hong Kong's institutional intermediation role while ruling out those that would create the kind of chokepoint dependency that national policy is designed to avoid.

### **2.5.3 The Belt and Road Dimension and Global Connectivity Geopolitics**

China's LEO ambitions are linked to Belt and Road connectivity and the provision of digital infrastructure across overseas markets. This dimension is commercially relevant because users in many of those markets will need more than raw connectivity: they will need legal certainty, financing, compliance frameworks, and trusted dispute-handling.

That creates both an opportunity and a sequencing imperative for Hong Kong. The demand may be immediate, but the city's ability to serve it depends on whether the necessary institutional infrastructure is built in time.

### **2.5.4 Regulatory Architecture and International Governance**

The governance of international institutions responsible for managing space resources is a further geopolitical dimension. The ITU's spectrum and orbital slot management regime, the United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS), and emerging discussions about debris mitigation, on-orbit servicing, and traffic management standards are all arenas in which the interests of major space powers will be contested. For Hong Kong, which has traditionally served as a platform for international legal and regulatory engagement, there is an opportunity to contribute to the development of international space law and governance — hosting arbitration proceedings, contributing expertise to standard-setting processes, and providing a neutral forum for dispute resolution. The Asian Academy of International Law and similar institutions based in Hong Kong are already active in this space.

## **2.6 Chapter Conclusion: Hong Kong's Opportunity Within the National Enterprise**

Hong Kong's development of a role in the LEO economy is therefore not and cannot be a purely local enterprise. The technical and industrial preconditions of the sector are being built at the national level, and Hong Kong's strategy must be anchored in that reality.

It follows that Hong Kong's most productive role is not to replicate mainland launch or manufacturing capability, but to become the platform through which national LEO capacity is financed, insured, legally structured, analytically enriched, and globally intermediated.

## Chapter 3: Economics at Work: Business Models and the China–Hong Kong Industrial Chain

This chapter performs three tasks. First, it reframes the LEO economy as enabling infrastructure rather than a narrowly defined technology sector. Second, it identifies the structural characteristics and commercialization constraints that shape different market segments. Third, it maps Hong Kong's role within the China–Hong Kong industrial chain and explains why that role is primarily one of downstream intermediation.

### 3.1 Reframing the LEO Economy: From Technology Sector to Economic Infrastructure

The contemporary LEO economy can no longer be analysed adequately as a specialized space industry defined mainly by satellite manufacturing and launch. Large constellations increasingly function as a general-purpose infrastructure layer supporting communications, logistics, monitoring, mobility, compliance, and data-intensive services well beyond the space sector itself.

Once LEO is viewed this way, the relevant question changes. Ownership of satellites is neither a necessary nor sufficient condition for value capture; value increasingly accrues to actors that can organize access, reduce transaction costs, package services for sectoral users, manage legal and financial risk, and create trusted governance frameworks around data and service delivery.

### 3.2 Four Defining Characteristics of the LEO Economy

#### Characteristic 1: Infrastructure-style economics

LEO systems are characterized by high upfront investment, low marginal cost once operational, and broad downstream spillovers. This gives them the economic profile of enabling infrastructure rather than a narrowly contained product market.

#### Characteristic 2: Predominantly B2B and intermediary-based commercialization

Most commercially significant uses of LEO reach end users through firms, institutions, insurers, logistics providers, telecom operators, and public agencies rather than through simple one-to-one retail relationships.

#### Characteristic 3: Dual-market composition

The LEO economy contains both mature, relatively predictable markets and newer, innovation-heavy markets characterized by uncertain demand and long validation cycles. These two market types require different policy tools and different commercialization expectations.

#### Characteristic 4: Innovation lifecycle dependency [18]

LEO services evolve through fluid, transitional, and more standardized phases. Some uses can be commercialized with existing institutional tools, while others require experimentation, data access, and tolerance for failure before they become investable.

The practical implication is that the LEO economy is not static. It evolves through a product–process cycle in which institutions matter as much as technology, especially where markets remain uncertain and applications are still being discovered. This cycle has profound implications for how Hong Kong should sequence its strategic interventions. Fluid Phase (Market Introduction): currently, many LEO applications—particularly in data analytics and consumer services—are in a high-innovation, high-uncertainty phase.

In this stage, value is created through product innovation and differentiation. Hong Kong's role is to leverage mainland China's proven satellite infrastructure to identify and test high-value use cases in sectors like maritime, finance, and logistics. Policy during this phase must prioritize experimentation and tolerate failure. Transitional Phase (Expansion): as 'dominant designs' emerge for specific services, the focus shifts toward process

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[18] Source: Abernathy, W.J. and Utterback, J.M. (1978). Patterns of industrial innovation. *Technology Review*, 80(7), 40-47.

innovation—improving scalability, reducing costs, and streamlining delivery. Hong Kong can then leverage its logistical and financial depth to optimize the 'commercialization bridge' for national constellations.

**Specific Phase (Maturity):** Eventually, LEO services become infrastructure-like utilities. At this stage, Hong Kong’s competitive advantage rests on its institutional toolkit—its legal system, financial intermediation, and 'HK Certified' standards—to manage the cross-border data flows and complex service contracts of a mature global market. By aligning its strategy with this lifecycle, Hong Kong avoids the trap of competing on infrastructure alone and instead focuses on the specific type of innovation—whether product-led or process-led—that matches the market’s current maturity level.

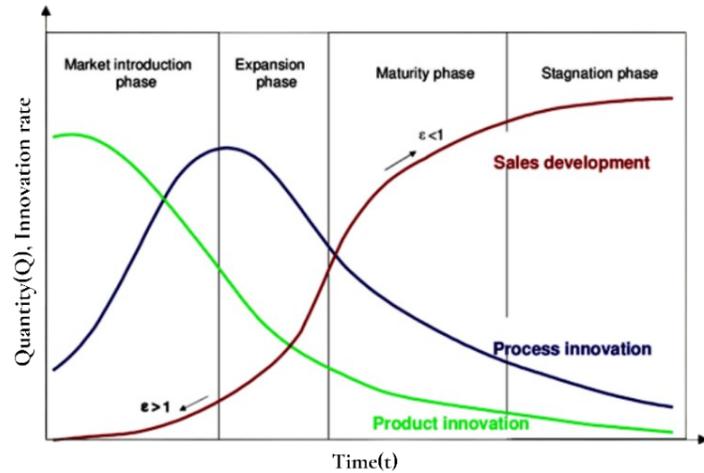


Figure 3.1: Product–Process Innovation Life Cycle

### 3.3 Two-Market Classification and the Four Commercialization Constraints

Commercialization gap lens: four recurring constraints

Across the report, **four recurring constraints** structure the commercialization problem: **long-horizon financing, risk transfer, legal enforceability, and trusted data governance**. These constraints do not bite equally across all market types, which is why a single undifferentiated policy approach would be inadequate.

**In mature markets**, some of these constraints are already partially resolved by identifiable users, clearer procurement pathways, and more legible demand. **In innovation-heavy markets**, they are not pre-resolved and therefore require more active institutional support.

**In existing deterministic markets**, financing horizons are shorter, adoption pathways are more visible, and contract structures are easier to design. Commercialization is therefore constrained less by imagination than by coordination, approvals, and service reliability.

**In innovative indeterminate markets**, by contrast, none of the four constraints is pre-resolved. Financing is uncertain, risk transfer is harder, legal structure is more experimental, and data quality and governance become central to market trust.

### 3.4 Business Model I: Space-Based Communications and Connectivity Leasing

Business Model I serves sectors such as aviation, maritime, logistics, and emergency communications. These are relatively legible enterprise markets in which demand exists, but commercial scaling depends on regulatory clarity, service integration, and transaction structures rather than on Hong Kong owning satellites itself.

Hong Kong's value proposition in this model is institutional intermediation: contracting, financing, insurance, certification, and cross-border packaging. The city's contribution is to make capacity usable, bankable, and trusted. The product in practice is therefore not raw satellite capacity but contractual access rights bundled with institutional assurances — service levels, liability allocation, dispute-handling, and integration with operational systems.

The four commercialization constraints apply here in a relatively manageable form. The key task is not invention from scratch, but aligning approvals, contracts, financing, and anchor demand so that a technically available service becomes a practical business.

### 3.5 Business Model II: Space-Based Data Reporting and Analytics Services

Business Model II concerns the transformation of raw satellite data into reporting tools, compliance services, monitoring products, risk analytics, and sector-specific intelligence. If Model I sells connectivity as a utility, Model II sells decision-support and problem-solving.

Hong Kong's comparative advantage here lies in its ability to combine data with legal interpretation, finance, insurance, trade, and governance expertise. The value lies not in the data alone, but in trusted outputs that help users act.

This model is also the most innovation-intensive. Many of its highest-value uses must be discovered through experimentation, which is why long-horizon financing, trusted data governance, and regulatory room for testing become particularly important.

### 3.6 Business Model III: Consumer-Oriented Satellite Services

Business Model III covers consumer-oriented services such as direct-to-device and broader satellite-enabled consumer IoT. Strategically, it may become important, but it is less suitable as the starting point of a Hong Kong LEO strategy. Hong Kong's role in this model is more likely to be that of demonstration environment, testing ground, and selective commercialization platform than first-mover mass-market operator.

The main constraints lie in device ecosystems, telecom partnerships, pricing, user behavior, and regulatory adaptation — factors that are less immediately tractable through Hong Kong policy alone. Model III should therefore be treated as a later-stage opportunity. Early public effort should focus on models in which Hong Kong's institutional strengths can produce earlier and clearer returns.

### 3.7 The China-Hong Kong LEO Industrial Chain

A core claim of this report (**Table 3.1**) is that Hong Kong's role in the LEO economy is best understood as the international commercialization layer of China's emerging LEO system. Chinese Mainland provides the hardware base; Hong Kong adds value where that capacity must be converted into finance, law, insurance, analytics, compliance, and internationally acceptable market arrangements.

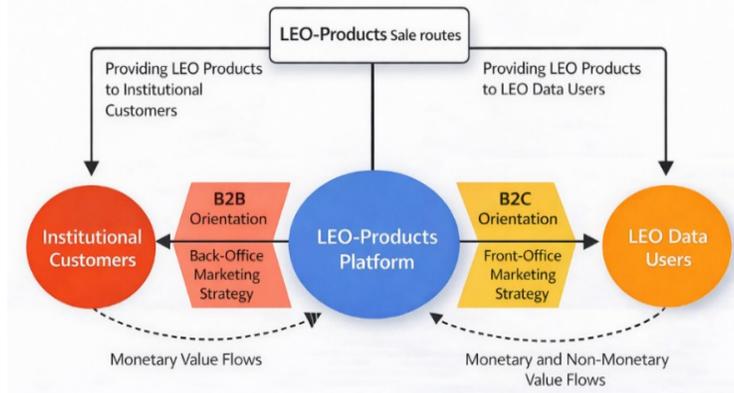
**Table 3.1: China-Hong Kong LEO Industrial Chain — Key Handoff and Interface Points [19]**

Industrial Chain Stage	Chinese Mainland 's Role	Hong Kong's Intermediation Function	Key Interface Mechanism
Constellation infrastructure	Satellite manufacturing, launch, and orbital deployment (Qianfan/G60, Guowang, Galaxy Space)	No role in manufacturing or launch; receives data and capacity as input	API data access agreements; capacity leasing contracts; gateway station operation
Capacity commercialization	State-owned and commercial operators sell wholesale satellite capacity and data	Structures capacity into internationally bankable products: SLAs, insurance wrappers, RMB-denominated bonds	Governance wrappers; contract standardisation; financial instruments under HK law
Data processing and analytics	National constellation generates raw data; mainland firms develop primary analytics	Converts analytics into decision-grade products with audit trails, liability frameworks, and cross-border compliance packaging	Data trust agreements; quality assurance protocols; HKSTP processing facilities
International market access	Mainland operators lack international legal credibility and cross-border contract enforceability in many jurisdictions	Provides common law contract enforcement, HKIAC arbitration, Specialist's-linked insurance, international investor access	HKIAC arbitration clauses; HK law governed contracts; Specialist's co-underwriting
Belt and Road deployment	National strategy drives connectivity deployment across Belt and Road markets	Structures financing, provides compliance templates, develops 'HK Certified' standards for deployment in Belt and Road jurisdictions	HK LEO Gateway standards; bilateral space cooperation agreements; template SLA frameworks
Innovation and applications discovery	Mainland universities and R&D institutions contribute technical research	Funds and incubates unexpected applications through LEIF; provides market access testing via HK pilot environment	LEIF grants; InnoSpace+ facilities; public sector data partnership agreements

[19] Note: LEIF: LEO Economy Innovation Fund (proposed in Chapter 5). 1C2S: One Country, Two Systems. HK: Hong Kong. Sources: Compiled by POD Research Team.

This industrial-chain mapping reveals three structural features. First, the value Hong Kong adds is not simply administrative; it is transactional and market-making. Second, that value is hardest to substitute where international trust, legal credibility, and financial structuring are required. Third, the model works best when Hong Kong is positioned as a complement to, rather than a replica of, mainland capability.

While Sections 3.4 through 3.6 detailed the specific functional requirements of Connectivity Leasing (Model I), Data Analytics (Model II), and Consumer Services (Model III), **Figure 3.2** illustrates the overarching operational framework that connects these models to the market. [20]



**Figure 3.2: B2B&C Business Operation Model of the LEO Economy**

As Hong Kong positions itself as an institutional intermediary, it must support a hybrid flow of services. This model demonstrates how 'governance wrappers'—including legal enforceability and financial structuring—allow for a dual-track approach: satisfying the high-reliability needs of enterprise and government clients (B2B) while simultaneously enabling the mass-market scale required for direct-to-device consumer applications (B2C). For Hong Kong, this integrated B2B&C model represents the final stage of the 'commercialization bridge,' where national LEO capacity is fully translated into a bankable, globally accessible service ecosystem.

### 3.8 Overseas Market Strategies for Hong Kong-Based LEO Firms

Across all three models, Hong Kong-based firms operating overseas should follow a common strategic principle: prioritize institutional intermediation over infrastructure ownership. The city's role is strongest where users need trusted packaging, legal certainty, financing, analytics, and cross-border service integration.

That in turn means aligning market entry with the innovation lifecycle of each target segment. Mature overseas uses can be commercialized earlier through structured service offerings, while innovation-heavy uses require patient piloting and closer ecosystem support.

Hong Kong should also function as a de-risking hub for overseas market entry. Its value lies in resolving the commercialization gap for mainland LEO capacity in markets where users require additional trust, enforceability, or financial structure.

For overseas consumer markets in particular, expansion should be cautious and selective. Mass-market scaling should come only after device integration, user experience, telecom bundling, and regulatory clarity have become sufficiently mature.

### 3.9 Chapter Conclusion

This chapter establishes the conceptual and structural foundation of the report. It reframes LEO as enabling infrastructure, distinguishes market types, identifies four recurring commercialization constraints, defines three business models, and locates Hong Kong's role within the China–Hong Kong industrial chain. The next step is to translate that analytical logic into an operational sequencing framework for policy.

[20] Source: Compiled by POD Research Institute

## Chapter 4: The Three Business Models — Comparative Matrix and Policy Sequencing

Chapter 3 established the economic logic of the three business models. This chapter translates that logic into policy sequencing. Different models become commercially viable under different conditions, so they should not be pursued with identical urgency or identical tools.

The readiness gates discussed in this chapter are not a rigid, step-by-step sequential process. Instead, they help LEO entrepreneurs and policymakers understand the critical thresholds that each business model must achieve. These gates can be advanced simultaneously or in parallel, with only one logical sequence: usable data must be secured first before moving on to developing applications, acquiring customers, and nurturing relevant talent. The purpose of readiness gates is to examine whether a project is sufficiently mature, whether risks can be controlled, and whether the business model is truly feasible. They also serve as an important basis for judging whether a data service can evolve from pure technology into practical, trusted, and profitable commercial services.

### 4.1 Comparative Model Matrix

The comparative matrix (Table 4.1) should be read as a **prioritization tool**. Model I sits closest to practical commercialization because its users and demand drivers are already relatively visible. Model II has higher strategic and margin potential but requires stronger data access, institutional trust, and product experimentation. Model III may eventually become significant, but it is the least suitable as an early public-policy priority because it depends on wider ecosystem maturity.

**Table 4.1: Comparative Matrix — Three Business Models [21]**

Dimension	Model I: Connectivity Leasing	Model II: Data & Analytics Services	Model III: Consumer Services
Market type	Existing deterministic	Hybrid: existing and innovative	Innovative indeterminate (emerging)
Innovation lifecycle	Transitional to specific	Fluid to transitional	Fluid
Primary constraints	Legal enforceability and risk transfer	Long-horizon financing and data governance are primary	All four; device integration is the external variable
Hong Kong's function	Institutional intermediation and governance wrappers	Data-trust platform and analytics commercialisation	Demonstration and regulatory reference environment
Gross margin range (illustrative)	35–40% (illustrative, enterprise B2B connectivity)	70–85% analytics; 50–65% sector IoT (illustrative)	Variable; depends on whether HK earns intermediation fees
Sequencing priority	First (foundational)	Concurrent with Model I, intensifying from Year 2	Third (after Models I and II operating)
Key policy trigger-Basis for Proposals in Chapter 5	Proposal 1: regulatory coordination office (Year 1)	Proposals 2, 3, 5: finance, analytics programme, Innovation Hub (Year 1–5)	Proposals 6 and 7: anchor company and gateway (Year 2–7)

### 4.2 Model I: Key Policy Sequencing Points

Model I addresses existing deterministic markets — aviation, maritime, logistics, and emergency communications — in which demand is already identifiable. Its commercial activation depends less on technical invention than on regulatory clarity, service integration, and transaction structures that make adoption practical for institutional users.

The minimum viable condition is therefore institutional readiness: clear spectrum coordination procedures, predictable certification pathways, workable contract templates, and anchor-demand pilots that demonstrate reliability in real operating conditions.

The readiness gates discussed in this chapter are not a rigid, step-by-step sequential process. Instead, they help LEO entrepreneurs and policymakers understand the critical thresholds that each business model must achieve. These gates can be advanced simultaneously or in parallel, with only one logical sequence: usable data must be secured first before moving on to developing applications, acquiring customers, and nurturing relevant talent. The

[21] Sources: Note: Gross margin figures are illustrative ranges for selected downstream business types from comparable firms — not forecast averages for Hong Kong. See Table 5.2 for full LEIF tier structure and Appendix D for full readiness-gate detail per model.

purpose of readiness gates is to examine whether a project is sufficiently mature, whether risks can be controlled, and whether the business model is truly feasible. They also serve as an important basis for judging whether a data service can evolve from pure technology into practical, trusted, and profitable commercial services.

### 4.3 Model II: Key Policy Sequencing Points

Model II spans both existing and innovative markets. It is strategically attractive because it can generate higher profit margins, but it cannot be unlocked by licensing reform alone. It requires usable data access, trusted governance, validation pathways, and an environment that allows experimentation across legal, financial, and sectoral boundaries.

This makes Model II the clearest case for active policy creation rather than simple regulatory facilitation. The key task is to create conditions under which analytics products can be tested, trusted, and gradually adopted by institutional customers.

### 4.4 Model III: Policy Sequencing Points

Model III is the most sequentially dependent. Its commercial viability depends on device integration, telecom partnerships, pricing, user behavior, and ecosystem conditions that are only partially within Hong Kong's control.

Hong Kong's near-term role in this model is therefore to maintain optionality through testing, certification, and demonstration rather than to make consumer satellite services the centrepiece of early public investment.

### 4.5 Synthesis Overview: Near-, Medium-, and Long-Term Priorities

The comparative matrix and model sequencing points reveal a clear policy priority structure (Table 4.2). In the near term (Year 1–3): regulatory coordination is the foundational prerequisite for all models; the government-funded LEO Economy Innovation Fund mechanism and Maritime Analytics Programme launch the analytics pipeline; and government anchor-customer procurement validates Model I. In the medium term (Year 2–5): LEO Finance Centre, Innovation Hub, and Anchor Company build the institutional density that converts pilots into commercial scale. In the longer term (Year 3–7): the Space Law Chamber and Belt and Road Gateway provide the internationalization infrastructure.

A key insight from the sequencing logic is that Hong Kong does not need to achieve everything simultaneously. Near-term interventions are relatively low-cost institutional decisions. Medium-term interventions require larger financial commitments but are de-risked by near-term foundations. This sequencing significantly reduces total upfront public investment and is itself a source of late-mover advantage.

#### 4.5.1 Readiness Gates for Model: Connectivity Leasing [22]

These readiness gates are not a strict, fixed sequence of steps that must be followed one by one. Instead, they are four key requirements that Model 2 must meet. These readiness gates can be worked on at the same time or in overlapping stages. The only logical order is that we must first have data before we can talk about applications, customers, and talent.

Their role is to check whether the project is mature, risks are manageable, and the business model works. They are the key standard for judging whether data services can change from technology into practical, trusted, and profitable services.

For Model I, the essential readiness sequence runs from regulatory clarity to service reliability, anchor demand, and scalable contracting. The purpose of the gate logic is not to create bureaucratic hurdles, but to identify the institutional conditions under which technically available connectivity leasing becomes a usable and bankable service (Table 4.2).

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[22] The term “Readiness Gates” in this report is used as an author-defined analytical framework, conceptually drawing on staged-readiness and gated-development traditions found in Technology Readiness Levels (NASA), Adoption Readiness Levels (U.S. Department of Energy), Manufacturing Readiness Levels (U.S. Department of Defense), and Stage-Gate innovation management. See National Aeronautics and Space Administration. (2023, September 27). Technology readiness levels. <https://www.nasa.gov/directorates/somd/space-communications-navigation-program/technology-readiness-levels/>; U.S. Department of Energy, Office of Technology Commercialization. (n.d.). Adoption readiness levels (ARL) framework. <https://www.energy.gov/technologycommercialization/adoption-readiness-levels-arl-framework>

- Gate 1: Regulatory Readiness
- Gate 2: Service Readiness
- Gate 3: Anchor Demand Readiness
- Gate 4: Scaling Readiness
- Gate 5: Infrastructure Governance Readiness

**Table 4.2: Mapping Readiness Gates to Policy Proposals — Model I [23]**

Readiness Gate	What Must Be Achieved	Primary Constraint Addressed	Ch.5 Gate-Unlocking Proposal
Gate 1: Regulatory Readiness	OFCA spectrum procedures; predictable certification pathways; transparent licensing timelines	Legal enforceability; data governance	Proposal 1: Cross-Bureau Coordination Office (Year 1)
Gate 2: Service Readiness	Constellation performance meets sector thresholds; security assurance established	Risk transfer (operational)	Proposal 2: LEO Finance Centre instruments enable service-level insurance (Year 1-2)
Gate 3: Anchor Demand Readiness	Public agency pilots; reference contracts from major commercial customers	Long-horizon financing (demand certainty)	Proposals 1 and 3: government-as-anchor-customer; maritime programme (Year 1-3)
Gate 4: Scaling Readiness	Standardized SLA templates; routine integration; competitive dynamics active	Legal enforceability; risk transfer	Proposal 1: HK LEO Entry Package; Proposal 7: standards and marketing (Year 3+)
Gate 5: Governance Readiness	Essential service dependence; regulatory oversight obligations formalised	All four constraints in mature form	Long-term regulatory development (Year 5+)

#### 4.5.2 Readiness Gates for Model II: Space-Based Data and Analytics Services

For Model II, the key conditions are usable data access, quality assurance, validation pathways such as sandboxes or pilots, institutional customer adoption, and a sustained research-and-talent pipeline. These requirements reflect the fact that analytics businesses succeed only when data can be turned into trusted decisions for real users.

- Gate A: Data Access and Quality Foundation
- Gate B: Regulatory Sandbox for Innovative Applications
- Gate C: Institutional Customer Adoption
- Gate D: Talent and Research Pipeline

**Table 4.3: Mapping Readiness Gates to Policy Proposals — Model II [24]**

Readiness Gate	What Must Be Achieved	Primary Constraint Addressed	Ch.5 Gate-Unlocking Proposal
Gate A: Data Access and Quality	API agreements with national operators; quality assurance protocols; InnoSpace+ processing infrastructure	All four constraints — data is the prerequisite for all others	Proposals 5 and 6: Innovation Hub; data partnership agreements (Year 2-5)
Gate B: Regulatory Sandbox	90-day sandbox admission; experimental analytics operation; evidence-base generation	Long-horizon financing; legal enforceability	Chapter 5 Section 5.5: regulatory sandbox component (Year 1-3)
Gate C: Institutional Customer Adoption	Three priority analytics product families; anchor customers in insurance and trade finance; government data partnerships	All four constraints active simultaneously	Proposal 3: Maritime-Insurance-Finance Analytics Programme (Year 1-3)
Gate D: Talent Pipeline	Innovation Hub operational; 5-10 academic chairs; Tech.Pass-equivalent talent scheme	Long-horizon financing (human capital)	Proposals 5 and Chapter 5 Section 5.5 talent components (Year 2-5)

#### 4.5.3 Readiness Gates for Model III: Consumer-Oriented Satellite Services

Model III is the most sequentially dependent of the three models. Its commercial viability depends on gates that are outside Hong Kong's direct institutional control — global device manufacturer integration, user terminal cost

[23] Sources and Note: Footnote 3; Proposals are detailed in Chapter 5. Year references are indicative horizons, not calendar deadlines; readiness gates take precedence over timelines.

[24] Sources: Footnote 3; Note: The four constraints are: (1) long-horizon financing, (2) risk transfer, (3) legal enforceability, (4) trusted data governance. LEIF = LEO Economy Innovation Fund (proposed in Chapter 5).

reduction, mainstream consumer awareness — and on institutional gates that can only be opened after Models I and II have established the LEO service ecosystem in Hong Kong. The sequencing imperative from Chapter 3 applies fully: Model III should not be the subject of significant public investment until Models I and II are operating (Table 4.4).

- Gate X: Device Integration Readiness
- Gate Y: Telecom Partnership Readiness
- Gate Z: Overseas Market Validation Readiness

**Table 4.4: Mapping Readiness Gates to Policy Proposals — Model III [25]**

Readiness Gate	What Must Be Achieved	Primary Constraint Addressed	Chapter 5 Connection
Gate X: Device Integration	Consumer protection and certification frameworks; reference jurisdiction status for global device manufacturers	Legal enforceability; data governance (consumer data)	Proposal 1: regulatory coordination; contributes to Belt and Road standards (Year 2-4)
Gate Y: Telecom Partnerships	Working partnerships between constellation operators and HK telecoms; B2B2C commercial arrangements validated	Risk transfer (consumer liability); long-horizon financing (network investment)	Proposal 6: anchor LEO company cultivates telecom partnerships (Year 2-4)
Gate Z: Overseas Market Validation	Hong Kong trial data on usage and pricing; overseas telecom partnerships established; additive use-case proposition validated	All four constraints applied to overseas market context	Proposal 7: Belt and Road Gateway includes consumer connectivity dimension (Year 3-7)

## 4.6 Synthesizing the Three Models: Sequencing Logic

For LEO businessmen and government officials, the readiness-gate analysis across all three models therefore points to a disciplined sequence: early focus on regulatory and contractual activation for Model I, simultaneous institution-building for Model II, and a later, more selective approach to Model III. Sequencing is about institutional readiness, not the absence of demand. Table 4.5 is an updated version of Table 4.1 that adds the revenue stability dimension.

In the near term, Hong Kong should prioritize the few interventions that unlock practical commercial use. In the medium term, the priority shifts to adoption, analytics capability, and ecosystem depth. Over time, the objective is to turn those early institutional advantages into a durable downstream platform.

The framework also clarifies why Hong Kong does not need to do everything at once. The city can create real value by moving first where its institutional toolkit matters most, while allowing more sequentially dependent markets to mature.

**Table 4.5: Comparative Characteristics Across Models I, II, and III [26]**

Characteristic	Model I:	Model II:	Model III:
	Connectivity Leasing	Data Analytics Services	Consumer Services
Market type (Chapter 3)	Existing deterministic	Hybrid: existing and innovative	Innovative indeterminate (near-term)
Innovation lifecycle phase	Transitional to specific	Fluid to transitional	Fluid
Primary commercialisation constraint	Legal enforceability and risk transfer	Long-horizon financing and data governance	All four, with device integration as the external variable
Hong Kong's primary function	Institutional intermediation and governance wrappers	Data-trust platform and analytics commercialization	Demonstration and regulatory reference environment
Revenue stability	High: long-term contracts, renewal income	Lower initially; stabilizes after institutional adoption	Low initially; dependent on consumer scale
Gross margin potential (per Chapter 5)	35-40% (enterprise B2B connectivity)	70-85% (analytics); 50-65% (sector IoT)	Variable; dependent on whether HK earns intermediation fees
Sequencing priority	First (foundational)	Concurrent with Model I, intensifying from Year 2	Third (after Models I and II are operating)

[25] Sources: Footnote 3; Note: Model III requires Gates X and Y before Gate Z, and both Models I and II should be operational before significant Model III public investment is made.

[26] Note: Gross margin figures are illustrative ranges for selected downstream business types drawn from comparable firms, not forecast averages for Hong Kong. Sequencing priorities reflect the readiness-gate analysis above.

## 4.7 Chapter Conclusion

The three business models presented across Chapters 3 and 4 show that Hong Kong's role is consistent even though the timing differs across markets. Hong Kong adds value through institutional intermediation — governance capacity, legal structure, finance, insurance, analytics, and trusted market access.

What changes from model to model is not the basic role, but the readiness conditions under which that role can be commercially activated. The next chapter turns this sequencing logic into strategy and policy design.

## Chapter 5: Strategies That Make Hong Kong Tick in the LEO Economy

### 5.1 Introduction: Four Layers of the Strategic Argument

Hong Kong should not attempt to replicate the full LEO value chain. Its comparative advantage lies in the non-manufacturing layer — software, analytics, law, finance, insurance, data governance, and commercial intermediation. The strategic question is therefore not whether Hong Kong can become another launch or manufacturing centre, but whether it can become the most effective platform for converting national LEO capacity into bankable and internationally trusted services.

The answer can be organized around four interlocking layers: competitive positioning, comparative lessons, China–Hong Kong complementarity, and innovation. Each matters, but the common thread is that Hong Kong succeeds only by competing where institutional excellence rather than hardware scale determines value.

The rest of the chapter therefore focuses on how Hong Kong can target the highest-margin downstream segments, learn from other jurisdictions without copying them mechanically, and build the innovation system required to discover and commercialize new LEO applications.

### 5.2 The Innovation Imperative: Unexpected Applications as the True Engine of LEO Value

The most profitable LEO business model is not the sale of satellite data itself, but the delivery of cross-disciplinary solutions in which satellite inputs operate as an enabling layer behind a more specific institutional or commercial product. Users buy regulatory clearance, risk reduction, logistics visibility, or compliance assurance — not raw data for its own sake.

#### 5.2.1 The Hidden Profit: Solutions, Not Data Sales

A cocoa trader needs regulatory clearance, not an image of the Amazon. An investor needs a risk alert before an earnings call, not a heat-signature dataset. An insurer needs an automatic payout trigger, not a flood map. A bank needs a green-loan verification report, not a land-cover raster. A factory in a flood-prone coastal area needs an early warning message, not raw sensor readings. In each case, the satellite remains upstream and largely invisible; the product being sold is the decision-support object it enables.

These applications emerge when non-space experts recognize that orbital data can solve an entrenched problem in their own field. This is the defining logic of unexpected LEO value creation: profits come from cross-disciplinary recombination, not simply from selling access to space-derived data (Table 5.1).

**Table 5.1: Illustrative Unexpected LEO Applications: From Satellite Data to Commercial Solutions [27]**

Application Domain	Traditional Approach	Unexpected LEO Solution	Paying Product	Commercial Evidence
Supply Chain Compliance	On-site audits and supplier declarations	Satellite deforestation monitoring converts imagery into pass/fail compliance certificates for EU anti-deforestation rules	Regulatory clearance — market access permission, not imagery	Planet Labs/NICFI: ~US\$43M contract

[27] Sources: Appendix E. In each case, the satellite is an upstream enabler invisible to the end customer. The commercial product is the decision-support object — certificate, score, trigger, verification, or alert — rather than the underlying imagery or telemetry.

Application Domain	Traditional Approach	Unexpected LEO Solution	Paying Product	Commercial Evidence
Financial Risk Intelligence	Earnings releases and company filings	Satellite-derived signals on industrial activity and weather converted into portfolio risk alerts	Subscription risk scores for investors, ahead of company disclosures	MSCI GeoSpatial Analytics within MSCI's ~US\$3.13B FY2025 turnover
Insurance & Claims	Manual claims assessment over months	Parametric insurance linked to satellite-measured flood, wind, or vessel triggers releases funds automatically	Automatic payout event — hours not months	Swiss Re parametric solutions; ICEYE catastrophe analytics (US\$136M Series D)
Sustainable Finance & Lending	Costly site visits for ESG loan verification	Satellite monitoring replaces physical verification of farm practices and land use for green loan approval	Green loan verification report — an audit substitute	InSoil/HeavyFinance: €20M EIF cornerstone investment
Disaster Early Warning	Ground sensors requiring terrestrial connectivity	Satellite IoT connects off-grid flood sensors to deliver early alerts before water reaches communities	Early-warning alert message — a text before the flood arrives	Myriota flood early-warning IoT contract: A\$5.48M

### 5.2.2 The Risk-Sharing Rationale: A LEO Economy Innovation Fund

Private capital funds applications with predictable returns. It systematically under-funds early-stage exploration whose payoff is uncertain. Satellite data applications are a textbook case: a parametric insurance product requires actuarial research, earth observation processing, legal structuring, and domain expertise — no single private firm has the incentive or capability to fund all four simultaneously.

Luxembourg's LuxIMPULSE programme and ESRIC Start-up Support Programme provide the precise template Hong Kong requires: non-repayable grants that explicitly accept failure as part of the public return on investment. Together they have attracted more than 80 space companies and research organizations to Luxembourg. The proposed LEO Economy Innovation Fund (LEIF) replicates this model in three tiers (Table 5.2).[28]

**Table 5.2: LEO Economy Innovation Fund (LEIF) — Tier Structure [29]**

Tier	Name	Grant Size	Repayability	Target	Luxembourg Equivalent
1	Exploratory Research Grant	Up to HK\$1.5M	Non-repayable even on project failure	University-industry cross-disciplinary research into novel satellite data applications; academic chairs producing applied research	ESRIC Start-up Support Programme (non-repayable up to €200,000)
2	Proof-of-Concept Development Grant	Up to HK\$6M (1:1 matched by applicant)	Non-repayable if milestones met; partial recovery if missed without justification	Prototype analytics products, parametric insurance pilots, ESG compliance feed validation in real institutional customer environments	LuxIMPULSE R&D grants for novel space technology development
3	InnoSpace+ Incubation Track	HKSTP facility access, advisory support, data API access for 24 months	No repayability; government retains option for small equity stake (up to 5%) at exit	Scale-ready analytics ventures requiring institutional environment, national constellation data API access, and commercial pilot facilitation	Luxembourg's ecosystem-level incubation combining ESRIC and LuxIMPULSE support within LSA's broader framework

### 5.2.3 The Necessary Condition: An Open, Cross-Disciplinary Environment

Unexpected applications cannot be legislated into existence, but the conditions that produce them can be deliberately constructed. The single most important prerequisite is an environment that is structurally open to new ideas: one that places satellite data access in the hands of domain specialists from finance, law, agriculture,

[28] Luxembourg Space Agency. (2026, February 25). Funding. <https://space-agency.public.lu/en/support/industry-portal/funding.html> ; Luxembourg Space Agency. (2026, January 21). Luxembourg reaffirms its commitment to the European Space Agency and to the development of the national space ecosystem. <https://space-agency.public.lu/en/news-events/news/2025/luxembourg-reaffirms-commitment-esa-ministerial-council.html> ; European Space Resources Innovation Centre. (2026). Business incubator. <https://www.esric.lu/commercialization/business-incubator> ; European Space Resources Innovation Centre. (2026, February 8). SSP6 – ESRIC Start-up Support Programme. <https://www.esric.lu/commercialization/business-incubator/ssp6>

[29] Sources: Footnote 4; Notes: LEIF is distinct from the commercially oriented LEO Innovation Fund in Proposal 2. LEIF addresses pre-commercial, exploratory, and proof-of-concept stages; Proposal 2's fund addresses commercial-stage Series A and B investment. Both should be reported under a single LEO Economy financing architecture for coordination.

insurance, urban planning, and logistics — not merely satellite engineers — and that treats experimentation and failure as the cost of discovery rather than evidence of mismanagement. Value emerges at the boundary between orbital capability and unsolved institutional problems, and that boundary must be actively managed. An innovator’s nationality is not an issue, as long as they bring feasible and well-grounded ideas. Whoever has a creative and innovative mind can participate in Hong Kong LEO ecosystem.

Where satellite agencies speak primarily to other satellite agencies, the output is predictable: incremental refinement of products that already exist. Where a satellite data scientist works alongside an actuary, a trade compliance lawyer, or an agricultural credit officer, the output is categorically different — the kind of disciplinary collision that turns a flood-extent observation into an automatic insurance payout, or a deforestation signal into a supply-chain clearance certificate. The strategic implication is direct: the real return on LEO investment is not captured by executing the anticipated roadmap with greater efficiency. It is captured in the margin between what was planned and what was discovered.

### 5.3 The Global Competitive Landscape: Where the Highest Margins Are, and Whether Hong Kong Can Capture Them

The illustrative gross-margin ranges for selected downstream business types provide a strategic guide: remote sensing and AI analytics (70–85%) > integrated platforms (60–80%) > sector IoT (50–65%) > enterprise B2B connectivity (35–40%). These are indicative benchmarks drawn from comparable firms in analogous markets — not forecast averages for Hong Kong specifically — and should be treated as directional guidance rather than financial projections. Nonetheless, the strategic hierarchy they imply is robust: the highest-margin segments are also those where Hong Kong’s institutional strengths are most decisive.

#### 5.3.1 The Manufacturing Tier: A Domain for National Investment, Not Hong Kong Competition

The manufacturing tier is dominated by large national programmes and firms with deep industrial and launch capacity. The conclusion for Hong Kong is therefore not to enter that race late, but to build where institutional depth, market trust, and cross-border intermediation matter more than hardware scale.

#### 5.3.2 The Non-Manufacturing Tier: Global Leaders and Five Hong Kong Strategic Implications

Surveying leading overseas non-manufacturing firms reinforces five implications for Hong Kong. It should target the data-to-decision pipeline rather than the data itself; choose domain depth before platform breadth; use government and public agencies as early anchor customers; adopt API-first architecture to support scaling; and actively deploy its advantages in law, finance, and institutional trust.

**Table 5.3: Selected Global Non-Manufacturing LEO Leaders [30]**

Company	Model	Performance	Key Success Drivers
SpaceX Starlink (United States)	Platform OS + SaaS	US\$12–16B revenue (2025); 60–80% gross margin; 9M+ subscribers	Vertical integration; continuous over-the-air (OTA) software updates; API-first enterprise integration
Planet Labs (United States)	Earth Observation Analytics SaaS	~US\$320M revenue; 57–60% gross margin; US\$734M backlog	Daily full-Earth imaging; AI/ML converts pixels to decision signals; government anchor contracts
Amazon Kuiper (United States)	Cloud-Satellite Convergence	US\$10B+ committed; 50–70% margin projected at scale	Cloud ecosystem lock-in; enterprise bundle connectivity + cloud; AWS edge nodes globally
BlackSky Technology (United States)	Real-Time Geospatial Intelligence	~US\$100M revenue; 50–55% gross margin	Hourly revisit cadence; AI natural-language interface; sector-specific dashboards
Eutelsat OneWeb (UK/France)	Enterprise B2B Connectivity	€1.1B revenue; LEO +59.7% YoY; 35–40% margin	Pure B2B model; platform APIs enable resale by telecom partners
SES (Luxembourg)	Managed Satellite Services	€2.35B+ revenue; MEO+LEO hybrid	35+ years operational maturity; Luxembourg domicile provides EU credibility

[30] Sources: Appendix F; Notes: OTA = Over-The-Air software updates pushed remotely to satellites and terminals without physical intervention, allowing continuous product improvement after deployment.

Five strategic implications follow directly from this survey:

Implication 1 — Target the data-to-decision pipeline, not the data itself. Hong Kong should focus on products that convert satellite inputs into decisions, triggers, and operational intelligence.

Implication 2 — Choose domain depth before platform breadth. Maritime, trade finance, insurance, and compliance are stronger starting points than broad undifferentiated platform-building.

Implication 3 — Government as anchor customer is both replicable and urgent. Early public-sector adoption can validate products and reduce commercialization risk.

Implication 4 — API-first architecture is a design requirement. Scalable downstream businesses depend on reusable data and software infrastructure rather than one-off bespoke projects.

Implication 5 — Institutional trust is Hong Kong's non-replicable advantage, but only if actively deployed through legal, financial, and regulatory design.

The five implications point to the same conclusion: Hong Kong's competitive strategy should be anchored at the top of the gross margin hierarchy, using its institutional trust advantages as the differentiator that technology-first competitors cannot replicate.

## 5.4 Learning from Singapore — and Going Beyond

Singapore is the most instructive regional comparator: a small, open, institutionally sophisticated economy with no domestic launch capability and strong financial and professional services. Its application-first, hardware-agnostic model is the right template. However, five structural dimensions favour Hong Kong over Singapore decisively (Table 5.4).

**Table 5.4: Hong Kong vs Singapore — Five Structural Differentiators [31]**

Dimension	Singapore	Hong Kong Structural Advantage
Constellation Data Access	Purchases data commercially from Planet, Maxar, Airbus at full market prices. No access to Chinese constellation data.	Direct access to Qianfan/G60 and Guowang data at conditional- terms under 1C2S. Structural cost advantage for HK-based analytics firms.
Belt and Road Gateway	No relationship with mainland Chinese constellation operators; cannot package Chinese LEO capacity for international customers.	1C2S legal system + mainland alignment + international credibility enables Chinese constellation services to be contracted, financed, and litigated under HK law.
Space Finance	Strong financial centre; no offshore RMB capability. Cannot structure RMB-denominated space finance instruments.	World's largest offshore RMB centre. Can create RMB-denominated satellite leasing bonds, parametric insurance, and LEO investment funds unavailable to Singapore.
Legal Toolkit	Clear licensing and fintech sandbox; no space-specific commercial law framework yet.	Common law enforcement, HKIAC arbitration, specialist reinsurance co-underwriting, HKEX capital markets — a bundled capability Singapore cannot replicate.
Hardware-Progress Alignment	Benefits only from commercially purchased data improvements at market price.	Each technical advance in national constellations (sub-40ms latency, 10+ Gbps per satellite) directly and preferentially expands HK's addressable software market.

Three elements of Singapore's model are directly replicable: an application-first, hardware-agnostic product strategy; a coordinated institutional architecture with a clear mandate; and government-as-anchor-customer to validate and de-risk commercial products. Hong Kong should differentiate aggressively on the five dimensions Singapore cannot access: national constellation data at conditional-preferential data access terms (subject to national policy confirmation), the Belt and Road LEO gateway role, offshore RMB space finance, its deeper legal-financial toolkit, and its alignment with national hardware progress. Hong Kong is not a slightly different Singapore; it is a structurally distinct opportunity rooted in a complementarity that Singapore has no equivalent of.

[31] Source: Appendix G

## 5.5 Catch-Up Proposals: Drawing on UK and Luxembourg Experience

The UK demonstrates how a major financial center can reorient toward a downstream, applications-led model through deliberate national strategy and anchor-company cultivation (sector income £17.5B, 48,800 jobs). Luxembourg demonstrates how a very small economy can use legal innovation, targeted public investment, and an anchor company to become a globally recognised space finance, law, and operations hub. Drawing on both models and Singapore’s, seven integrated proposals constitute Hong Kong’s LEO catch-up strategy (Table 5.5).

In the table, "Mirrors UK Catapult model; builds software product pipeline; operational complement to LEIF" means that the UK Catapult model refers to a network of publicly-funded innovation centers established by Innovate UK from 2011 onward, each focused on a specific technology sector — including the Satellite Applications Catapult based in Harwell Science and Innovation Campus, Oxfordshire. The defining feature of a Catapult is that it sits between pure research (universities) and pure commercialization (venture-backed companies).[32] It de-risks the "valley of death" — the stage where a promising technology exists in a lab but no private investor will yet fund its productization. The Satellite Applications Catapult specifically helped small UK companies turn raw satellite data into commercial software products, providing prototyping facilities, market access support, and anchor-client matchmaking. Proposal 5 proposes Hong Kong replicate this model by housing a similar function within HKSTP's InnoSpace+ facility: taking LEO data capabilities developed in universities or by mainland hardware partners and building them into market-ready software and analytics products for Hong Kong's financial, maritime, insurance, and logistics sectors.

Also “The Luxembourg/SES model” refers to how Luxembourg transformed itself from a small, landlocked country with no obvious space credentials into Europe's leading satellite finance and regulatory hub — principally by attracting SES (originally Société Européenne des Satellites) to base its global headquarters there in 1985. [33] SES gave Luxembourg's nascent space economy institutional credibility, a large employer, a regulatory testing ground, and a magnet for the legal, financial, and insurance services that cluster around any major satellite operator. Luxembourg then built outward from that anchor: space law, space resources legislation, the LuxIMPULSE programme,[34] and the broader space industry cluster that exists today. The anchor company created industry gravity — meaning other smaller firms, suppliers, lawyers, and financiers relocated to Luxembourg because SES was there, not because Luxembourg had independently built all those services first.

“The UK/OneWeb model” refers to the UK government's decision in 2020 to acquire a 20% stake in OneWeb after it filed for bankruptcy, effectively making the UK a state shareholder in a LEO broadband constellation. The rationale was partly industrial policy — securing domestic satellite manufacturing at Airbus's Stevenage facility — and partly strategic positioning, ensuring the UK had an indigenous constellation capability post-Brexit when it lost access to Galileo. OneWeb (now Eutelsat OneWeb) gave the UK an anchor asset around which downstream services, regulatory frameworks, and export opportunities could be organized.[35]

**Table 5.5: Seven Strategic Proposals for Hong Kong’s LEO Catch-Up Programme[36]**

No.	Proposal	Type	Horizon	Readiness Gate	Strategic Rationale
1	Cross-Bureau LEO Coordination Office	Institutional governance	Near-term (Yr 1)	Model I Gates 1 and 3	Mirrors Singapore NSAS; resolves coordination gap; markets HK as ‘LEO Gateway’; foundational prerequisite for all other proposals
2	LEO Finance Centre within HKMA/HKEX	Space finance	Near-term (Yr 1–2)	Model I Gates 2 and 4; Model II Gate A	Mirrors Luxembourg model; uniquely enabled by offshore RMB; Singapore cannot replicate; distinct from LEIF

[32] This is a UK Research and Innovation body — an official government-linked source. It states: the Satellite Applications Catapult was established at Harwell in May 2013 by Innovate UK, as one of a network of Catapults to accelerate the take-up of emerging technologies and drive economic growth. see Full URL: <https://www.ukspacefacilities.stfc.ac.uk/Pages/Satellite-Applications-Catapult-%E2%80%93-Harwell.aspx>

[33] Etienne Schneider (Luxembourg Minister of Economy), "How Luxembourg Becomes Europe's Commercial Space Exploration Hub", *Réalités Industrielles*, May 2019, pp. 69–74.

[34] Luxembourg Space Agency. (n.d.). Funding [Industry portal], <https://space-agency.public.lu/en/support/industry-portal/funding.html>

[35] Bowen, B.E., "British strategy and outer space: A missing link?", *The British Journal of Politics and International Relations*, 2018 — assesses the UK as a secondary space power and analyses the strategic risks of dependence on allies for sovereign space capability. Yahoo Finance URL: <https://journals.sagepub.com/doi/abs/10.1177/1369148118758238>

[36] Horizon references are indicative implementation horizons rather than rigid deadlines. Proposal 6 is restricted to mainland Chinese operators and technically non-US-dependent operators to comply with technology sovereignty constraints identified in Chapter 2. Source: Compiled by POD Research Team

No.	Proposal	Type	Horizon	Readiness Gate	Strategic Rationale
3	Maritime-Insurance-Finance LEO Analytics Programme	Model II analytics vertical	Near-term (Yr 1–3)	Model II Gate C	Highest gross profit margin segment (70–85%); exploits national data advantage; directly addresses all four commercialisation constraints
4	HK Space Law Chamber at HKIAC + Space Law LLM	Legal and arbitration	Medium-term (Yr 2–4)	Model I Gate 4; Model II Gate C	Mirrors UK English-law advantage; addresses Chinese constellation contracts requiring neutral enforcement outside mainland courts
5	LEO Economy Innovation Hub at HKSTP InnoSpace+	R&D-to-market pipeline	Medium-term (Yr 2–5)	Model II Gates A and D	Mirrors UK Catapult model; builds software product pipeline; operational complement to LEIF
6	Attract and Cultivate Anchor LEO Company with Regional HQ	Ecosystem seeding	Medium-term (Yr 2–4)	Model III Gates Y and Z; Model I Gate 3	Mirrors Luxembourg/SES and UK/OneWeb models; provides industry gravity; restricted to mainland Chinese operators per technology sovereignty constraint
7	HK as Belt and Road and Asian Countries LEO Gateway — Standards and Marketing	International positioning	Longer-term (Yr 3–7)	Model I Gate 4; Model III Gate Z	What Singapore cannot do; positions HK as institutional bridge between national constellations and Belt and Road markets; sequenced for institutional readiness, not distant demand

## 5.6 Critical Assumptions Requiring Policy Confirmation

The strategic case in this chapter rests on several consequential assumptions that are plausible within the One Country, Two Systems framework but still require policy confirmation: **access to national-constellation data on commercially usable terms, willingness by an anchor mainland-linked firm to establish a substantive Hong Kong presence, and the possibility that Hong Kong-branded standards or templates can gain recognition in relevant overseas markets.**

If these assumptions are only partially confirmed, the proposals should be adjusted rather than abandoned. The core thesis — downstream intermediation combined with continual innovation — remains valid even under more conservative scenarios.

### 5.6.1 Proposal 1: Cross-Bureau LEO Coordination Office (Year 1)

The single most important near-term reform is a Cross-Bureau LEO Coordination Office that aligns OFCA, CEDB, InvestHK, and innovation agencies around licensing, market entry, and investor-facing problem-solving. In an emerging infrastructure sector, administrative coherence is itself a competitive asset.

The objective is simple: reduce friction, shorten approval times, and make Hong Kong easier to navigate for firms seeking to commercialize LEO services.

### 5.6.2 Proposal 2: Build a LEO Finance Platform and Set up LEIF (Year1 -Year2)

In Years 1–2, Hong Kong should establish a dedicated LEO Finance Centre with support from the HKMA and HKEX to channel capital into commercially viable LEO-related businesses and position the city as a financing hub for the LEO-enabled economy.

The platform should also support RMB-denominated LEO financial products, alongside 200% tax deductions for eligible R&D expenditure and a preferential low profits tax rate for qualifying firms. Together, these measures would create a finance-led commercialization framework and strengthen Hong Kong’s role as a financial, legal, and investment hub for the LEO-enabled economy.

A central pillar should be the creation of a HK\$2 billion LEO Innovation and Investment Fund (LEIF) built on a three-layer non-returnable grant structure that supports firms at the earliest stages of development and allows room for failure. The first layer should support prototype development, the second should fund experimentation and testing, and the third should provide start-up support for early commercial formation. This design is important because many LEO-enabled applications face high uncertainty in their formative stage and cannot be financed effectively through conventional return-driven investment alone.

### **5.6.3 Proposal 3: Maritime-Insurance-Finance LEO Analytics Programme (Year 1–3)**

The maritime-insurance-finance nexus offers one of the clearest bridges between national satellite capability and Hong Kong's existing institutional strengths. It is also one of the most promising areas for high-value analytics applications.

Priority product families include satellite-enhanced cargo insurance triggers, sanctions and dark-vessel compliance analytics, and commodity-flow intelligence for trade and finance users. These are commercially intelligible use cases in sectors where Hong Kong already possesses real depth.

The programme should therefore be structured as a practical public-private pilot platform rather than as abstract technology promotion. Its value lies in generating real products, customers, and market proof.

### **5.6.4 Proposal 4: HK Space Law Chamber at HKIAC and Space Law LLM (Year 2–4)**

A specialist Space Law Chamber within HKIAC, complemented by advanced legal training in Hong Kong universities, would strengthen the city's ability to support cross-border LEO transactions through trusted contract design, dispute resolution, and legal interpretation.

If Hong Kong aims to become a commercialization platform, it must also become a legal platform. Institutional credibility in this field will depend on specialist capacity, not merely on generic legal reputation.

### **5.6.5 Proposal 5: LEO Economy Innovation Hub at HKSTP InnoSpace+ (Year 2–5)**

A LEO Economy Innovation Hub within HKSTP's InnoSpace should focus on downstream application-building rather than upstream hardware. Its purpose is to convene firms, researchers, and sector specialists around real commercial problems and provide infrastructure for pilot validation and product development.

The hub should also serve as the operational home of the innovation-fund logic discussed earlier, ensuring that research, experimentation, and commercialization are connected rather than institutionally fragmented.

### **5.6.6 Proposal 6: Cultivate an Anchor LEO Company with Regional HQ (Year 2–4)**

Attracting a mainland-linked anchor LEO company to establish a substantive regional presence in Hong Kong would help create demonstration effects, deal flow, ecosystem density, and credibility for follow-on firms and investors.

The strategic importance of an anchor firm is not symbolic. It is to provide a platform around which legal, financial, analytics, insurance, and downstream service capabilities can cluster and scale.

The anchor-company strategy can therefore be understood in two tiers: a primary mainland-related operator that brings technological linkage and strategic rationale, and a broader circle of international ecosystem partners that deepen the downstream market around it.

### **5.6.7 Proposal 7: HK as Belt and Road and Asian Countries LEO Gateway — Standards and Marketing (Phase I: Year 1–3; Phase III: Year 3–7)**

Hong Kong's long-run external role should be to become the preferred platform through which Chinese LEO-linked services are packaged for Asian and Belt and Road markets. That includes marketing, standards, templates, legal structure, analytics, and trusted dispute-handling.

This gateway role should be built in stages. In the early phase, Hong Kong can begin soft-launch functions while core institutional infrastructure is still being assembled. In the later phase, it can support fuller cross-border commercialization once legal, analytics, and anchor-firm capacity are stronger.

The point is not that internationalization comes after all domestic preparation is complete. Rather, international market positioning should begin early but scale only as institutional readiness improves.

## **5.7 Chapter Conclusion: Late Entry, Long Vision, and Tolerance for Failure**

The strategy presented in this chapter rests on four integrated layers. The first is competitive positioning: the highest-margin segment of the non-manufacturing LEO economy — remote sensing and AI analytics at 70–85% gross profit margins — is where Hong Kong's institutional strengths apply most powerfully. The second is

comparative positioning: Luxembourg, Singapore, and the UK all invested early in research-to-market pipelines, anchor-company cultivation, and coordinated institutional architecture. The LEIF replicates Luxembourg's most important signal: that frontier innovation is a public good and welcome foreign experts' participation, not merely a commercial opportunity. The third is China's national strategy: Hong Kong is not being asked to compete with the national hardware programme — it is being invited to be the international commercialization layer when the services stage arrives. The fourth is the late-mover argument: late entry means Hong Kong can observe which applications have achieved genuine commercial traction, which business models have failed, and which institutional frameworks have proved inadequate.

## Chapter 6: Consolidated Conclusion and a 5-10 Year Plan for Hong Kong's LEO Economy

### 6.1 Answers to the Four Policy Guiding Questions

Chapter 1 framed four policy guiding questions to structure the analysis. This section closes the loop by summarizing each answer explicitly, before the chapter develops the full synthesis and 5–10 year plan.

PGQ1: China's technological maturity and downstream opportunity. China's domestic LEO sector has moved beyond the conceptual stage and entered a phase of accelerated industrial build-out. Its technological maturity is demonstrated by expanding constellation deployment, growing satellite manufacturing capacity, improving ground infrastructure, and clear progress toward reusable launch and space-based computing. Although China still trails the United States in certain areas — mature reusable-launch operations and some cost efficiencies — the gap is narrowing. The national LEO programme is now sufficiently advanced to provide the hardware, data, and orbital capacity on which Hong Kong can build downstream commercial activity.

PGQ2: Hong Kong's comparative advantages and constraints. Hong Kong's potential lies not in launch, mass manufacturing, or sovereign constellation ownership, but in downstream institutional intermediation. Its principal comparative advantages are common-law contract enforceability, international arbitration, financial structuring, insurance and risk transfer, cross-border data governance, and the ability to package satellite-enabled services for global markets under One Country, Two Systems. Its binding constraints are not the absence of upstream industrial or high-end manufacturing capability — which the Mainland provides — but the limited domestic depth in space systems engineering, the constrained supply of LEO-specialist talent, and the nascent innovation pipeline needed to develop and scale competitive downstream products within the relevant commercialization window.

PGQ3: The feasible strategic framework. The feasible development model is a downstream, innovation-based LEO economy integrated with the national programme. The report identifies three workable business models: space-based connectivity leasing (most immediate and stable entry point), space-based data and analytics services (highest long-term value and margins), and consumer-oriented satellite services (later-stage opportunity). The overall framework is sequenced: regulatory and licensing clarity first, anchor demand and financing mechanisms second, and analytics, legal, insurance, and internationalization functions thereafter.

PGQ4: International lessons. Jurisdictions such as Luxembourg, the United Kingdom, and Singapore demonstrate that strong value capture is possible without domestic launch capability, through legal-regulatory positioning, downstream services, financing, analytics, and innovation support. The key implication for Hong Kong is that late entry can still be advantageous if focused on the right part of the value chain. Hong Kong should adapt — not copy — these economies' core lesson: profitable participation in LEO comes from becoming a trusted platform for commercialization, governance, and experimentation.

Recapitulation of the arguments. First, the global LEO economy is increasingly an infrastructure economy in which most revenue is generated downstream rather than in launch or satellite manufacturing. Second, Hong Kong is a late entrant and has no realistic comparative advantage in launch, mass manufacturing, or sovereign constellation ownership. Third, that late entry does not condemn Hong Kong to irrelevance, because the most commercially meaningful downstream functions - finance, law, insurance, data governance, analytics, certification, and internationalization - are precisely the areas in which Hong Kong is structurally strongest under 'One Country, Two Systems'. Fourth, the strategic prize lies not merely in reselling connectivity, but in building

a continuously innovative ecosystem that turns national LEO capacity into trusted, high-value services for regional and global markets.

## **6.2 Why Constant and Continual Innovation Must Sit at the Centre**

Innovation must sit at the centre of Hong Kong's LEO strategy because the highest-value part of the LEO economy lies in downstream services, analytics, and institutional applications, not in launch or manufacturing. The most profitable products are rarely predictable in advance. They emerge when satellite capability is combined with unresolved problems in finance, law, insurance, logistics, compliance, and urban management. Hong Kong's long-term commercial success therefore depends not on reproducing existing services more efficiently, but on generating new applications that the market did not previously know how to define or price.

For that reason, Hong Kong must treat the LEO economy as an innovation system rather than merely a licensing or intermediation platform. Innovation in this field is inherently uncertain: many experiments fail, many ideas do not scale, and successful products often emerge only by a certain degree of chance after repeated trial, recombination, and adaptation. Failure is therefore not evidence of strategic weakness. It is a normal part of the discovery process. A system that demands certainty before experimentation will only produce incremental improvements to existing products. A system that allows failures to happen is the one most likely to discover genuinely new, high-margin applications.

This is also why an open environment is indispensable. The LEO economy depends not only on satellite engineers, but on an agile ecosystem that is open to domestic and overseas talent, entrepreneurs, researchers, corporate users, and investment funds. Without such groups, innovation is discounted before it reaches the market: ideas are narrower, experimentation is weaker, risk capital is thinner, and the translation from technical capability to commercial product slows down. In contrast, an open ecosystem allows different disciplines, business models, and market signals to collide productively. That is where commercially transformative applications are most likely to emerge.

The policy implication is direct. Hong Kong needs institutions that widen participation, lower experimentation costs, and make failure politically and financially tolerable. This is the strategic purpose of the LEO Economy Innovation Fund, the InnoSpace+ Innovation Hub, and open API access to national constellation data. Their function is not simply to back projects that are already proven, but to create the conditions under which many experiments can be attempted, most of which may fail, so that a small number of commercially significant breakthroughs can emerge. Without that open, failure-tolerant, and talent-attracting ecosystem, Hong Kong's LEO economy would be confined to lower-margin intermediation rather than the higher-value innovation space on which durable competitiveness depends.

Innovation also matters for cost competitiveness. As China's launch costs fall and on-orbit computing improves, the input cost of satellite-enabled analytics and decision-ready data will decline. For Hong Kong, whose role is concentrated in the service and analytics layer, this means that continual innovation is not only the source of new revenue opportunities, but also the mechanism through which downstream products become more affordable, scalable, and internationally competitive. Constant and continual innovation is therefore the core condition for both profit creation and long-term market viability in Hong Kong's LEO economy.

## 6.3 A 5-10 Year Timeline for LEO Development

The practical question is how Hong Kong should convert this strategic logic into a disciplined programme (Table 6.1). The answer is not to create a long list of disconnected initiatives. It is to pursue a three-phase plan that begins with institutional foundations, moves into commercialization and product formation, and then scales outward into regional and global market making.

**Table 6.1: A 5-10 year development plan for Hong Kong's LEO economy**

Phase	Indicative years	Strategic focus	Illustrative KPIs
Phase I - Foundations	2026-2027	Create the institutional base for licensing, contracting, innovation funding, and data access	1) Cross-bureau coordination mechanism established; 2) standard licensing pathway published; 3) LEIF launched; 4) at least 3 public-sector or quasi-public pilot projects; 5) first data-access or partnership agreements signed with national operators
Phase II - Commercialisation	2028-2030	Build bankable enterprise products in connectivity and analytics, with Hong Kong as the validation and intermediation hub	1) 10+ institutional pilots or commercial contracts; 2) at least 3 recurring analytics product lines; 3) dedicated LEO insurance / financing products in market; 4) 2-3 anchor firms or regional headquarters established in Hong Kong; 5) average licensing / approval cycle materially shortened
Phase III - Scaling and Internationalisation	2031-2035	Turn Hong Kong into a recognized Asia-facing LEO commercialization, arbitration, and market-access platform	1) Hong Kong-linked LEO services deployed in multiple Belt and Road or Asia-Pacific markets; 2) cumulative finance raised and insured value reaching policy-set targets; 3) regular HKIAC / legal-service pipeline for LEO disputes and contracts; 4) consumer and enterprise reference deployments exported to overseas markets; 5) measurable share of sector value coming from analytics and value-added services rather than pure intermediation

## 6.4: Leo Economy KPI Framework

**Table 6.2: LEO Economy KPI Framework — Phased Development (2026–2035)**

KPI Area	Phase I Foundations (2026–2027) Readiness Gates 1–2	Phase II Commercialization (2028–2030) Readiness Gates 2–4	Phase III Scaling & Internationalization (2031–2035) All Readiness Gates
<b>A. Institutional Infrastructure (Proposal 1)</b>	<ul style="list-style-type: none"> <li>Establish one LEO coordination unit within CEDB</li> <li>Publish 30-day spectrum licensing service target</li> <li>Launch “HK LEO Market Entry Package”</li> <li>Complete one government anchor-customer procurement</li> </ul>	<ul style="list-style-type: none"> <li>Serve <math>\geq 5</math> international LEO operators</li> <li>Hong Kong participates as gateway in <math>\geq 3</math> international forums</li> <li>100% of standard applications completed within 30 days</li> </ul>	<ul style="list-style-type: none"> <li><math>\geq 2</math> jurisdictions adopt HK entry package as reference model</li> <li>Average approval time for complex licences <math>\leq 90</math> days</li> <li>Publish annual LEO regulatory performance report</li> </ul>
<b>Space Finance (Proposal 2)</b>	<ul style="list-style-type: none"> <li>Establish LEO Finance Centre within HKMA/HKEX</li> <li>Issue one RMB-denominated satellite leasing bond (pilot)</li> <li>Approve HK\$2B LEO innovation fund structure</li> <li>Introduce tax incentives (200% R&amp;D deduction)</li> </ul>	<ul style="list-style-type: none"> <li><math>\geq 2</math> RMB satellite bonds attract international investors</li> <li>One parametric insurance product commercialised</li> <li><math>\geq</math>HK\$1B LEO financing arranged via Hong Kong</li> </ul>	<ul style="list-style-type: none"> <li><math>\geq 5</math> RMB LEO financial products in operation</li> <li><math>\geq 3</math> LEO firms in Series A/B funding stage within portfolio</li> <li>Cumulative LEO financing <math>\geq</math>HK\$5B</li> </ul>
<b>Legal &amp; Arbitration (Proposal 4)</b>	<ul style="list-style-type: none"> <li>Publish two standard space contract templates</li> <li>Complete feasibility study for space law chamber</li> <li>Design space law LLM programme</li> </ul>	<ul style="list-style-type: none"> <li>HKIAC space law chamber operational</li> <li><math>\geq 2</math> disputes or advisory cases handled</li> </ul>	<ul style="list-style-type: none"> <li><math>\geq 10</math> space-related cases handled annually by HKIAC</li> <li><math>\geq 20</math> LLM graduates enter industry</li> </ul>

KPI Area	Phase I Foundations (2026–2027) Readiness Gates 1–2	Phase II Commercialization (2028–2030)Readiness Gates 2–4	Phase III Scaling & Internationalization (2031–2035)All Readiness Gates
		<ul style="list-style-type: none"> <li>• First LLM cohort launched (HKU/CUHK)</li> </ul>	<ul style="list-style-type: none"> <li>• ≥2 Belt and Road jurisdictions adopt HK SLA templates</li> </ul>
<b>B. Commercial Development - Analytics &amp; LEIF (Proposals 3 &amp; 5.2)</b>			
	<ul style="list-style-type: none"> <li>• Allocate HK\$500M for initial LEIF funding</li> <li>• ≥5 Tier-1 exploratory grants issued</li> <li>• One anchor-customer analytics contract signed</li> <li>• Establish 70–85% gross margin benchmark</li> </ul>	<ul style="list-style-type: none"> <li>• ≥3 Tier-2 projects enter institutional testing</li> <li>• Three analytics product lines with paying customers</li> <li>• ≥1 parametric cargo insurance product launched</li> <li>• ≥1 “dark vessel / AML” product adopted by banks</li> </ul>	<ul style="list-style-type: none"> <li>• ≥3 products achieve ≥70% gross margin</li> <li>• ≥2 “unexpected applications” validated</li> <li>• ≥5 analytics product lines with recurring revenue</li> </ul>
<b>Anchor Company (Proposal 6)</b>			
	<ul style="list-style-type: none"> <li>• InvestHK develops dedicated HQ support package for LEO firms</li> <li>• Initiate one formal negotiation (e.g., Galaxy Space / G60)</li> </ul>	<ul style="list-style-type: none"> <li>• One mainland LEO operator establishes substantive HQ in Hong Kong</li> <li>• ≥50 full-time professional staff</li> <li>• ≥5 supporting firms co-locate</li> </ul>	<ul style="list-style-type: none"> <li>• ≥2 additional mainland LEO firms establish presence</li> <li>• ≥20 firms form ecosystem cluster</li> <li>• ≥5 markets served from HK-based HQ</li> </ul>
<b>C. Innovation &amp; Talent - Innovation Hub (Proposal 5)</b>			
	<ul style="list-style-type: none"> <li>• HKSTP InnoSpace+ LEO hub operational</li> <li>• One national constellation data API agreement signed</li> </ul>	<ul style="list-style-type: none"> <li>• ≥5 LEO academic chairs established</li> <li>• ≥10 overseas specialists admitted via Tech.Pass-type scheme</li> <li>• ≥3 industry-academia pilot projects (LEIF Tier-2)</li> </ul>	<ul style="list-style-type: none"> <li>• ≥20 research and industry professionals based in hub</li> <li>• ≥5 projects graduate to market deployment</li> <li>• ≥10 new ventures incubated annually</li> </ul>

## 6.5 Synthesis: One Integrated Conclusion

Taken together, the four guiding question answers and the strategic evidence across Chapters 2–5 lead to one integrated conclusion: Hong Kong can secure a meaningful role in the national and global LEO economy, but only by treating LEO as a long-horizon innovation system. The city should not attempt to replicate the mainland's upstream hardware strengths. Its competitive path is to convert China's growing LEO capacity into trusted, bankable, internationally usable products and services — the role most consistent with Hong Kong's institutional strengths, and the role most likely to remain commercially valuable as the national LEO sector continues to mature.

### Final Comment

The window is now open. The correct strategy is neither passivity nor overstatement. It is patient institution-building, constant experimentation, and relentless conversion of national technological progress into internationally competitive products and services.

— End of Report —

# 第一章：引言

## 1.1 研究背景：香港的晚起步，以及下游領域的重要性

低軌衛星正逐漸成為新一輪經濟發展的基礎設施，其價值不僅體現於通信或地球觀測本身，更在於基於這些能力，在物流、金融、保險、合規、交通移動及數據驅動決策等領域衍生出的多元服務體系。隨著低軌系統的規模化發展，產業價值創造的重心正從「將硬體送入軌道」轉向「在地面構建可靠、受信任且具商業價值的服務體系」。

全球低軌產業已進入競爭白熱化階段，國家級衛星座、民營運營商及大規模軌道申請均表明，低軌不再是狹義的技術領域，而是成為戰略與經濟競爭的核心賽道。表一列出 2024–2025 年全球十大航天經濟體的年度估計收入排名，涵蓋上游製造、發射至下游衛星服務與應用的完整價值鏈。在此背景下，香港參與該產業發展既具緊迫性，也面臨「晚入局」的現實挑戰。[37]

然而，香港入局時並不具備航天產業上游的核心資源：無發射場地、無本土火箭製造基礎、無推進技術或軌道系統工程領域的制度經驗。因此，香港不宜以模仿上游發展模式定義產業成功，其核心戰略命題在於：如何在大規模衛星座部署的產業生態中，佔據具備盈利性的發展位置。

這一定位並非退而求其次的選擇。當產業重心從硬體擁有轉向商業化應用，香港在金融、法律、仲裁、保險、數據治理及國際中介服務的制度優勢，反而變得更為重要。本報告的核心政策命題在於：香港如何將與內地聯動的低軌能力，轉化為受全球認可、具投資價值、可國際化推廣且商業可持續的高價值服務。

表一、全球十大航天經濟體年度收入排名（2024–2025 年估計）

排名	經濟體	估計收入 (十億美元)	市場份額 (約)	主要驅動因素
1	美國	3,750–3,850 億	約 62%	SpaceX/星鏈主導地位、龐大國防預算（770 億美元以上）、地面系統。
2	中國	950–1,100 億	約 17%	國網/G60 低軌星座、國家支持的製造業、年複合增長率 10.3%。
3	日本	300–350 億	約 5%	下游精密硬件、全球導航衛星系統、先進機械人技術。
4	英國	240–270 億	約 4%	Eutelsat OneWeb、高增值衛星服務、海事電信。
5	法國	190–220 億	約 3%	空中巴士/泰雷茲製造、地球觀測、阿里安 6 號發射服務。
6	德國	140–170 億	約 2.5%	新太空創業生態系統 (Isar/RFA)、高精度光學元件。
7	印度	100–120 億	約 1.8%	具成本效益的發射服務（印度空間研究組織）、不斷擴展的商業生態系統、年複合增長率 9.5%。
8	南韓	80–100 億	約 1.5%	國防航天快速發展、韓國增強衛星系統 (KASS)、海事通訊。
9	意大利	70–90 億	約 1.2%	軌道物流 (D-Orbit)、國際空間站貨運、航天製造。
10	盧森堡	50–70 億	約 1.0%	SES 衛星集團、航天金融、歐洲最高航天業佔 GDP 比率 (0.135%)。

## 1.2 下游主導：太空經濟產業逾 90% 的收入來源於製造與發射環節之外

2024 年全球航天經濟總規模達約 6130 億美元，2020 年以來年複合增長率約 7.8%，預計 2026 年初將接近 7120 億美元，2035 年將達約 1.4 萬億美元。

[37] 收入區間與市場份額數據採用「自下而上三角驗證法」，以太空基金會 (Space Foundation) 2024 年 6,130 億美元全球基準值為核心，輔以官方政府報告、企業財務披露及經驗證的產業增長預測。本表旨在作為戰略框架工具，凸顯香港在全球低軌 (LEO) 經濟中的定位，既反映美中兩國的主導地位，也體現盧森堡、英國等聚焦下游經濟體的發展可行性。

現代航天經濟的核心特徵在於，絕大部分商業價值創造於製造與發射環節之外。如表二所示，產業上游僅佔全行業收入的 5% 至 10%，而絕大部分收入來源於下游環節，包括地面設備、衛星應用服務及各類地面衍生應用。若採用更廣義的航天經濟界定標準，製造與發射環節的收入佔比將進一步降低。

對於香港而言，這一收入結構的意義不僅在於下游價值規模龐大，更在於價值獲取的方式。如表三所示，下游收入部分來源於衛星相關服務及數據應用的回報；同時，表四表明，間接產業價值還通過結構化項目融資、普通法合同制定與國際仲裁、跨境數據治理與合規等間接中介服務實現增值。綜合來看，低軌經濟的商業重心並非硬體生產，而在於服務交付、資源整合及制度中介的產業生態——這正是香港在「一國兩制」框架下，作為內地運營商與全球市場橋樑的獨特優勢所在。

產業下游的主導地位，隨著上游成本持續下降進一步強化。在發射成本降低、衛星部署規模化的背景下，硬體與軌道定位接入已逐漸成為產業發展的基礎要素，而非商業利潤的核心來源。整個產業的價值重心，正轉向、集中於具備以下能力的市場參與者：能夠將衛星數據整合為客戶定制化解決方案、管理法律與商業風險、設計交易架構，並提供穩定可靠的終端應用項目。

對於香港而言，產業下游具主導地位，是整體發展戰略的基礎。香港無需在缺乏規模與比較優勢的領域參與競爭，而應聚焦於產業價值高度集中的賽道——這也是為何產業下游（而非發射或製造）應成為香港低軌產業的核心發展領域。

國際經驗進一步印證了這一觀點：德國、英國、盧森堡、新加坡等國家的實踐表明，即便無獨立發射能力，經濟體仍可通過產業系統整合、服務生態構建、金融、法律、治理及區域商業中介等方式，深度參與低軌產業發展（表五）。

由此得出的政策啟示是：香港無需硬生生照搬某一國家的發展模式，且「發射主權」並非獲取產業價值的先決條件，關鍵在於經濟體能否在產業價值鏈中，佔據具備盈利性且受全球信任的位置。

表二、全球太空經濟收入構成（2024 年）[38]

分部	收入（約數）	佔狹義衛星產業收入比重（約 2930 億美元）	佔完整太空經濟收入比重（約 6130 億美元）
(1)發射服務	約 90 億美元	約 3%	約 1%
(2)衛星製造	約 200 億美元	約 7%	約 3%
<b>(1)+(2)小計</b>	<b>約 290 億美元</b>	<b>約 10%</b>	<b>5%</b>
(3)地面設備及營運	約 1560 億美元	約 53%	約 25%
(4)衛星服務	約 1080 億美元	約 37%	約 18%
<b>(3)+(4)小計</b>	<b>約 2630 億美元</b>	<b>約 90%</b>	<b>約 43%</b>
(5)地面賦能解決方案	約 3200 億元	—	約 52%
<b>完整太空經濟</b>	<b>約 6,130 億美元</b>	<b>100%</b>	<b>100%</b>
<b>(1)+(2)+ (3)+(4)+(5)總計</b>			

[38] 備注：2024 年衛星產業各細分領域收入數據，引自布萊斯科技（BryceTech）為衛星產業協會（Satellite Industry Association）編製的《2024 年全球衛星產業收入報告》；2024 年全球航天經濟總規模 6130 億美元數據，引自太空基金會（Space Foundation）發布的《2025 年第二季度航天報告》。「地面賦能解決方案」（Terrestrial enabled solutions）為作者透過計算得出，即全球航天經濟總規模與衛星產業總收入的殘差。至於更廣義的「賦能經濟」概念詮釋框架，則參考 Neoh（2025 年）的相關研究。

表三、低軌衛星高層業務範疇及對應服務 [39]

高層業務範疇	對應低軌衛星服務
全球連接服務	寬頻互聯網（固定、企業及流動）；回傳（backhaul）及幹線傳輸服務；衛星直連終端（Direct-to-Device, D2D）；緊急及災害應對通信；政府安全通信
定位、導航與授時	高精度定位與導航服務；精確授時與同步服務；全球導航衛星系統（GNSS）增強與韌性服務
地球觀測與情報	光學及合成孔徑雷達（SAR）遙感；氣象及環境監測；海事監察（AIS、暗船識別）；航空追蹤（ADS-B）；地理空間分析與變化監測
物聯網與機器對機器服務	全球物聯網連接；遠端資產追蹤與監控；工業感測數據回傳；分散式系統數據分發
移動性與垂直應用解決方案	海事連接與船舶運營；航空機上連接；陸地流動（車輛、鐵路、偏遠基建）；專業 B2B 垂直行業解決方案

表四、香港低軌衛星經濟的間接收入來源 [40]

核心相關業務範疇	具體間接收入來源
結構性項目融資	香港金融機構為 LEO 衛星項目提供融資（貸款安排、債券發行、股權融資）所產生的費用；參與相關投資所得的投資收益；風險評估、金融結構設計及融資顧問費；相關業務帶來的利得稅收入
上市與資本市場服務	香港交易所費用（首次上市、年費、交易、結算、數據授權）；專業中介費（保薦人 / 承銷、律師、會計師、估值師）；持續合規服務費；專業服務帶來的稅收
國際仲裁與太空法	LEO 合約設計及爭議解決的法律顧問費；香港國際仲裁中心（HKIAC）仲裁費；太空法顧問及交易法律服務費；太空法專業培訓與認證收入
航天保險與風險轉移	由香港保險公司承保的發射及在軌保險保費；參數型保險產品費用；再保險中介費；保監局對相關產品的監管與牌照收入
跨境數據治理與合規	跨境數據傳輸合規、數據安全評估與治理設計的顧問費；LEO 數據跨境流動的合規審計服務費；相關專業培訓與認證收入

表五、發射能力與 LEO 價值捕捉比較（以美元計） [41]

經濟體	獨立發射能力	具代表性的項目
美國	有	政府航天支出約 770 億美元（2024）；全球 124 億美元 SpaceTech 投資中約 73 億美元來自美國（2025）
中國	有	2025 年約 90 次發射；國網星座 136 顆；千帆擁約 108 顆
日本	有	JAXA 太空戰略基金約 67 億美元（10 年）；商業生態持續擴展
印度	有	2025–26 年太空預算約 14.6 億美元；創投基金約 1.09 億美元
法國	無（ESA）	ESA 部長級會議承諾 223 億歐元（約 259 億美元）；IRIS <sup>2</sup> 核心參與者
德國	無（ESA）	OHB 收入約 11.1 億美元（2024）；ESA 最大出資國之一
英國	無（ESA）	太空產業收入約 233.8 億美元；就業約 48,800 人
盧森堡	無（ESA）	SES 收入超過 23.2 億美元（2024）；全球領先太空金融與法律中心
新加坡	無	約 70 間太空企業（涵蓋製造、服務、數據處理）；政府投入 2.7 億新元（STDP）；專注 SAR、小型衛星與量子安全通信；預計僅地球觀測應用可於 2030 年為東南亞 GDP 帶來 1,000 億美元增量；2026 年成立國家太空署（NSAS）

### 1.3 政策指導問題

本報告是一份政策導向的分析建議報告，核心戰略主張為：香港應聚焦低軌經濟的下游、制度與創新密集型領域參與全球競爭。整體分析圍繞四大核心問題展開：

[39] 數據來源：POD 研究團隊整理。

[40] 資料來源見附錄 B。

[41] 數據來源：附錄 A。德國、英國、盧森堡為收入數據可驗證的參照國，公開可獲得具體的產業總收入或板塊收入數據；新加坡為區域參照國示例，其「應用為先、不依賴硬體」的發展戰略與本報告為香港建議的策略一致，但尚未公開可與英國（約 230 億美元）、盧森堡（SES 公司收入）媲美的產業價值捕捉總數據，新加坡的案例主要用於佐證戰略方向，而非已驗證的收入規模。

1. 中國本土低軌產業的技術成熟度、研發能力及產業發展水平如何，為香港帶來了哪些下游發展機遇？
2. 在國家低軌經濟發展體系中，香港的比較優勢、約束條件及現實制度功能是什麼？
3. 最適合香港的戰略框架是什麼？基於市場成熟度與制度準備度的差異，如何制定科學的實施時序？
4. 從盧森堡、英國、新加坡等國際經驗中，非火箭發射國家可汲取哪些啟示，以掌握長線產業價值？

## 1.4 研究目標

本研究旨在為香港低軌經濟發展構建可落地的政策框架，具體目標包括：

- 從經濟角度（而非單純技術視角）闡明低軌經濟的內涵及特色，指出成熟服務市場與創新密集型市場的區分；
- 界定將低軌衛星數據輸出轉化為商業價值的三大核心商業模式，並闡釋香港的定位與參與方式；
- 梳理香港在「中港低軌產業鏈」中的獨特中介角色，明確指出內地實現國際商業化的銜接節點與中港合作界面；
- 識別產業商業化的四大核心瓶頸——長周期融資、風險轉移、法律可執行性、受信任的數據治理，並分析其對不同市場類型的影響；
- 提出具體政策方向，明確指出香港的行動領域的優先次序、試點方向及商業化所需的構建制度能力。

## 1.5 研究方法

本研究採用政策分析方法，融合文獻分析、不同地區低軌經濟發展對比、概念框架構建、產業鏈梳理及定向定量分析，既實現對產業結構的審視，也基於審視結果為香港提出可行的發展戰略。

# 第二章：低軌經濟與國家戰略：利益相關方須知

低軌（LEO）經濟的興起，代表二十一世紀最具深遠影響的技術與商業轉型之一。任何希望在香港未來LEO經濟發展的利益持分者，均應清楚認識：有意義的參與路徑並非從本地出發，而是透過理解中美戰略競爭下所構建的國家政策框架。本章檢視此背景的四個相互關聯維度：LEO經濟形成所需滿足的技術條件；國家發展LEO經濟長期積累的技術能力；中美在LEO領域的競爭動態及中國縮小與美國差距的努力；以及中國商業選擇和地緣戰略考量。

## 2.1 LEO 經濟形成的技術前提條件

低軌經濟的形成並非僅由市場需求驅動，而是依賴於一系列相互關聯的技術先決條件——上軌能力、衛星製造、頻譜治理及地面基礎設施，缺乏這些條件，商業服務便無法實現可靠部署與規模化發展。

### 2.1.1 軌道進入與發射經濟學

上軌能力是發展健全低軌衛星經濟的**首要技術條件**。如表六所述，重點不在能否發射衛星，而在是否能以合理成本、足夠發射頻率與規模，長期支援衛星星座的建置、補充與升級。以商業角度而言，發射成本效益決定低軌系統能否脫離示計畫，成為穩定、可長久使用的通訊、數據與服務基礎建設。

發射產業的真正價值，在於成本高低與商業擴張能力之間的平衡。如果發射費用昂貴、發射次數不足、作業又不穩定，衛星星座業者就很難維持穩定連續的訊號覆蓋，無法按時更換使用到期的衛星，也沒辦

法跟上市場需求來擴充網路容量。反過來說，一旦發射服務變得更穩定、成本更低、產業化更成熟，就能為大規模的下游應用，以及更可預期的商業化發展，打下堅實基礎。

香港的發展前景，取決於我們國家是否擁有**足夠強大的火箭發射體系**，能夠長期、大規模地佈建衛星星座。從這個角度來看，對比之所以重要，並不是因為它描述香港直接負責的業務，而是因為它點出了**上游產業的關鍵條件**——只有這個條件成立，香港才能發揮後端下游的角色。國家的火箭發射系統越強、擴充規模的能力越好，香港就越有機會成為一個平台，專門負責低軌道衛星應用的：融資、法律架構設計、服務整合，以及國際商業化推廣。

**表六、中美代表性火箭發射成本對比[42]**

對比指標	美國 (SpaceX 獵鷹 9 號)	中國 (主流長征系列)
代表性火箭	獵鷹 9 號 Block 5 (可重複使用)	長征系列 (2C/2D/3B/6/8) —— 本表統計期內均為一次性火箭
低軌每公斤發射成本	14,000–18,000 元 / 公斤 (批量 / 議定商業價格)	28,000–50,000 元 / 公斤 (主流商業價格)
相對於獵鷹 9 號成本倍率	基準 (1 倍)	1.6–3.6 倍
火箭可重複使用性	一級火箭完全可重複使用	可重複使用計劃推進中，2026 年 3 月前中國尚未有可重複使用火箭進入主流商業服務
獵鷹 9 號成本優勢來源	一級火箭可重複使用，節省約 60%-70% 的火箭總成本；垂直整合模式 (發動機、結構、航電、軟件均自主研發)，消除外部供應商利潤；高發射頻率 (2024 年發射 158 次)，快速攤薄固定成本	主要採用一次性火箭架構；國有企業體制缺乏 SpaceX 的垂直整合模式；成本劣勢具結構性，但隨著藍箭航天朱雀三號等可重複使用火箭的發展，差距正逐步縮小
2026 年發展展望	星艦計劃進一步大幅降低成本，完全重複使用後每公斤發射成本或低於 100 美元	2026 年是朱雀三號回收與重複使用測試的關鍵年，測試成功將標誌著中國首款具商業可行性的可重複使用火箭誕生

### 2.1.2 衛星製造與大規模生產

**第二項技術前提**，是具備星座級部署所需的產量、可靠度及成本的衛星製造能力。SpaceX 位於華盛頓州雷德蒙德的 Starlink 生產設施日產約 10 顆衛星 (每週約 70 顆)，採用高度自動化組裝線，自產推進、航電及軟體，單顆衛星成本介於 50 萬至 100 萬美元之間。

中國衛星製造基礎正快速擴張。銀河航天 (Galaxy Space) 已展示批量製造能力，完成 30 餘顆測試衛星，並擁有瞄準高產量的生產設施。時空道宇 (Geespace) 運營衛星超級工廠模式，商業衛星製造商包括長光衛星、微納星空、國星宇航等正擴大產能。中國商業衛星製造業在絕對產量、自動化整合及單位成本效率上仍落後 SpaceX，但縮小差距已成為「十四五」規劃明確優先事項。

### 2.1.3 頻譜治理與地面基礎設施

**第三項技術先決條件**是要通過國際電信聯盟 (ITU) 的登記與協調機制，實現射頻頻譜與軌道位置的有效治理。先申請、先部署的運營商將佔據更優質的軌道層與頻段，形成資源配置的先發優勢。中國在 2025 年 12 月 25 日至 31 日間申請約 20.3 萬個衛星軌道位置，正是為了在資源擁擠前搶佔頻譜與軌道資源的戰略佈局。[43]

**第四項技術先決條件**，是地面基礎設施——具體包括門戶站、遙測跟蹤與指令 (TT&C) 設施，以及使用者終端。低軌通信服務的實際性能好不好，很大程度上取決於兩個關鍵：一是地面站的分佈密度和地理佈局是否合理，二是使用者終端的成本高低以及是否容易獲取。在這一領域，行業已有明確的突破案例：SpaceX 推出的自組裝相控陣終端，售價僅為 349 至 600 美元，大大降低了消費者使用低軌通信

[42] 匯率：1 美元 = 7.1 人民幣 (2024 年平均匯率，中國人民銀行)；數據 2026 年 3 月核實。數據來源：詳見附錄 B。

<sup>43</sup> The ~203,000 ITU slot filings represent spectrum reservation strategy; China's current operational deployment plans total approximately 28,000 satellites across Qianfan and Guowang constellations."

服務的門檻；國內方面，中國衛星星座運營商也在積極研發，力求推出具備市場競爭力的地面終端解決方案。聚焦香港地區，銀河航太香港公司聯合香港電訊環球示範站，成功實現了 100Mbps 以上的雙向通信性能。這一成果也標誌著，國家衛星星座在香港的商業化部署進程中，地面基礎設施的建設正穩步推進、持續完善。

## 2.2 中國在 LEO 發展的長期積累

中國在太空領域的發展，遠比商業低軌道衛星時代早數十年。瞭解這段長期累積的制度與技術經驗非常重要，因為只有放在國家整體實力建構的大格局下，才能看清香港的定位。

### 2.2.1 北斗作為從落後追趕的模板

北斗衛星導航系統，是大陸發展低軌衛星最具參考價值的國內先例。2000 年北斗剛推出時只是區域系統，當時 GPS 早已主導全球，北斗處於明顯劣勢：美國 GPS 有超過 20 年營運經驗、全球龐大使用者裝置，並在航空、航海、精準農業等領域成為事實上的國際標準。大陸的對策是有計畫、分階段追趕：先建立區域能力，再擴及全球，每個階段都運用前一階段累積的技術與制度經驗。到 2020 年，北斗三號（BDS-3）以 35 顆衛星完成全球覆蓋，關鍵指標表現已與 GPS 相當，甚至更優異。

北斗的發展歷程，正好對大陸低軌衛星計畫，帶出三個示範重點：只要國家長期堅持，關鍵基礎建設技術從後追上是做得到的，重點在戰略決心與制度組織，不只是技術問題。標準與管理制度和技術一樣重要：北斗要被國際採用，不只需要卓越性能，還要獲得國際電信聯盟（ITU）認可、國際相容標準，以及訊號穩定的可信賴機制。當然，商業成功不能只靠佈建衛星，還要刻意打造下游應用生態系。

對香港的低軌衛星策略來說，北斗的例子有明確啟示：就像北斗要靠下游應用，才能把衛星能力轉為經濟價值；大陸低軌衛星同樣需要下游體系，而香港正好可以在其中扮演核心的制度與服務角色，把軌道資源轉成國際信任、具商業價值的服務。

### 2.2.2 國家規劃與產業目標

中國已公佈兩大核心國家級低軌衛星星座計畫：由上海航太電子技術研究院牽頭、上海垣信衛星科技有限公司運營的千帆計畫（G60），規劃部署約 1.5 萬顆衛星，截至 2025 年 12 月已入軌 108 顆組網衛星；由中國衛星網路集團主導的國網（GW）星座，規劃部署約 1.3 萬顆衛星，2025 年 12 月底已入軌 136 顆。僅兩大星座公開規劃總量已近 2.8 萬顆。

「十四五」規劃（2021-2025 年）將商業航太與衛星互聯網提升至前所未有的戰略高度，行業獲得大規模公共投資、製造基地優先土地供應、商業發射審批流程簡化及專業產業園區建設等一系列政策支援。「十五五」規劃期（2026-2030 年）預計將成為中國低軌產業從「基礎設施投資」向「商業服務部署」轉型的關鍵階段——這一階段，香港的「超級連絡人 / 超級增值人」仲介角色將凸顯關鍵商業價值。

## 2.3 國家 LEO 產業地理：空間分工、製造集中與內需導向

中國低軌經濟的國家戰略，不僅是衛星研製計劃，更是一套精細的產業地理布局——不同區域被賦予專業化角色，共同構建完整的國家產業鏈。如表七所示，這一空間勞動分工具備高度的架構性精準度：海南文昌作為國家及商業發射基地，是火箭發射基礎設施與新興國際航天城的核心；上海作為火箭與衛星量產中心，承擔著火箭、衛星的大規模量產任務，並集聚 G60（千帆）星座核心產業集群；北京與雄安新區是星座運營與空天信息示範核心區，中國衛星網路集團（負責國網星座運營的國企）總部及衛星互聯網應用核心研發機構均佈局於此；深圳作為商業衛星產業鏈新樞紐，提供衛星核心部件、相控陣天線及地面終端設備；西安與武漢是傳統航天研發測試基地，供應衛星平臺、有效載荷研發及精準工程能力；成都被定為高階應用研發、軌道計算能力及「人工智慧 + 衛星」融合發展核心區；南通則承擔地面站運營與數據中繼的配套角色，為上海的火箭與衛星製造生態提供支撐。這一功能分工是「十四五」與

「十五五」規劃期的刻意設計，體現了國家推動低軌產業系統「跨地理集群垂直與水平整合」的戰略決心，而非將產業能力集中於單一區域。

在這一戰略化產業地理布局的背景下，表八展示的 2025 年區域收入數據，揭示了中國內地低軌經濟與全球產業格局的顯著結構性差異：在八大核心低軌產業樞紐中，**製造、發射及硬體業務**合計佔產業總收入的約 58%——其中武漢達 73.7%、深圳達 75.2%，北京與雄安新區相對較低但也達 37%。與之形成對比的是，本報告表二顯示，製造與發射環節僅佔全球狹義衛星產業收入的約 10%、廣義航天經濟的約 5%。可見，**中國內地低軌經濟仍高度集中於上游製造層級**，非製造業收入——包括衛星服務、數據處理、應用研發及生態服務——在內地各區域平均僅佔約 42%，而全球狹義衛星產業的非製造業收入佔比高達 90%。這一非製造業發展的短板並非僅存在於二線區域：即便是最具分析與服務屬性的北京與雄安新區，其低軌收入中仍有 37% 來源於製造相關業務。結構性啟示十分明確：中國國家低軌經濟目前仍以「基礎設施建設」為核心，尚未轉型為「服務與應用導向」的經濟形態。而中國製造業為主的產業結構與全球下游為主的收入結構之間的差距，正是香港具備戰略定位優勢的核心空間。

表八中可見的第二項結構性不對稱，在於對國內需求的高度依賴。綜合八大地區數據，國內交易收入約佔低軌（LEO）產業總收入的 85%，海外交易僅貢獻約 15%。這種國內市場集中的特徵在各地區均保持一致：南通的海外收入為零，因其核心功能是提供本土地面站及供應鏈支援；武漢與西安的海外收入均不足 3%；而作為國家星座運營總部所在地的北京及雄安新區，其國際交易收入僅佔總收入的 5%。就海外收入佔比而言，深圳是最具國際化導向的樞紐，達約 30.9%，這反映出其作為商業衛星製造及零部件出口中心的定位；上海緊隨其後，約為 27.7%，其憑藉電子製造業積累的硬體出口能力，是國際收入的主要驅動力。中國低軌經濟第三大出口地區為文昌，海外收入佔比 16.7%，這歸因於其作為服務國際客戶的國家級 / 商業發射基地的角色。

綜合表七與表八，香港低軌產業的戰略定位具備了明確的實證背景：中國已構建起架構清晰、地理分佈的低軌產業體系，硬體與基礎設施領域發展迅速，但從「物理基礎設施」向「商業服務」與「國際市場布局」的轉型仍處於初期階段。內地低軌經濟的製造業屬性與本土需求依賴，證實了全球毛利率最高的「下游服務、數據分析與國際化功能」，與中國龐大的星座部署目標之間仍存在顯著的發展短板。15% 的海外收入佔比並非產業天花板，而是在適中介基礎設施支撐下，具備巨大商業擴張潛力的基線。而這一領域，正是香港的制度比較優勢——普通法可執行性、國際金融基礎設施、受信任的數據治理及全球市場商業聯繫——最具戰略意義的應用場景。隨著中國「十五五」規劃期（2026-2030 年）迎來從「基礎設施部署」向「商業應用與服務規模化」的關鍵轉型，當前正是香港構建制度與創新體系，成為中國低軌能力「海外商業化層級」的黃金窗口。

本報告聚焦低軌（LEO）衛星經濟及其上下游產業供應鏈。酒泉衛星發射中心雖執行部分中低軌科學衛星任務，但僅限實驗與研究用途，並非用於大規模商業低軌衛星星座佈署。此外，酒泉不具備文昌等低緯度發射場的地理優勢，不利高效率、大規模低軌發射。即便近期媒體與政策討論將酒泉納入國家低軌經濟發展布局，仍未改變其核心戰略定位與商業低軌衛星發射能力的侷限性。由於酒泉以發射任務為主，非本研究強調的低軌核心產業鏈環節，因此本節探討西安於低軌經濟之角色時，未將其納入分析。

表七、國家低軌衛星產業區域分工總覽（2026）

地區	核心定位	2026年重點項目	2026年關鍵指標	2025年硬件範疇收入	2025年軟件範疇收入
海南文昌	發射基地	海南商業航天發射場二期（3、4號工位）；文昌國際航天城；構建「火箭鏈、衛星鏈、數據鏈」產業生態	<ul style="list-style-type: none"> <li>文昌航天城入駐航天企業超過700家</li> <li>3、4號工位於2026年底具備發射能力</li> <li>年發射能力 ≥ 60次</li> </ul>	火箭發射服務；航天製造配套零部件；地面站硬件設備；發射場配套硬件研發與銷售	產業園營運；企業孵化；航天數據服務；產業配套諮詢；發射場營運支援（不含發射服務）
上海	火箭與衛星批量製造中心	「千帆星座」低軌寬帶星座；G60星鏈；「上海衛星」「上海火箭」商業航天製造集群	<ul style="list-style-type: none"> <li>2026年中約324顆、年底約648顆衛星</li> <li>初步實現全球覆蓋</li> <li>年產能：數十枚火箭、600顆衛星</li> </ul>	火箭與衛星整機及核心硬件製造；精密航天零部件加工	星座規劃；產業鏈整合；衛星數據中繼與處理；技術諮詢
北京及雄安	國家星座運營、信息產業中心	中國衛星網絡集團總部（國網星座）；雄安衛星製造與智能製造平台	<ul style="list-style-type: none"> <li>集聚相關機構 ≥ 400家</li> <li>承擔大規模衛星互聯網運營與應用</li> </ul>	衛星整機製造；核心硬件研發；航天測試設備	星座運營準備；空天信息平台運營；研發測試服務；產業集群管理；應用場景開發
深圳	商業衛星產業鏈高地	核心部件、相控陣天線、終端設備及應用平台；複製手機產業鏈模式	<ul style="list-style-type: none"> <li>為千帆、國網等星座提供核心供應</li> <li>中國兩大衛星互聯網製造與應用中心之一</li> </ul>	衛星核心部件；天線；終端硬件；星載電子設備	應用平台營運；售後與技術支援；產業數字化服務；場景定制
武漢	國家級商業航天產業基地	火箭、衛星平台、地面設備與應用研發與生產一體化	<ul style="list-style-type: none"> <li>支援國家高密度發射需求</li> <li>上下游協同發展能力完整</li> </ul>	火箭與衛星平台部件；地面設備；測試儀器	測試與校準服務；產業配套服務；衛星數據應用推廣
西安	傳統航天研發基地	低軌衛星平台與載荷研發與測試	<ul style="list-style-type: none"> <li>支援導航、通信、遙感星座規模化生產</li> </ul>	衛星平台與載荷製造；精密核心部件	研發設計服務；測試與認證服務
成都	航天應用 + 在軌算力 + 應用	在軌計算、AI + 衛星、遙感與邊緣計算應用	<ul style="list-style-type: none"> <li>2026年提升在軌算力與數據處理能力</li> <li>透過數據應用提升在軌資產價值</li> </ul>	配套硬件；在軌計算設備；航天電子部件	在軌算力服務；數據分析；AI算法開發；區域應用服務
南通	支援上海為主，地面站與數據中繼樞紐	長三角地面站集群；數據中繼服務	<ul style="list-style-type: none"> <li>提升千帆等星座數據吞吐量與覆蓋能力</li> </ul>	地面站硬件；航天配套零部件	地面站營運；數據中繼與傳輸；數據儲存服務

表八、2025年中國低軌衛星產業區域收入雙維度指標（以億元人民幣計）[44]

地區	產業總收入	硬件收入	軟件收入	內銷收入	外銷收入
海南文昌	19.8 (100%)	11.6 (58.6%)	8.2 (41.4%)	16.5 (83.3%)	3.3 (16.7%)
上海	42.6 (100%)	31.1 (73.0%)	11.5 (27.0%)	30.8 (72.3%)	11.8 (27.7%)
北京及雄安	58.3 (100%)	21.6 (37.0%)	36.7 (63.0%)	55.4 (95.0%)	2.9 (5.0%)
深圳	37.9 (100%)	28.5 (75.2%)	9.4 (24.8%)	26.2 (69.1%)	11.7 (30.9%)
武漢	15.6 (100%)	11.5 (73.7%)	4.1 (26.3%)	15.2 (97.4%)	0.4 (2.6%)
西安	18.5 (100%)	13.2 (71.4%)	5.3 (28.6%)	18.1 (97.8%)	0.4 (2.2%)
成都	12.7 (100%)	5.1 (40.2%)	7.6 (59.8%)	11.9 (93.7%)	0.8 (6.3%)
南通	8.9 (100%)	2.1 (23.6%)	6.8 (76.4%)	8.9 (100%)	0.0 (0%)
總收入	214.3 (100%)	124.7 (58.2%)	89.6 (41.8%)	183.0 (85.4%)	31.3 (14.6%)

[44] 數據說明與來源：附錄 C

## 2.4 中美在低軌領域的競爭

美國與中國在低軌衛星領域的競爭，並非一般商業競爭，而是圍繞基礎建設、技術標準、市場准入與未來數位依賴度的戰略較勁。

### 2.4.1 Starlink 的戰略意義與先發優勢

SpaceX 旗下星鏈計劃在低軌通信市場建立了絕對的先發優勢：目前已部署約 1 萬顆衛星，驗證了巨型星座模式的商業可行性，實現了規模化商業收入，並在頻譜協調、星間激光鏈路管理等領域積累了豐富的運營經驗。俄烏衝突中，星鏈的戰略意義體現得淋漓盡致——在地面基礎設施遭破壞後，星鏈為烏克蘭軍民提供了韌性通信基礎設施，支撐無人機作戰與戰場協調。中國已在 5G 基站基礎設施上投入約 7000-8000 億元人民幣，對低軌全球通信技術的成熟可能導致大量地面投資被邊緣化存在戰略憂慮。由美國掌控、可規避國家地面網絡的全球通信架構，引發了各主要大國對通信主權的深度思考，這一問題沒有一個國家可忽視。

### 2.4.2 技術差距及其結構性根源

目前 SpaceX 和中國在低軌衛星群部署規模上的差距，核心原因就在於發射成本與效率的根本差異。SpaceX 的獵鷹 9 號火箭能重複使用，每次任務能搭載更多衛星，而且回收後很快就能再次發射——這些優勢讓它能以更快速度、更低花費部署衛星，這是中國現有火箭還沒達到的水平。2024 年 SpaceX 一共進行了 134 到 144 次發射，同一枚火箭助推器最短只要 13 天就能再次升空。如果按「每公斤運輸費」來算，中國的發射成本大概是 SpaceX 的 1.6 到 3.6 倍。

不過，這樣的成本劣勢並非永久。火箭引擎零件的 3D 列印技術快速進步，長征十二號、藍箭朱雀三號、天兵天龍三號等可重複使用商用火箭都進入關鍵測試階段。2026 年將是中國商用火箭驗證第一階垂直回收與重複使用技術的關鍵一年。這些發展顯示，兩者差距在 2026-2030 年間將明顯縮小。

### 2.4.3 軌道與頻譜資源競爭

中美競爭中最為激烈的領域，是對有限的軌道與頻譜資源的爭奪。SpaceX 為星鏈計劃申請約 4.2 萬個衛星軌道位置，加之亞馬遜柯伊伯、歐星 OneWeb 等運營商的申請，已對規劃中的低軌資源形成大量先佔先機。中國的三大國家級星座計劃，不僅是商業投資，更是一場資源爭奪行動：通過申請約 3 萬個衛星軌道位置並推進快速部署，中國正搶佔軌道與頻譜資源——此類資源一旦被別國先取得，便難以找到替代。

### 2.4.4 標準制定與數位排他風險

除資源競爭外，全球低軌通信標準的治理權是更長遠的焦慮點。若美國在低軌領域建立主導地位，並將中國運營商排除在互操作性協議、認證安排及標準制定機構之外，中國可能面臨類似半導體領域的技術孤立風險。這一風險進一步強化了中國加快本土低軌計劃、研發獨立技術體系的政治必要性，也直接決定了香港低軌項目可開展的國際合作類型——這一考量也為第五章探討的技術主權約束提供了依據。

## 2.5 地緣政治考量及其對 LEO 經濟的重要性

低軌道衛星經濟的地緣政治面向，本來就是商業邏輯的核心，而非附帶因素。由誰建置低軌道基礎設施、採用何種技術架構、依循誰的治理規範、為誰謀取利益，這些決策都和大國之間對於二十一世紀國際秩序的競爭密不可分。對香港而言，地緣政治環境直接決定了它擁有的機會、面對的限制，以及投資低軌道相關產業的戰略意義。

### 2.5.1 通訊主權與國家安全

俄烏衝突以實際戰場狀況，驗證了過去僅屬抽象概念的重要論點：在現代衝突中，掌握通訊基礎設施的控制權，往往成為關鍵勝負因素。對落實一國兩制的香港而言，國安層面的通訊安全並非僅關乎內地，

保障香港金融市場、物流運作、公民社會所依賴的通訊設施穩定、安全與完整，是中央與香港特區的共同利益。

### 2.5.2 技術主權與「卡脖子」風險

半導體的經歷，深深影響中國對科技依賴的戰略思維。美國出口管制先進晶片，重創華為與中國科技產業，這類弱點暴露，讓「卡脖子」成為中國產業政策的核心觀念。在低軌道衛星領域，潛在卡脖子環節包括：火箭技術、依賴美國設計半導體的衛星零件、地面終端設備，以及衛星星座運作的軟體與標準。對此，中國力求在低軌道完整產業鏈實現自主可控。

對香港而言，這種科技主權方向，決定了低軌道合作的可行模式：會造成依賴美國技術的合作或龍頭企業策略，很難獲得國家政策支持。第五章在設計龍頭企業方案時，直接納入這項限制：支持能強化香港制度中介角色的合作，排除會造成卡脖子依賴、與國家政策相悖的模式。

### 2.5.3 「一帶一路」維度與全球連接地緣政治

中國的低軌發展目標，與「一帶一路」互聯互通及為海外市場提供數字基礎設施緊密相連。這一維度的商業意義在於，許多「一帶一路」市場的用戶，不僅需要基礎通信服務，更需要法律確定性、融資支持、合規框架及受信任的爭議解決機制。

這為香港帶來了機遇，也提出了時序性要求：市場需求可能是即時的，但香港能否承接這一需求，取決於必要的制度基礎設施是否及時設立。

### 2.5.4 監管架構與國際治理

負責管理太空資源的國際機構治理，是另一個地緣政治維度。國際電信聯盟的頻譜與軌道位置管理制度、聯合國和平利用外層空間委員會，以及有關太空碎片緩解、軌道服務、交通管理標準的新興討論，皆是各大航天強國利益博弈的場域。對於向來充當國際法律與監管互動平台的香港而言，這裡存在參與國際太空法與治理體系建設的機遇——承辦仲裁程序、為標準制定提供專業支持、打造爭議解決的中立平臺。總部設於香港的亞洲國際法律研究院等機構，已在該領域開展積極行動。

## 2.6 本章結論：香港在國家戰略中的發展機遇

因此，香港發展低軌產業角色，從來都不是、也不可能是純本地的事務。該產業的技術與產業先決條件由國家層面構建，香港的發展戰略必須立足於這一現實。由此可見，香港最具價值的角色，並非複製內地的發射或製造能力，而是成為國家低軌能力實現融資、保險、法律構建、數據分析增值及全球中介的核心平臺。

## 第三章：產業經濟邏輯：商業模式與中港產業鏈協同

本章承擔三大任務：第一，將低軌經濟重新定位為**支撐性基礎設施**，而非狹義的技術產業；第二，識別塑造不同市場細分領域的結構特徵與商業化約束；第三，梳理香港在中港低軌產業鏈中的角色，並闡釋其為何以下游中介為核心定位。

### 3.1 重新框定 LEO 經濟：從技術部門轉向經濟基礎設施

現在大家談到低軌道衛星經濟，不能再把它只看成是「太空專用產業」了——也就是那種只負責造衛星、發衛星的領域。事實上，現在大規模的衛星群，已經像我們生活中的自來水、電力一樣，屬於大家都能用的基礎建設，能支援通訊、物流運輸、各種監測、行動服務，還能幫助企業符合法規要求、提供各種數據服務，早就超出了「太空產業」的範圍。

如果用這個角度來看，真正的核心問題就不一樣了：並不是說你擁有了衛星，就能賺到錢、拿到價值。反而現在的價值，越來越集中在這幾種角色身上：能把各種資源整合起來的人、能降低大家做生意成本的人、能實實在在為各個行業提供服務的人、能幫忙處理法律和財務風險的人，還有能建立一套讓大家信任的數據和服務管理規則的人。

### 3.2 LEO 經濟的四項定義特徵

#### ● 特徵一：基礎設施屬性的經濟邏輯

低軌衛星系統一開始需要投入大量資金，但正式營運之後，每多增加一位用戶的成本很低，還能帶動許多行業一起受惠。它的經濟特性比較像公共基礎建設，而不只是一般商品。

#### ● 特徵二：以企業對企業（B2B）和中介服務為主的商業化模式

低軌衛星系統的絕大部分商業價值，並非透過直接零售的方式服務一般終端用戶，而是透過企業、機構、保險業者、物流商、電信業者與公共部門這些中間單位，真正落實各類商業應用。

#### ● 特徵三：雙重市場結構

低軌經濟同時包含成熟、需求可預期的市場，以及新興、創新密集、需求不確定且驗證周期長的市場。兩類市場需要不同的政策工具與商業化預期。

#### ● 特徵四：依賴創新生命週期演進 [45]

低軌衛星（LEO）服務的發展會經歷「靈活探索期」「過渡擴張期」和「標準成熟期」三個階段。有些用途靠現有的制度和工具就能商業化，另一些則得先反覆嘗試、獲取數據，還得容許失敗，才能吸引投資。低軌經濟不是一成不變的，它會跟着「產品研發→流程優化」的循環往前進——在這個過程裡，制度和技術同樣重要，尤其是在市場還不確定、新應用還在摸索的階段。這一點，對香港該按什麼順序推動相關戰略影響很大。

**靈活探索期（市場導入階段）：**現在很多低軌應用（尤其是數據分析和消費者服務領域）都處在「高創新、高不確定」的階段。這個階段的價值，來自產品創新和與眾不同的特色。香港要做的，就是借力內地已經成熟的衛星基礎設施，在航運、金融、物流這些領域，找有高價值的使用場景並試點。這個階段的政策，得把「鼓勵嘗試」放在首位，也要能接受失敗。

[45] Source: Abernathy, W.J. and Utterback, J.M. (1978). Patterns of industrial innovation. *Technology Review*, 80(7), 40-47.

**過渡擴張期（市場擴張階段）：**等特定服務形成了大家都認可的「主流模式」後，重點就會轉到「流程創新」——比如提升規模、降低成本、簡化服務交付方式。這時候，香港就能憑藉自身的物流和金融優勢，幫國家衛星座打通「商業化橋樑」，讓技術更好地落地賺錢。

**標準成熟期（市場成熟階段）：**最後，低軌服務會變成像水電一樣的基礎設施。到這個階段，香港的競爭優勢就靠一套「制度工具」——包括法律體系、金融中介服務，還有「香港認證」標準——來處理成熟全球市場裡的跨境數據流動和複雜服務合同。

只要香港的戰略跟着這個發展週期走，就不會陷入「只靠基礎設施競爭」的陷阱，而是能針對市場當前的成熟度，聚焦合適的創新類型——要麼靠產品創新帶動，要麼靠流程創新突破。

### 3.3 雙市場分類與四項商業化約束

從「商業化發展差距」的角度來看，低軌衛星產業一直面臨四個反覆出現的難題（也就是所謂的「商業化約束」）：一是需要長時間的資金支持（長周期融資），二是很難把經營風險轉移出去（風險轉移），三是相關的法律條款能不能真正執行（法律可執行性），四是數據管理要做到讓大家都信任（得信任的數據治理）。

這四個難題，對不同類型的市場影響不一樣，所以想用同一套政策、同一種辦法解決所有問題，是行不通的。

先說成熟市場：在這類市場裡，因為有明確的用戶群、清晰的採購流程，還有能確定的需求，所以上面提到的部分難題，已經得到了一定程度的解決；但在創新很多、變化很快的市場（創新密集型市場）裡，這幾個難題還沒解決，因此需要更主動、更有針對性的制度和政策來支持。

再看現有的「確定性市場」（也就是需求、模式都比較明確的市場）：這裡的融資時間更短、落地應用的路徑更清晰、合作合同也更容易設計，商業化面臨的主要困難，集中在各部門協調、相關手續審批，以及服務能不能長期穩定這幾點上。

與之對應的是「創新型非確定性市場」（也就是模式、需求都還不確定，充滿創新空間的市場）：這裡的四個難題都沒解決——融資能不能到位說不準、風險很難轉移、相關的法律架構還在摸索階段，而衛星數據的質量好不好、管理得規不規範，更是大家能不能信任這個市場的關鍵。

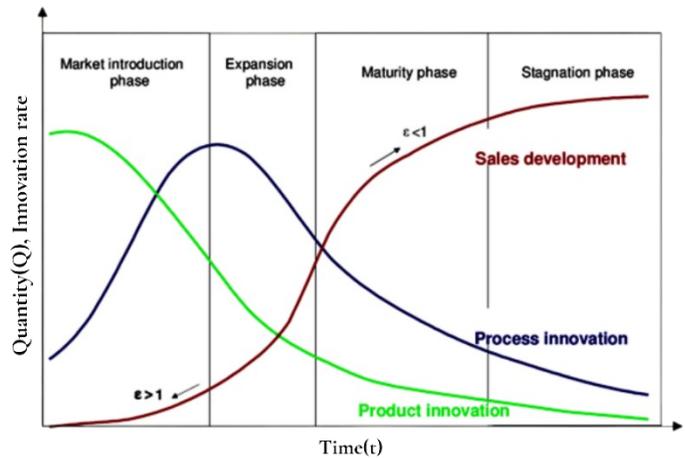
### 3.4 商業模式 I：基於太空的通訊與連接租賃

第一類商業模式主要服務航空、航海、物流與緊急通訊等行業。這些領域的市場需求很明確，不過業務能否做大，關鍵在於法規是否清晰、服務能否有效整合、交易架構是否完善，而不是香港必須自己擁有衛星。

香港在這類模式中的價值，在於發揮制度中介的角色，包括合約規範、融資安排、保險機制、各類認證，以及跨境服務的整合。香港的作用，是把衛星所提供的技術能力，變成好用、好融資、大眾與企業都願意信任的商業服務。

這類模式真正提供的產品，不只是單純的衛星通訊資源，而是搭配完整制度保障的服務使用權，當中包含服務品質標準、責任劃分、爭議解決方式與系統整合。

圖一、產品 - 工藝創新生命週期



前面提到的四項商業化限制，在這類模式中相對容易解決。重點不在於香港從頭研發衛星技術，而是整合審批流程、商業合約、融資方案與市場真實需求，把技術上可行的服務，真正變為可落地、可營運的商業模式。

### 3.5 商業模式 II：基於太空的數據報告與分析服務

第二種商業模式，是將衛星收集到的原始數據，加工成各類實用工具與服務，例如市場監測報告、法規遵從服務、風險分析、以及各行業專用的決策情報。如果說第一種模式是販賣衛星連線服務，第二種模式就是販賣決策輔助與問題解決方案。

香港在這個模式的優勢，在於可以把衛星數據，結合法律、金融、保險、貿易與治理等專業能力。它的價值並不在數據本身，而是在於提供可信、可直接使用的分析結果。

這也是最需要創新的商業模式，高價值的應用必須透過實際測試與摸索才能成形。因此，長期穩定的資金支持、具公信力的數據治理機制，以及可以測試新規則的空間，都顯得格外重要。

### 3.6 商業模式 III：面向消費者的衛星服務

第三種商業模式，包含了直接連用戶終端的服務，以及範圍更廣的、靠衛星支持的民用物聯網服務——這些都是直接面向普通消費者的。從長遠戰略來看，這個領域未來可能很有價值，但並不適合香港作為低軌產業的起步項目。

香港在這種模式裡，更適合扮演「示範場地、測試基地」的角色，或是有選擇性地做商業化的平台，而不是搶先去做消費市場的開拓者。

這種模式面臨的主要困難，來自用戶終端的生態建設、與電信公司的合作、定價合理與否、用戶使用習慣，以及監管政策的匹配——這些問題，單靠香港自己的政策是很難單獨解決的。

所以，第三種模式應該看作是香港低軌產業後期的發展機會，前期香港的公共資源，應該優先投入到那些能快速發揮自身制度優勢、並且能帶來明確回報的模式上。

### 3.7 內港低軌產業鏈協同

本報告的核心觀點之一（詳見表九）是：香港在低軌衛星經濟裡的角色，最容易理解的說法就是——它是中國新興低軌系統「走向國際、做商業化」的關鍵環節。簡單來說，內地負責打造衛星、火箭、地面設施這些硬體基礎；而到了需要把這些硬體能力，轉化成金融支持、法律保障、保險服務、數據分析、合規認證，以及能被國際市場認可的商業合作模式時，香港就能發揮作用，創造更多價值。

表九、內港低軌衛星產業鏈：關鍵交接與介面環節[46]

產業鏈階段	中國內地的角色	香港的中介功能	核心合作機制
星座基礎設施	負責衛星製造、發射及在軌部署（如千帆 / G60、國網、銀河航天）	不參與製造或發射，而是作為數據與容量的接收端	API 數據接入協議；容量租賃合約；開道地面站營運
容量商業化	國有及商業運營商出售批發衛星容量與數據	將容量轉化為具國際可融資性的產品，例如服務水平協議（SLA）、保險包裝、人民幣計價債券	治理包裝；合約標準化；香港法律下的金融工具
數據處理與分析	國家星座產生原始數據；內地企業開發初級分析能力	將分析結果轉化為可供決策使用的產品，並加入審計軌跡、責任框架及跨境合規包裝	數據信託協議；品質保證協議；香港科技園處理設施
國際市場進入	內地營運商在不少司法管轄區仍欠缺足夠的國際法律可信性及跨境合約執行力	提供普通法合約執行、HKIAC 仲裁、專項保險安排及國際投資者接觸渠道	HKIAC 仲裁條款；香港法律管轄合約；專項保險共同承保

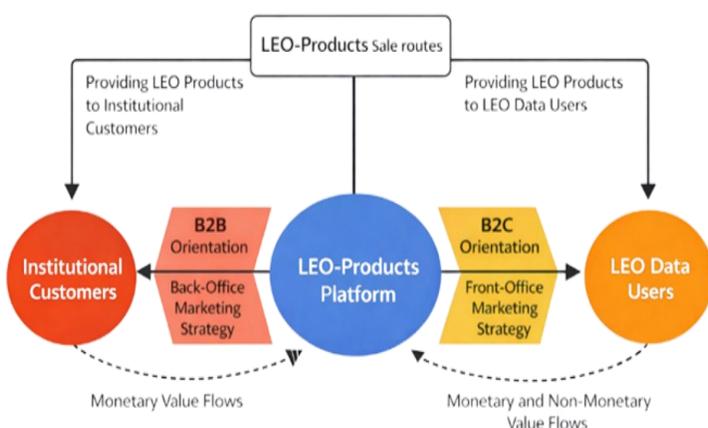
[46] 註：LEIF = 低地球軌道經濟創新基金（第五章建議）；一國兩制 = One Country, Two Systems；來源：POD 研究團隊整理。

產業鏈階段	中國內地的角色	香港的中介功能	核心合作機制
一帶一路部署	國家戰略推動在「一帶一路」市場部署衛星連接能力	負責融資安排、提供合規範本，並為「一帶一路」司法管轄區建立「HK Certified」標準	香港 LEO Gateway 標準；雙邊航天合作協議；標準化 SLA 框架
創新與應用發掘	內地大學及研發機構提供技術研究	透過 LEIF 資助及孵化非預期應用，並利用香港試點環境進行市場測試	LEIF 資助；InnoSpace+ 設施；公營部門數據合作協議

這份產業鏈分析告訴我們三個關鍵特點，用通俗的話說就是：

香港能創造的價值，不只是簡單的行政手續這類基礎服務，更重要的是能牽線搭橋、搭建交易體系、培育市場，讓相關業務能順利開展。只要是需要國際社會信任、有法律保障（大家認可其法律效力）、有完善財務架構的領域，香港的作用就很難被其他地方替代。香港只有做內地做不到、能彌補內地不足的事，而不是照搬內地的模式、重複內地的優勢，這樣的發展模式才能達到最好的效果。

圖二、LEO 經濟體的 B2B&C 業務營運模式



第 3.4 至 3.6 節已詳細說明連線租賃（模式一）、數據分析（模式二）、消費者服務（模式三）的功能需求，而圖二則呈現這三種模式對接市場的整體營運架構。

香港作為制度中介，必須支援混合式服務流動。這套模式透過法律執行力、財務架構等「治理包裝」，實現雙軌並行：一方面滿足企業與政府客戶（B2B）的高可靠度需求，另一方面達到裝置直連消費者應用（B2C）所需的大規模市場。對香港而言，這種 B2B&C 整合模式是「商業化橋樑」的最終階段，能將國家低軌道衛星能量，完整轉化為具融資價值、全球通用的服務生態系統。

### 3.8 香港 LEO 企業的海外市場策略

不論是前面提到的三種商業模式，香港企業在海外經營時，都要遵循同一個核心策略：優先做好「制度中介」的角色，而不是自己去建衛星、地面站這些基礎設施。

只要是需要別人信任、法律條款明確可執行、需要融資支持、需要專業分析，以及需要整合跨境服務的領域，香港的優勢都是最突出的。這也意味著，香港企業進入海外市場時，要根據當地應用的創新階段來調整：如果當地已有成熟的低軌應用，就可以用標準化的服務，儘早實現商業化、賺到錢；如果是還在摸索的高創新性應用，就需要多花點耐心試運行，同時搭建好配套的生態體系來支持。

另外，香港也應該成為海外市場的「風險管控中心」，幫助內地的低軌衛星技術和服務，彌補在那些重視信任度、法律效力和財務架構的海外市場裡，商業化過程中存在的不足。

尤其是海外的消費者市場，香港企業千萬不能急著擴張，一定要謹慎行事、有選擇地布局；只有等到終端設備整合到位、用戶使用體驗做好、和當地電信公司合作順利，並且當地的法規環境也成熟之後，才能大規模推廣業務。

### 3.9 本章結論

本章為本報告奠定了**概念與結構基礎**：將低軌重新定位為支撐性基礎設施，區分了不同市場類型，識別了四大反覆出現的商業化瓶頸，界定了三大商業模式，並明確了香港在中港產業鏈中的角色。下一步，將把這一分析邏輯轉化為**可操作的政策時序框架**。

## 第四章：三大商業模式——對比與政策時序

第三章建立了三大商業模式的經濟邏輯，本章將這一邏輯轉化為政策時序安排。不同模式的商業可行性取決於不同條件，因此不宜以相同的緊迫性和政策工具推進。

本章討論的驗證節點並不是一定要照著固定先後順序一步步做的流程，而是讓 LEO 企業家和政策制定官員知道，每一種商業模式都必須達到的重要門檻。這些門檻可以同時推動、也可以交叉進行，只有一項邏輯先後：一定要先有可用的數據，才能繼續發展應用服務、開發客戶、培養相關人才。驗證節點的作用，是用來檢查項目是否足夠成熟、風險能不能掌控、商業模式是否真的可行。它也是判斷一項數據服務，能不能從單純的技術，變成實際可用、大眾信任、能夠獲利的商業服務的重要依據。

### 4.1 商業模式比較

這份比較（表十）可用作優先順序評估工具。模式一最接近實際商業化，因為客戶與需求都相對明確。模式二的戰略價值與獲利空間更高，但需要更充足的數據、制度信任與產品測試。模式三未來潛力大，卻最不適合作為早期政策重點，因為必須依賴整體產業生態成熟。

表十、三種商業模式比較[47]

維度	模式一：連接容量租賃	模式二：數據與分析服務	模式三：消費型服務
市場類型	既有確定性市場	混合型：既有 + 創新	創新不確定性市場（新興）
創新生命週期	過渡至特定階段	流動至過渡階段	流動階段
主要約束	法律可執行性與風險轉移	長周期融資與數據治理為主	四項約束皆存在；終端設備整合為外部變數
香港角色	制度中介與治理包裝	數據信任平台與分析商業化	示範與監管參照環境
毛利範圍（示意）	35-40%（企業 B2B 連接）	70-85%（分析）；50-65%（行業 IoT）	視乎是否收取中介費而定
推進優先序	第一（基礎）	與模式一同步，並於第 2 年後加強	第三（待模式一及二成熟後）
關鍵政策觸發--- 第五章建議的依據	建議一：監管協調辦公室 （第 1 年）	建議二、三、五：金融、分析計劃、 創新中心（第 1-5 年）	建議六及七：龍頭企業與 Gateway（第 2-7 年）

### 4.2 模式 I：核心政策排序要點

模式一對應航空、海事、物流、應急通信等現有確定性市場，需求已明確可識別。其商業化落地，並非依賴技術發明，而是取決於監管清晰度、服務整合能力和交易結構設計，使機構用戶能夠實際採用。

因此，模式一的最低可行條件是制度成熟度：清晰的頻譜協調流程、可預期的認證路徑、可行的合同模板，以及能在真實運營環境中驗證服務可靠性的核心需求方試點。

### 4.3 模式 II：核心政策排序要點

模式二涵蓋現有與創新市場，具備高獲利與戰略價值，但只靠放寬授權無法推動。它需要可用的數據、可信的治理、驗證機制，以及能跨法律、財金、產業領域嘗試的環境。因此模式二最需要主動制定政策，而非單純放寬法規。核心任務是建構合適環境，讓分析產品可被測試、建立信賴，並逐步獲機構客戶採用。

### 4.4 模式 III：政策排序要點

模式三的依賴性最高，商業可行性取決於裝置整合、電信合作、定價、用戶行為與生態環境，當中不少環節香港都無法完全掌控。因此香港短期內不應把消費者衛星服務列為早期政策投資重點，而是透過測試、驗證與示範，保留未來發展的彈性。

[47] 毛利為示意範圍，並非香港預測平均值。詳見表十五（LEIF 架構）及附錄 G（各模式準備度門檻）。

## 4.5 整合總覽：短、中、長期重點任務

這份比較矩陣與模式發展時程，呈現出明確的政策優先時序（表十一）

- 短期（1-3 年）：法規協調是所有模式的基礎；政府設立低軌道經濟創新基金、航海分析計畫，啟動數據分析產業鏈；並以政府採購驗證模式一。
- 中期（2-5 年）：打造低軌道金融中心、創新樞紐與標竿企業，強化制度能量，將測試計畫擴大為商業規模。
- 長期（3-7 年）：成立太空法學中心、一帶一路平台，建構國際化基礎。

從發展時序及過程可清楚顯示：香港不需一次做完所有事。短期政策屬於低成本的制度規劃；中期需較大金錢，但已有基礎降低風險。這樣的階段式布局能大幅減少前期公共投資，也是後進者的優勢所在。

### 4.5.1 模式 I 準備門檻：連接租賃

針對模式一，發展的關鍵順序為：法規明確化、服務穩定、穩定需求、可擴展的合約機制。設立這套門檻邏輯並非製造行政障礙，而是找出對應的制度條件，讓衛星連線租賃從技術可行，變成實用、具融資價值的商業服務（表十一）。

- 驗證節點 1：監管成熟度
- 驗證節點 2：服務成熟度
- 驗證節點 3：核心需求成熟度
- 驗證節點 4：規模化成熟度
- 驗證節點 5：基礎設施治理成熟度

表十一、模式一 成熟度驗證節點與政策建議對應[48]

成熟度驗證節點	需實現目標	解決的核心約束	對應第五章政策建議
節點 1： 監管成熟度	通訊事務管理局頻譜審批流程明確； 認證路徑可預期；執照審批時限透明	法律可執行性； 數據治理	建議 1：跨局協調辦公室（第 1 年）
節點 2： 服務成熟度	星座性能達到行業標準；安全保障體系建立	風險轉移（運營層）	建議 2：低軌金融中心工具支持服務水平保險（第 1-2 年）
節點 3： 核心需求成熟度	公共機構試點落地；大型商業客戶參考合同制定	長周期融資（需求確定性）	建議 1、3：政府作為核心採購方；海事分析專項計劃（第 1-3 年）
節點 4： 規模化成熟度	標準化服務水平協議模板落地；常態化服務整合；市場競爭機制形成	法律可執行性； 風險轉移	建議 1：香港低軌企業入園配套包；建議 7：標準制定與市場推廣（第 3 年起）
節點 5： 治理成熟度	基礎服務依賴性明確；監管監督義務正式化	四大約束均進入成熟階段	長期監管體系建設（第 5 年起）

### 4.5.2 模式 II 準備門檻：基於太空的數據與分析服務

針對模式二，關鍵條件包括：可使用的數據取得、品質把關、沙盒或先導計畫等驗證機制、機構客戶導入，以及持續的研發與人才鏈。這些要求反映出：數據分析產業只有在能把數據轉成使用者可信賴的決策依據時，才能成功（見表十二）。

- 驗證節點 A：數據接入與質量基礎
- 驗證節點 B：創新應用監管沙盒

[48]來源與註：註 3；政策建議詳見第五章。年份為參考時間，非硬性截止日期；成熟度驗證節點優先於時間表。

- 驗證節點 C: 機構用戶採用
- 驗證節點 D: 人才與研發體系

表十二、模式二 成熟度驗證節點與政策建議對應[49]

成熟度驗證節點	需實現目標	解決的核心約束	對應第五章政策建議
節點 A: 數據接入與質量	與國家運營商簽署數據介面 (API) 協議; 質量保證協議落地; InnoSpace + 處理基礎設施建成	四大約束 (數據是所有環節的前提)	建議 5、6: 創新樞紐; 數據合作協議 (第 2-5 年)
節點 B: 創新應用監管沙盒	90 天沙盒入園審批; 創新分析服務實驗落地; 積累實證數據	長周期融資; 法律可執行性	第五章 5.5 節: 監管沙盒模塊 (第 1-3 年)
節點 C: 機構用戶採用	三大優先分析產品體系落地; 保險、貿易金融領域核心客戶確定; 政府數據合作落地	四大約束同時存在	建議 3: 海事 - 保險 - 金融分析專項計劃 (第 1-3 年)
節點 D: 人才體系	創新樞紐投入運營; 設立 5-10 個高校學術講座席; 推出類科技通行證人才計劃	長周期融資 (人力資本)	建議 5 及第五章 5.5 節人才模塊 (第 2-5 年)

#### 4.5.3 模式三的商業化成熟度驗證節點

模式三是三種當中依賴度最高的。它的商業可行性取決於香港無法直接掌控的條件: 全球裝置廠商整合、終端機降價、消費者認知, 以及必須等模式一、二成熟後才能達成的制度條件。如同第三章所強調的時程順序: 在模式一、二穩定運作前, 不應對模式三投入大量公共資源 (見表十三)。

- 驗證節點 X: 終端整合成熟度
- 驗證節點 Y: 電信合作成熟度
- 驗證節點 Z: 海外市場驗證成熟度

表十三: 準備度門檻與政策建議對應——模式三[50]

準備度門檻	必須達成事項	主要對應約束	與第 5 章的對應關係
門檻 X: 設備整合	建立消費者保障及認證框架; 成為全球設備製造商可參照的司法管轄區	法律可執行性; 數據治理 (消費者數據)	建議一: 監管協調; 並有助形成「一帶一路」標準 (第 2-4 年)
門檻 Y: 電訊合作	星座營運商與香港電訊商建立可運作的合作關係; B2B2C 商業安排完成驗證	風險轉移 (消費者責任); 長周期融資 (網絡投資)	建議六: 由龍頭 LEO 企業培育電訊合作夥伴關係 (第 2-4 年)
門檻 Z: 海外市場驗證	取得香港試驗中的使用及定價數據; 建立海外電訊合作關係; 驗證附加型應用場景的價值主張	四項約束均延伸至海外市場情境	建議七: 「一帶一路」Gateway 納入消費型連接維度 (第 3-7 年)

#### 4.6 三大模式整合: 時序邏輯總結

對低軌經濟業者與政府官員而言, 三大模式的門檻評估指出了一套明確步驟: 先優先完善模式一的法規與合約機制, 同步建置模式二所需的制度環境, 模式三則延後、謹慎推動。階段規劃著重制度成熟度, 而非需求不足。表十四是表十的更新版本, 新增了「收入穩定性」維度, 此維度可作為關鍵決策工具, 用以指導香港低軌 (LEO) 經濟的戰略優先順序規劃、資源配置及風險管理。其核心功能在於補充其他維度 (如市場類型、利潤率、約束條件等), 並為三大商業模式的推進時序提供實務依據。

短期內香港應聚焦少數能啟動商業應用的措施; 中期優先推廣應用、強化分析能力、深化生態系; 長期則把前期制度優勢轉為穩固的下游平台。

這套架構也說明香港不需全面同步推動, 只要先發揮最擅長的制度優勢, 等待依賴度較高的市場逐步成熟, 就能創造真實價值。

[49]資料來源: 註 3; 四項約束分別為: (1) 長周期融資、(2) 風險轉移、(3) 法律可執行性、(4) 可信數據治理。

[50]資料來源: 註腳 3。模式三必須先完成門檻 X 與門檻 Y, 方可推進門檻 Z; 同時, 模式一與模式二亦應先投入運作, 之後才適宜對模式三作出大規模公共投資。

表十四、模式一、二、三之間的比較特徵[51]

特徵	模式一：連接租賃	模式二：數據分析服務	模式三：消費型服務
市場類型（第 3 章）	既有確定性市場	混合型：既有與創新並存	創新不確定性市場（短中期）
創新生命週期階段	過渡至特定階段	流動至過渡階段	流動階段
主要商業化約束	法律可執行性與風險轉移	長周期融資與數據治理	四項約束皆存在，而設備整合為外部變數
香港的主要功能	制度中介與治理包裝	數據信任平台與分析商業化	示範及監管參照環境
收入穩定性	高：依賴長期合約與續約收入	初期較低；待機構客戶採用後趨於穩定	初期較低；取決於消費市場規模
毛利潛力（按第 5 章）	35–40%（企業 B2B 連接）	70–85%（分析）；50–65%（行業 IoT）	可變；取決於香港是否能收取中介費用
推進優先序	第一（基礎性）	與模式一同步推進，並自第 2 年起加強	第三（待模式一與模式二投入運作後）

## 4.7 本章結論

第三章和第四章提出的三大商業模式表明，儘管不同市場的發展時序不同，但香港的產業角色始終一致——通過制度中介實現價值增值，包括治理能力、法律結構、融資、保險、分析及可信的市場接入。

不同模式的差異，並非香港的核心角色，而是這一角色能夠實現商業化激活的成熟度條件。下一章將把這一時序邏輯，轉化為具體的戰略與政策設計。

## 第五章：香港低軌經濟的核心發展策略

### 5.1 引言：戰略論述的四大層級

香港不應複製整條低軌道衛星產業鏈，其優勢在於非製造領域：軟體、分析、法律、金融、保險、數據治理與商業中介。因此戰略關鍵並非成為發射或製造中心，而是成為把國家低軌道能量轉為具融資價值、國際可信服務的最佳平台。

答案可圍繞四個層級：競爭定位、借鑑經驗、中港互補、創新。共同核心是：香港只有在制度優勢決定價值、而非硬體規模取勝的領域，才能成功。本章後續將探討香港如何鎖定高獲利下游領域、合理借鑑國外經驗、建構創新體系，並將低軌道新應用商業化。

### 5.2 創新的必然要求：不可能預知的應用是低軌價值的真正引擎

低軌衛星產業最賺錢的商業模式，不是靠賣衛星收集到的原始數據，而是靠提供結合多領域知識的完整解決方案——其中衛星數據只是一個基礎支撐，用來輔助打造更具體的制度服務或商業產品。換句話說，用戶真正願意付錢買的，不是那些未經處理的原始數據，而是能幫他們搞定監管審批、降低經營風險、隨時掌握物流狀況，或是確保自身經營符合相關規定的服務。

#### 5.2.1 隱性利潤：解決方案而非數據銷售

可可貿易商需要的是法規許可的解決方案，而非亞馬遜空拍照；投資人需要的是財報前的風險警示，而非熱感數據；保險業需要自動理賠觸發機制，而非淹水地圖；銀行需要綠色貸款驗證報告，而非地表覆蓋圖；沿海工廠需要淹水預警訊息，而非原始感測數據。每個案例中，衛星都隱藏於後端、不被看見，

[51] 註：毛利率數據為可比企業特定下游業務的示例區間，並非香港的預測平均值。時序優先級基於上述成熟度驗證節點分析。

銷售的產品是決策輔助成果。這類應用來自非太空領域專業人士，發現衛星數據能解決自身產業問題。低軌道衛星的核心價值邏輯就在於：**利潤來自跨領域整合**，而非單純販售太空數據（表十五）。[52]

表十五、低軌衛星「非預期應用」示例：從衛星數據到商業解決方案[53]

應用領域	傳統做法	利用 LEO 的創新解決方案	付費產品	商業證據
供應鏈合規	實地審核與供應商申報	透過衛星監測森林砍伐情況，將影像轉化為符合歐盟反毀林規則的通過 / 不通過合規證明	監管通行證明——即市場准入許可，而非影像本身	Planet Labs / NICFI：約 4,300 萬美元合約
金融風險情報	依賴業績公告及公司披露	將來自衛星的工業活動與氣象訊號轉化為投資組合風險預警	面向投資者的訂閱式風險評分，早於企業正式披露	MSCI GeoSpatial Analytics，隸屬 MSCI 2025 財年約 31.3 億美元營業額體系
保險與理賠	需時數月的人手理賠評估	將參數型保險與衛星測得的洪水、風力或船舶觸發條件掛鉤，自動釋放理賠資金	自動賠付事件——按小時計，而非按月計	Swiss Re 參數型方案；ICEYE 災害分析（1.36 億美元 D 輪融資）
可持續金融與貸款	依賴高成本實地視察進行 ESG 貸款核查	以衛星監測取代對農業實踐及土地用途的實地核查，用於綠色貸款審批	綠色貸款核證報告——作為審計替代品	InSoil/HeavyFinance：歐洲投資基金（EIF）2,000 萬歐元基石投資
災害預警	依賴需接入地面網絡的地面感測器	透過衛星 IoT 連接離網洪水感測器，在洪水到達社區前發出預警	預警訊息——在洪水來臨前發出的文字訊息	Myriota 洪水預警 IoT 合約：548 萬澳元

### 5.2.2 風險分擔的合理性：低軌經濟創新基金（LEIF）

民間的錢（私人資金），只會投到「能預想到能賺多少錢」的項目，至於那些還不知道能不能賺錢、處在早期研發階段的項目，民間通常不願意多投入。衛星數據的應用就是這樣：像「參數型保險」這類應用，需要做精算研究、衛星遙感數據處理、搭建法律架構，還要懂相關領域的專業知識，沒有哪家民間企業有動力、也沒有能力，同時承擔這四件事的成本和風險。盧森堡有兩個計畫——LuxIMPULSE 和 ESRIC 新創計畫，就是香港可以參考的好例子：這兩個計畫會提供免費補助，而且就算項目失敗了，也會把它看作是公共投資的一部分（不追究過錯），就這樣吸引了超過 80 家和太空相關的企業、機構進駐當地。香港建議成立的「低軌道經濟創新基金（LEIF）」，就是參考了這個模式，分三個等級來推動相關項目（詳見表十六）。

表十六、低軌經濟創新基金（LEIF）——層級結構 [54]

層級	名稱	資助金額	是否需償還	目標	盧森堡對應做法
1	探索性研究資助	最高 150 萬港元	即使項目失敗亦毋須償還	支持大學與產業界跨學科研究新型衛星數據應用；設立產出應用研究的學術講座席位	ESRIC Start-up Support Programme（最高 20 萬歐元，不可償還）
2	概念驗證開發資助	最高 600 萬港元（申請方 1:1 配對）	如達成里程碑則毋須償還；如無合理原因未達標，則部分追回	用於分析產品原型、參數型保險試點、ESG 合規數據驗證等在真實機構客戶場景中的測試	LuxIMPULSE 研發資助，用於新型航天技術開發
3	InnoSpace+ 孵化通道	提供香港科技園設施、顧問支援及 24 個月數據 API 接入	毋須償還；政府保留退出時取得少量股權（最多 5%）的選擇權	面向具擴展潛力的分析型企業，需制度環境、國家星座數據 API 接入及商業試點便利	盧森堡結合 ESRIC 與 LuxIMPULSE，並置於 LSA 整體框架下的生態級孵化模式

[52] 資料來源：附錄 E。在上述各案例中，衛星只是上游使能基礎設施，對終端客戶而言往往不可見。真正的商業產品是證書、評分、觸發機制、核證報告或預警訊息等「決策支援物件」，而非底層影像或遙測數據本身。

[53] 來源：附錄 E。所有場景中，衛星均為上游支撐要素，對終端用戶隱形；商業產品是決策支持工具——證書、評分、觸發機制、驗證報告或警示信息——而非底層影像或遙測數據。

[54] 資料來源：註腳 4。LEIF 與建議二中較偏商業導向的 LEO Innovation Fund 有所區分。LEIF 針對商業化前、探索性及概念驗證階段；建議二中的基金則針對商業階段 A 輪及 B 輪投資。兩者應在同一套 LEO 經濟融資架構下統籌呈報。

### 5.2.3 必要條件：開放、跨學科的生態環境

我們沒辦法用法律強制要求大家做出創新的應用，但可以特意打造一個能催生創新的環境。最關鍵的一點，就是要願意接納新嘗試：把衛星資料開放給金融、法律、農業、保險、城市規劃、物流等各個領域的專家，而不只是局限在衛星工程師這個圈子裡。同時，要把實驗和失敗看作是探索過程中正常的成本，而不是管理上的失誤。真正的價值，藏在衛星技術和制度完善的結合裡，這一塊領域必須用心經營。只要點子實際可行、能落地，不管提出點子的人來自哪個國家，都可以參與到香港的低軌道產業生態中來。

如果從事太空相關的單位，只和同樣做太空的單位交流合作，最多只能在現有產品上做一些小的改進；但如果讓衛星資料科學家，和精算師、貿易律師、農業信貸人員一起合作，就有可能做出突破性的成果——比如把衛星觀測到的淹水情況，自動轉化為理賠依據；把森林砍伐的信號，轉化為供應鏈的認證標準。這就給我們一個重要的啟發：對低軌道產業的投資，真正的回報不在於按部就班地執行既定計劃、提高效率，而在於在計畫之外，通過跨界合作，意外探索出的新價值。

### 5.3 全球競爭格局：最高利潤所在及香港能否捕捉機遇

我們選定的下游業務類型，每種業務能賺的毛利率參考範圍，能給我們的戰略決策提供方向：賺錢空間從高到低排序是：遙感與人工智能分析（賺 70% 到 85%）> 綜合平台（賺 60% 到 80%）> 行業物聯網（賺 50% 到 65%）> 企業之間的連接服務（賺 35% 到 40%）。要注意的是，這些數據是參考其他可比企業得出的大概標準，不是專門針對香港市場算出的平均預測值，只能當成戰略方向的參考，不能當成具體的財務預測。雖然如此，它反映出的戰略重點還是很明確的：毛利率最高的那些細分領域，剛好就是香港能充分發揮自身制度優勢、起到關鍵作用的領域。

#### 5.3.1 製造層面：國家投資領域，非香港競爭領域

製造領域主要由具備雄厚產業與發射能力的大型國家計畫及企業主導。因此結論是：香港不應後發追趕這場競賽，而是專注在制度優勢、市場信譽、跨境中介，比硬體規模更重要的領域發展。

#### 5.3.2 非製造業層級：全球領導者與香港的五大戰略啟示

表十七列出了非製造領域的主要企業，目的是提取香港可復制的具體成功因素，並區分那些無法復制的因素。

表十七、全球選定的非製造型 LEO 領先企業[55]

公司	模式	表現	關鍵成功因素
美國 SpaceX 星鏈	平台作業系統 + SaaS	2025 年收入約 120–160 億美元；毛利率 60–80%；訂戶超過 900 萬	垂直整合；持續 OTA 軟件更新；以 API 為先的企業整合能力
美國 Planet Labs	地球觀測分析 SaaS	收入約 3.2 億美元；毛利率 57–60%；在手訂單約 7.34 億美元	每日全地球成像；AI / 機器學習將像素轉化為決策訊號；政府作為錨定客戶
美國 Amazon Kuiper	雲端—衛星融合	已承諾投入逾 100 億美元；規模化後預測毛利率 50–70%	雲生態鎖定效應；企業網綁式連接 + 雲服務；全球 AWS 邊緣節點
美國 BlackSky Technology	即時地理空間情報	收入約 1 億美元；毛利率 50–55%	按小時計重訪頻率；AI 自然語言介面；面向特定行業的儀表板
英國 / 法國 Eutelsat OneWeb	企業 B2B 連接	收入 11 億歐元；LEO 業務按年增長 59.7%；毛利率 35–40%	純 B2B 模式；平台 API 支援電訊商合作夥伴轉售
盧森堡 SES	受託衛星服務	收入超過 23 億歐元；MEO + LEO 混合模式	35 年以上營運成熟度；盧森堡註冊地帶來歐盟法域公信力

上述研究直接引出五大戰略啟示：

1. 重點放在「把數據變成決策依據」的價值鏈上，而不是只盯着數據本身——香港應該專心打造這類產品：把衛星提供的數據，轉化成能指導決策、觸發相關行動，以及幫助企業日常運營的有用信息。

[55] 資料來源：附錄 F。OTA (Over-The-Air) 指無須實體干預，即可遙距向衛星及終端推送軟件更新，從而在部署後持續改善產品。

2. 優先深入做某幾個行業，而不是盲目擴大平台規模——像海事、貿易金融、保險、合規這些領域，比打造一個什麼都包含、卻不精的泛化平台，更適合作為起步方向。
3. 讓政府成為核心客戶的模式，不僅能複製，而且很緊迫——早期讓政府部門使用相關產品，能證明產品的價值，還能降低企業商業化的風險。
4. 產品設計要優先考慮「介面便捷」（API-first）——那些能做大、能擴展規模的下游企業，需要的是能重複使用的數據和軟件基礎設施，而不是每次都要單獨定製的項目。
5. 制度帶來的信任，是香港獨有、別人很難複製的優勢——但這份優勢，需要通過完善法律、金融和監管體系，主動去發揮出來才行。

這五點啟示都指向同一結論：香港的競爭策略應鎖定高毛利環節，以制度信譽優勢作為科技導向，這是競爭者無法複製的核心差異。

## 5.4 借鑒新加坡經驗並實現超越

新加坡是最具參考價值的區域對標對象：一個小型、開放、制度完善的經濟體，無本土發射能力，但擁有強大的金融及專業服務。其應用優先、不依賴硬件的模式是正確的模板。然而，在五個結構性維度上，香港對新加坡具有決定性優勢（表十八）。

表十八、香港與新加坡——五大結構性差異優勢[56]

維度	新加坡	香港的結構性優勢
星座數據接入	需以商業價格向 Planet、Maxar、Airbus 購買數據；無法取得中國星座數據	可在一國兩制下，以具條件的方式直接接入千帆 / G60 及國網數據，對香港分析企業形成結構性成本優勢
一帶一路樞紐	與中國內地星座營運商無直接關係，無法為國際客戶打包中國 LEO 容量	一國兩制下的法律制度 + 與內地協同 + 國際可信性，使中國星座服務可在香港法律下完成簽約、融資及仲裁
航天金融	金融中心實力強，但不具離岸人民幣能力，無法設計人民幣計價的太空金融工具	全球最大離岸人民幣中心，可創設新加坡無法複製的人民幣衛星租賃債券、參數型保險及 LEO 投資基金
法律工具箱	牌照及金融科技沙盒制度清晰，但尚未建立專門的太空商業法律框架	普通法執行、HKIAC 仲裁、專業再保險共同承保、港交所資本市場——形成新加坡難以複製的綜合能力
硬體進步協同	只能以市場價格受惠於商業購入數據的技術提升	國家星座每一項技術進步（如低於 40 毫秒延遲、單星 10+ Gbps）都可直接並優先擴大香港可服務的軟件市場

新加坡發展太空產業的模式裡，有三個特點香港可以直接借鑒：第一，優先發展應用服務類產品，不要依賴賣衛星、設備這類硬體獲利；第二，建立分工清楚、方便各部門合作的組織架構；第三，讓政府成為主要的早期客戶，先測試產品是否可行，幫助企業降低經營風險。香港還要在五個新加坡做不到的地方，建立自己獨特的優勢：在一國兩制架構下，依照相關條件取得內地衛星星座數據（這部分需要國家政策確認）；擔任一帶一路低軌衛星業務的對外窗口；發展離岸人民幣的太空相關金融服務；擁有更完整的法律與金融工具；並且配合內地硬體技術的發展一起合作。因此，香港並不是「另一個新加坡」，而是擁有獨特條件的發展機會。香港最核心的優勢，在於和內地緊密配合、互補互利，這一點是新加坡完全無法模仿的。

## 5.5 追趕型建議：借鑒英國及盧森堡經驗

英國的實踐表明，一個大型金融中心可通過明確的國家戰略及錨定企業培育，轉向下游應用導向模式（行業收入 175 億英鎊，創造 4.88 萬個就業崗位）。盧森堡的實踐則表明，一個小型經濟體可通過法律創新、有針對性的公共投資及錨定企業，成為全球公認的太空金融、法律及運營樞紐。借鑒這兩個國家及新加坡的模式，七項整合建議構成了香港低軌領域的追趕戰略（表十九）。

[56] 資料來源：附錄 G。

表格中所述「參照英國 Catapult 模式、建置軟體產品鏈、與 LEIF 基金互補營運」意思如下：英國 Catapult 模式是英國創新署自 2011 年起設立的公費創新中心網絡，每個中心專注一個科技領域，包括位於牛津郡的衛星應用 Catapult 中心。它的核心特色是介於大學純學術研究與新創商業化之間，專門降低科技從實驗室走向產品的「死亡之谷」風險——也就是技術已有雛形、但民間資金不願投資商品化的階段。衛星應用 Catapult 專門協助英國中小企業，把衛星原始數據轉為商用軟體，提供雛型研發、市場對接、大客戶媒合等支援。第五項建議主張香港在科技園 InnoSpace + 內複製此模式：將大學與內地硬體合作夥伴的低軌道數據技術，轉化為適用於香港金融、航運、保險、物流的商用軟體與分析產品。

另外，「盧森堡 / SES 模式」是指：盧森堡本是內陸小國，原本沒有太空產業優勢，卻靠 1985 年吸引衛星巨頭 SES 將全球總部設立當地，一躍成為歐洲頂尖的衛星金融與法規樞紐。SES 為盧森堡剛起步的太空經濟帶來公信力、大量就業、法規測試環境，也吸引了衛星相關的法律、金融、保險服務進駐。盧森堡再以此為基礎，逐步建置太空法、太空資源立法、LuxIMPULSE 計畫，形成今日的太空產業聚落。這家指標企業發揮了「產業引力」：眾多小型廠商、供應商、律師與金融業者進駐盧森堡，是因為 SES 在此，而非盧森堡先自建完所有配套服務。

「英國 / OneWeb 模式」是指英國政府在 2020 年於 OneWeb 申請破產後，收購其 20% 股權，使英國成為這家低軌道寬頻衛星座業者的官方股東。背後理由一方面屬於產業政策——藉此保住空中巴士在英國斯蒂夫尼奇廠的衛星製造能量；另一方面則是戰略布局，讓英國在脫歐後失去伽利略衛星系統使用權之際，擁有自家的衛星座業能量。OneWeb（現為 Eutelsat OneWeb）為英國提供了核心資產，並以此建構下游服務、法規架構與海外出口商機。

表十九、香港低軌追趕計劃的七項戰略建議[57]

編號	建議	類型	時間範圍	對應準備度門檻	戰略理據
1	跨局 LEO 協調辦公室	制度治理	短期(第 1 年)	模式一門檻 1 與 3	參照新加坡 NSAS；解決協調缺口；將香港定位為「LEO 閘口」；為其他建議奠定基礎
2	在 HKMA / HKEX 內建立 LEO 金融中心	太空金融	短期(第 1-2 年)	模式一門檻 2 與 4；模式二門檻 A	參照盧森堡模式；由離岸人民幣優勢獨特支撐；新加坡無法複製；並有別於 LEIF
3	航運-保險-金融 LEO 分析計劃	模式二分析垂直應用	短期(第 1-3 年)	模式二門檻 C	毛利率最高的領域（70-85%）；利用國家數據優勢；直接應對四大商業化約束
4	於 HKIAC 設立香港太空法專庭 + 太空法 LLM	法律與仲裁	中期(第 2-4 年)	模式一門檻 4；模式二門檻 C	參照英國英美法優勢；回應中國星座合約在內地法院以外需中立執行的需要
5	在 HKSTP InnoSpace+ 設立 LEO 經濟創新中心	研發轉市場管道	中期(第 2-5 年)	模式二門檻 A 與 D	參照英國 Catapult 模式；建立軟件產品管道；與 LEIF 形成操作層面的互補
6	吸引及培育具區域總部功能的龍頭 LEO 企業	生態播種	中期(第 2-4 年)	模式三門檻 Y 與 Z；模式一門檻 3	參照盧森堡 / SES 及英國 / OneWeb 模式；提供產業聚集引力；受第 2 章技術主權約束，只限中國內地營運商
7	將香港打造為一帶一路及亞洲國家的 LEO Gateway 標準與推廣	國際定位	較長期(第 3-7 年)	模式一門檻 4；模式三門檻 Z	這是新加坡做不到的定位；將香港塑造成國家星座與一帶一路市場之間的制度橋樑；其推進取決於制度準備，而非遙遠需求假設

## 5.6 需政策確認的關鍵假設

本章提出的戰略主張，基於「一國兩制」框架下的若干合理假設，但仍需政策確認：能否按商業可用條件獲取國家星座數據；內地相關龍頭企業是否願意在香港設立實質性機構；香港品牌標準或模板能否在相關海外市場獲得認可。

[57] 時序說明：時序為實施參考週期，非剛性截止日期。建議 6 基於第二章識別的技術主權約束，限定引進內地中國運營商及技術上不依賴美國的運營商。來源：POD 研究團隊整理。

若這些假設僅部分得到確認，應調整建議而非放棄核心戰略——即便在更保守的場景下，「下游中介+持續創新」的核心論點依然成立。

#### **5.6.1 建議 1：跨部門低軌協調辦公室（第 1 年）**

短期最關鍵的改革，是設立跨局低軌協調辦公室，協調通訊事務管理局（OFCA）、商務及經濟發展局（CEDB）、投資推廣署（InvestHK）及創新相關機構，統籌執照審批、市場准入及投資者問題解決。在新興基礎設施產業中，行政協調一致性本身就是核心競爭優勢。

其目標簡潔明確：降低制度摩擦、縮短審批時長、提升香港對低軌服務商業化企業吸引力。

#### **5.6.2 建議 2：設立低軌金融中心及低軌創新投資基金（第 1-2 年）**

在第 1 至 2 年，香港應在香港金融管理局（HKMA）及香港聯合交易所（HKEX）的支持下，成立專門的低軌（LEO）金融中心，引導資金流向具商業可行性的低軌相關企業，並將香港定位為低軌賦能經濟的融資樞紐。該平台亦應支持人民幣計價的低軌（LEO）金融產品。期間，政府同時為符合資格的研企業提供 200% 稅務扣除優惠，並向合資格企業給予優惠低利得稅率。這些措施共同構建以金融為主導的商業化框架，進一步強化香港作為低軌賦能經濟之金融、法律及投資樞紐的角色。

另一核心支柱應為設立一筆規模 20 億港元的低軌創新投資基金（LEIF），該基金採用三層式非償還性補助架構，旨在支持處於發展初期的企業，並容許失敗的空間。第一層用於支持原型研發，第二層資助實驗與測試環節，第三層則為早期商業化階段的初創企業提供支援。此設計至關重要，因為許多低軌賦能應用在起步階段面臨高度不確定性，僅依靠追求回報的傳統投資模式，難以獲得有效的融資支持。

#### **5.6.3 建議 3：海事 - 保險 - 金融低軌數據分析專案（第 1 至 3 年）**

航運、保險與金融三者結合的領域，是最能把內地衛星實力與香港現有制度優勢連接起來的環節之一，也是極具潛力、能創造高價值分析服務的領域。優先發展的產品類型包括：透過衛星強化的貨物保險自動理賠機制、針對國際制裁與不明船隻的合規監控分析，以及提供貿易與金融業者使用的貨物流向情報。這些都是商業上明確可行的應用，而且香港在相關行業本來就具備深厚實力。

因此，相關計畫不應只是空泛地推廣技術，而要設計成政府與民間合作的實務測試平台。它的價值在於真正打造出產品、找到客戶，並證明這個市場模式是可行的。

#### **5.6.4 建議 4：設立香港太空法事務所及太空法學碩士項目（第 2-4 年）**

在香港國際仲裁中心內設立專門的太空法委員會，並在香港高校開設高階太空法律培訓，將強化香港支持跨境低軌交易的能力——包括可信的合同設計、爭議解決及法律解釋。若香港旨在成為商業化平臺，就必須同時成為法律服務平臺。該領域的制度公信力，取決於專業化能力，而非僅僅是通用法律聲譽。

#### **5.6.5 建議 5：香港科技園設創新空間+內設立低軌經濟創新樞紐（第 2-5 年）**

香港科學園 InnoSpace+ 裡的低軌經濟創新樞紐，應該專注發展後端應用服務，而不是去研發衛星、設備這類前端硬體。它的主要目標，是聚集企業、研究人員和各行業專家，一起針對真實的商業問題合作解決，同時提供場地與資源，方便大家進行測試、驗證和研發產品。

這個樞紐也應該負責營運前面提到的低軌道經濟創新基金（LEIF），讓研究、測試與商業化能夠緊密連接、順利推動，不要出現各環節各自為政、互相脫節的情況。

#### **5.6.6 建議 6：培育具備區域總部的低軌龍頭企業（第 2-4 年）**

引進與內地相關的低軌龍頭企業在港設立實質性區域總部，有助於創造示範效應、交易流、生態密度，並為後續企業與投資者提供公信力背書。龍頭企業的戰略重要性並非象徵性的，而是為法律、金融、分析、保險及下游服務能力的集聚與規模化，提供核心支撐平臺。

因此，龍頭企業戰略可分為兩個層級：一級是帶來技術聯動與戰略合理性的內地相關運營商；二級是圍繞該龍頭企業集聚的、深化下游市場的國際生態合作夥伴。

### 5.6.7 建議 7：香港作為「一帶一路」及亞洲國家低軌樞紐——標準制定與營銷（第一階段：第 1-3 年；第三階段：第 3-7 年）

香港的長期對外角色，應是中國低軌相關服務面向亞洲及「一帶一路」市場的首選包裝平臺，包括市場推廣、標準制定、合同模板、法律結構、分析服務及可信的爭議解決。這一樞紐角色應分階段推進：早期階段，在核心制度基礎設施建設期間，可啟動軟性推廣功能；後期階段，待法律、分析及龍頭企業能力成熟後，再支持全面的跨境商業化。

關鍵在於，國際化並非等待所有本土準備就緒後才啟動，而是應早期開展市場定位，並隨著制度成熟度逐步擴大規模。

## 5.7 本章結論：後發入場、長遠視野與對失敗的容忍

本章提出的戰略基於四大整合層級：第一，競爭定位——非製造業低軌經濟中毛利率最高的細分領域（遙感與人工智慧分析，毛利率 70-85%），正是香港制度優勢最能發揮作用的領域；第二，國際經驗借鑒——盧森堡、新加坡、英國均早期投資了「研發-市場轉化」產業鏈、龍頭企業培育及協調性制度架構，低軌經濟創新基金（LEIF）複製了盧森堡最重要的信號：前沿創新是公共產品，歡迎國外專家參與，而非僅僅是商業機遇；第三，中國國家戰略——香港無需與國家硬體項目競爭，而是在服務階段到來時，成為國際商業化層級；第四，後發優勢論點——後發入局使香港能夠觀察哪些應用已實現真正商業突破、哪些商業模式失敗、哪些制度框架存在不足。

# 第六章：整合結論及香港低軌經濟的 5 至 10 年規劃

## 6.1 四項政策指導問題的答案

第 1 章提出了四項政策指導問題，作為分析的框架。本節將明確總結每個問題的答案，而後本章將展開完整的整合分析及 5 至 10 年規劃。

**政策指導問題 1：中國的技術成熟度及下游機遇。**中國內地低軌領域已超越概念階段，進入產業加速建設期。其技術成熟度體現在：衛星星座部署規模持續擴大、衛星製造能力不斷增長、地面基礎設施逐步完善、可重複使用發射技術與空間計算能力取得明確進展。儘管中國在成熟可重複使用發射運營及部分成本效率方面仍落後於美國，但差距正逐步縮小。國家低軌計劃已足夠先進，能夠為香港提供開展下游商業活動所需的硬體、數據與軌道資源。

**政策指導問題 2：香港的比較優勢與約束條件。**香港的潛力不在於發射、大規模製造或主權星座擁有權，而在於下游制度中介服務。其主要比較優勢包括普通法合同可執行性、國際仲裁、金融結構化、保險與風險轉移、跨境數據治理，以及在「一國兩制」框架下為全球市場打包衛星賦能服務的能力。其約束條件並非缺乏上游產業或高端製造能力，這些內地已提供支持，而是太空系統工程領域的本土深度有限、低軌專業人才供應緊張，以及在相關商業化窗口內開發和規模化具有競爭力的下游產品所需的創新管道尚處於萌芽階段。

**政策指導問題 3：可行的戰略框架。**可行的發展模式是與國家計劃整合的、下游導向、創新驅動型低軌經濟。本報告識別了三大可行商業模式：基於空間的通信租賃服務（最即時、穩定的切入點）、基於空間的數據與分析服務（長期價值與毛利率最高）、面向消費者的衛星服務（後期發展機遇）。整體框架遵循時序推進原則：先實現監管與執照審批清晰化，再建立核心需求與融資機制，最後推進分析、法律、保險及國際化功能。

**政策指導問題 4：國際經驗借鑒。**盧森堡、英國及新加坡等司法管轄區的經驗表明，即使沒有本土發射能力，通過法律監管定位、下游服務、融資、分析及創新支持，仍可實現強大的價值捕獲。對香港而言，核心啟示是：若聚焦價值鏈的正確環節，後發入場仍可具備優勢。香港應借鑒而非復制，這些經濟體的核心經驗：低軌領域的盈利參與，源於成為商業化、治理及實驗的可信平台。

**論點總結。**第一，全球低軌經濟日益成為基礎設施經濟，絕大部分收入來源於下游，而非發射或衛星製造。第二，香港入局較晚，且在發射、大規模製造或主權星座所有權方面無現實比較優勢；第三，後發入局並不意味香港無關緊要，因為最具商業意義的下游功能——金融、法律、保險、數據治理、分析、認證及國際化——恰好是香港在「一國兩制」框架下的結構性強項；第四，戰略核心在於不僅僅轉售通信服務，而是構建持續創新的生態系統，將國家低軌能力轉化為面向區域及全球市場的可信、高價值服務。

## 6.2 為何持續創新必須置於核心地位

創新必須置於香港低軌戰略的核心，因為低軌經濟的最高價值部分在於下游服務、分析及制度應用，而非發射或製造。最具盈利性的產品往往難以提前預測。它們誕生於衛星能力與金融、法律、保險、物流、合規及城市管理領域未解決難題的結合之處。因此，香港的長期商業成功並不取決於更高效地複製現有服務，而在於開發市場此前未知如何定義或定價的新應用。

基於此，香港必須將低軌經濟視為一個**創新體系**，而非僅僅是牌照發放或中介平台。該領域的創新本質上具有不確定性：許多實驗會失敗，許多想法無法實現規模化，成功的產品往往需要經過反覆試驗、重組及調整，在一定程度上憑藉機遇才能誕生。因此，失敗並非戰略弱點的體現，而是探索過程中的正常環節。一個要求在實驗前確保萬無一失的系統，只能對現有產品進行漸進式改進；而一個容許失敗發生的系統，才最有可能發現真正全新、高利潤的應用及開發。

這也是為何開放環境不可或缺。低軌經濟不僅依賴衛星工程師，還依賴一個靈活的生態系統——向本地及海外人才、創業者、研究人員、企業用戶及投資基金開放。缺乏這些群體，創新在進入市場前就會被低估：想法更狹隘、實驗更薄弱、風險資本更匱乏，技術能力向商業產品的轉化速度也會放緩。相反，開放的生態系統能讓不同學科、商業模式及市場信號產生富有成效的碰撞，而這正是具有商業變革意義的應用最有可能誕生的地方。

香港需要建立能夠擴大參與範圍、降低實驗成本，並在政治及財務層面容忍失敗的機構。這正是低軌經濟創新基金（LEIF）、創新空間+（InnoSpace+）創新樞紐，以及開放國家星座數據接口（API）訪問權的戰略目的。它們的職能不僅是支持已被驗證的項目，更是創造條件，讓大量實驗得以開展（其中大多數可能失敗），從而誕生少數具有商業意義的突破性成果。若沒有這一開放、容忍失敗且吸引人才的生態系統，香港的低軌經濟將局限於低利潤的中介服務，而非支撐持久競爭力的高價值創新領域。

在發展創新的過程中，控制成本、提升競爭力同樣非常重要。隨著內地衛星發射花費越來越低、運算能力越來越強，透過衛星做出分析、提供決策資料的成本，只會繼續下降。對專注做服務與分析的香港來說，這代表：不斷研發創新，不只能帶來新的收入來源，更是讓後端相關產品價格更親民、規模做得更大、更具國際競爭力的關鍵方法。所以，持續創新不只是香港低軌經濟賺取利潤的核心，也是這個產業能夠長久在市場站穩腳步的必要條件。

## 6.3 低軌發展的 5 至 10 年時間表

實際問題在於，香港應如何將這一戰略邏輯轉化為嚴謹的實施計劃（表二十）。答案並非制定一長串互不相關的舉措，而是推進三階段規劃：從**制度基礎建設**起步，進入**商業化與產品形成**階段，最終實現**區域及全球市場的規模化拓展**。

表二十、香港低軌衛星經濟的五至十年發展計劃

階段	示意年份	戰略重點	示意性 KPI
第一階段——基礎建設	2026–2027	建立牌照、合約、創新融資及數據接入的制度基礎	1) 建立跨局協調機制; 2) 公布標準牌照路徑; 3) 推出 LEIF; 4) 至少開展 3 個公營或半公營試點項目; 5) 與國家營運商簽署首批數據接入或合作協議
第二階段——商業化	2028–2030	建立可融資的企業級連接與分析產品，並由香港擔任驗證與中介樞紐	1) 達成 10 個以上機構試點或商業合約; 2) 至少形成 3 條可持續收費的分析產品線; 3) 市場上出現專門的 LEO 保險 / 融資產品; 4) 2 至 3 間龍頭企業或區域總部落戶香港; 5) 平均牌照 / 審批時間顯著縮短
第三階段——擴展與國際化	2031–2035	將香港打造為面向亞洲的 LEO 商業化、仲裁及市場接入平台	1) 與香港相關的 LEO 服務在多個一帶一路或亞太市場落地; 2) 累計融資額與承保價值達到政策設定目標; 3) 形成穩定的 HKIAC / 法律服務 LEO 合約與爭議處理管道; 4) 消費及企業參考部署輸出至海外市場; 5) 可量化顯示行業價值中更大比重來自分析與增值服務，而非純中介收入

## 6.4 低軌經濟關鍵績效指標 (KPI) 框架

第一階段——基礎 (2026–2027) 準備度門檻 1–2	第二階段——商業化 (2028–2030) 準備度門檻 2–4	第三階段——擴展與國際化 (2031–2035) 所有準備度門檻
<b>A. 制度基礎 (Institutional Infrastructure) 治理 (建議 1)</b>		
<ul style="list-style-type: none"> <li>在商經局 (CEDB) 內設立 1 個 LEO 協調單位</li> <li>公布 30 日頻譜牌照服務目標</li> <li>發布「香港 LEO 市場進入套件」</li> <li>完成 1 個政府錨定客戶採購</li> </ul>	<ul style="list-style-type: none"> <li>服務 ≥ 5 個國際 LEO 營運商</li> <li>香港作為 gateway 出席 ≥ 3 個國際論壇</li> <li>100% 標準申請於 30 日內完成</li> </ul>	<ul style="list-style-type: none"> <li>≥ 2 個司法管轄區採用香港進入套件作為範本</li> <li>複雜牌照平均審批時間 ≤ 90 日</li> <li>每年發布 1 份 LEO 監管表現報告</li> </ul>
<b>太空金融 (建議 2)</b>		
<ul style="list-style-type: none"> <li>在 HKMA / HKEX 建立 LEO 金融中心</li> <li>發行 1 單人民幣衛星租賃債券試點</li> <li>通過 20 億港元 LEO 創新基金架構</li> <li>推出稅務優惠 (研發成本 200% 扣減)</li> </ul>	<ul style="list-style-type: none"> <li>≥ 2 隻人民幣衛星債券吸引國際投資者</li> <li>1 個參數型保險產品正式商業化</li> <li>經香港安排 LEO 融資總額 ≥ 10 億港元</li> </ul>	<ul style="list-style-type: none"> <li>≥ 5 種人民幣 LEO 金融產品於市場運作</li> <li>基金組合中 ≥ 3 間 A/B 輪 LEO 公司</li> <li>累計 LEO 融資 ≥ 50 億港元</li> </ul>
<b>法律與仲裁 (建議 4)</b>		
<ul style="list-style-type: none"> <li>發布 2 套標準太空合約模板</li> <li>完成太空法專庭可行性研究</li> <li>設計太空法 LLM 課程</li> </ul>	<ul style="list-style-type: none"> <li>HKIAC 太空法專庭正式運作</li> <li>處理 ≥ 2 宗爭議或諮詢案件</li> <li>HKU / CUHK 開辦首屆 LLM</li> </ul>	<ul style="list-style-type: none"> <li>HKIAC 每年處理 ≥ 10 宗太空法案件</li> <li>≥ 20 名 LLM 畢業生投入業界</li> <li>≥ 2 個一帶一路司法區採用香港 SLA 模板</li> </ul>
<b>B. 商業發展 (Commercial Development) 分析與 LEIF (建議 3、5.2)</b>		
<ul style="list-style-type: none"> <li>撥款 5 億港元 LEIF 首輪資助</li> <li>發放 ≥ 5 個第一層探索性資助</li> <li>簽訂 1 個錨定客戶分析合約</li> <li>設立 70–85% 毛利基準</li> </ul>	<ul style="list-style-type: none"> <li>≥ 3 個第二層項目進入機構測試</li> <li>形成 3 條分析產品線並有付費客戶</li> <li>≥ 1 個參數型貨運保險產品上線</li> <li>≥ 1 個「暗船 / AML」產品被銀行採用</li> </ul>	<ul style="list-style-type: none"> <li>≥ 3 個產品毛利 ≥ 70%</li> <li>≥ 2 類「非預期應用」成功驗證</li> <li>≥ 5 條分析產品線具持續訂閱收入</li> </ul>
<b>龍頭企業 (建議 6)</b>		
<ul style="list-style-type: none"> <li>InvestHK 為 LEO 設計專屬 HQ 支援方案</li> <li>啟動 1 宗正式談判 (如 Galaxy Space / G60)</li> </ul>	<ul style="list-style-type: none"> <li>1 間內地 LEO 營運商在港設立實質 HQ</li> <li>≥ 50 名專業全職人員</li> <li>≥ 5 間配套企業因其落戶香港</li> </ul>	<ul style="list-style-type: none"> <li>≥ 2 間新增內地 LEO 公司進駐香港</li> <li>≥ 20 間企業圍繞形成產業集群</li> <li>≥ 5 個市場由香港 HQ 輻射服務</li> </ul>
<b>C. 創新與人才 (Innovation &amp; Talent) 创新中心 (建議 5)</b>		
<ul style="list-style-type: none"> <li>HKSTP InnoSpace+ LEO 中心投入運作</li> <li>簽署 1 項國家星座數據 API 協議</li> </ul>	<ul style="list-style-type: none"> <li>≥ 5 個 LEO 學術席位運作中</li> <li>≥ 10 名海外專才透過 Tech.Pass 引入</li> <li>≥ 3 個產學合作試點 (LEIF 第二層)</li> </ul>	<ul style="list-style-type: none"> <li>≥ 20 名研究與產業人才在中心</li> <li>≥ 5 個項目由孵化進入市場</li> <li>每年 ≥ 10 個新創項目</li> </ul>

## 6.5 綜合結論

綜合第二章至第五章的戰略證據與四大政策核心問題的答案，可得出一個整合性結論：香港能夠在國家及全球低軌經濟中佔據重要地位，但這一目標的實現，必須將低軌視為**長期創新體系**，而非短期基礎設施建設項目。香港不應試圖複製內地的上游硬體優勢，其競爭路徑在於：將中國不斷增長的低軌能力，轉化為**受全球信任、具投資價值、可國際化應用的產品與服務**——這一角色與香港的制度優勢最契合，且隨著國家低軌產業的持續成熟，這一角色的商業價值將越來越突出。

### 最後評論

機遇之窗現已打開。正確的戰略既非被動等待，也非誇大其詞，而是耐心建設制度、持續開展實驗，並不懈地將國家技術進步轉化為具有國際競爭力的產品及服務。

——報告完——

## Appendix (English Only)

### Appendix A

Table 1.1 is a strategic framing tool (not a definitive financial dataset) designed to illustrate the global LEO economy competitive landscape. Revenue ranges and market shares are derived from a combination of official government reports, corporate financial disclosures, and logical extrapolation of historical growth trends. No single source explicitly states total space economy revenue for South Korea or Italy; their ranges reflect aggregated sectoral data.

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#### Methodology Note — Table 1.1: Global Top 10 Space Economies by Annual Revenue (2024–2025 Estimates)

Table 1.1 is constructed using a bottom-up triangulation approach combining top-down market sizing with jurisdiction-level aggregation. The space economy is defined across three revenue streams — upstream (satellite manufacturing and LEO launch services), midstream (constellation management and in-orbit logistics), and downstream (satellite-enabled services, Earth Observation, and ground equipment) — excluding non-orbital and deep-space activities, in alignment with Space Foundation and SIA frameworks.

The 2024 global baseline of US\$613 billion (Space Foundation, *The Space Report 2025 Q2*) anchors all market share calculations. Top-tier economy revenues are derived from official government reports (NASA, JAXA, MIIT), corporate disclosures (SES, Airbus, Leonardo), and industry data (SIA 2025, Novaspac 2025). Mid-tier estimates are projected forward from verified baselines: India from ISRO's ~\$8.5B (2022) at 9.5% CAGR; South Korea from KARI's \$6.2B (2022) at 7–9% CAGR; Italy bottom-up aggregated from Leonardo (~\$2.1B), Telespazio (~\$1.8B), and remaining sectoral activity. China's 10.3% and India's 9.5% CAGR figures reflect midpoints of official government growth forecasts. All non-USD figures apply 2024 average exchange rates (People's Bank of China).

*Limitation: Revenue ranges for South Korea and Italy are composite estimates, not single-source verified. All figures are indicative and intended for strategic framing purposes.*

## Appendix B

Note on cost figures used in this report: The RMB 14,000-18,000/kg figure throughout this chapter represents contractual and negotiated Falcon 9 rates reflecting reuse discounts. The Falcon 9 list price in 2026 is approximately US\$74M per launch, equating to roughly US\$3,246/kg at full 22,800 kg payload capacity. For comparability with China's published figures, all launch cost comparisons in this chapter use RMB per kilogram at the 2024 annual average exchange rate of 7.1 RMB/USD (People's Bank of China). Chapter 5 references the US\$1,500/kg figure, which reflects the lower end of published estimates for Starship's projected target cost; it is a forward-looking estimate rather than a current contractual rate. Readers should note this distinction.

Note: The table's historical '19 recoveries' figure referred to B1058 in December 2023. As of February 22, 2026, booster B1067 has completed a record 33 flights. SpaceX is certifying boosters for up to 40 flights.

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## Appendix D

Readiness Gates are the essential conditions that must be satisfied before a LEO business model can become commercially viable. They can be understood as a sequence of practical checkpoints, much like opening a restaurant: a business cannot serve customers before securing a hygiene licence, hiring a chef, and setting up operations. In the same way, Hong Kong cannot simply declare itself part of the LEO economy and expect commercial success. Each business model requires certain legal, technical, market, and institutional conditions to be in place before the next step becomes meaningful.

Chapter 4 discusses Readiness Gates because it asks a very specific question: what must happen first, and in what order, for different LEO businesses to work commercially in Hong Kong? Using aviation and shipping connectivity as an example, the chapter explains that the process begins with clear OFCA licensing rules, followed by proof that the service is reliable enough for demanding sectors such as airlines and maritime operators. After that, government agencies may need to act as early anchor customers to help create initial market demand, before standard contracts and service norms can be developed to make adoption easier. Only when the service becomes deeply embedded in critical operations does more formal infrastructure-style regulation become necessary.

This sequencing matters because policy resources are limited and poor timing can waste effort. There is little value in pushing advanced market expansion measures before the most basic regulatory or technical conditions are ready, just as there is no point designing a restaurant loyalty programme before the kitchen exists. The concept also links Chapter 4 directly to Chapter 5: Chapter 4 identifies the conditions that must be met, while Chapter 5 sets out the concrete policies needed to meet them. Together, the two chapters provide a logical action plan for how Hong Kong can build a viable LEO economy in the right order.

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## Appendix E

The LEO economy should not be dismissed as a “white elephant” because its real commercial value often lies far beyond selling broadband or satellite imagery itself. In many cases, the satellite is only the hidden infrastructure behind a much more useful end product. What customers actually pay for are practical, decision-ready outputs such as compliance evidence, risk scores, automatic insurance payouts, early-warning alerts, and instant operational connectivity. The true advantage of LEO systems is not simply sharper pictures, but the ability to generate cheap, frequent, and scalable updates about what is happening on the ground, which can then be turned into commercially valuable services.

A major theme running through these examples is that LEO enables the conversion of raw observation into actionable institutional products. In deforestation compliance, repeated satellite monitoring allows firms to produce pass-fail assessments that help companies satisfy anti-deforestation rules and maintain market access. In finance and ESG, regular observations can be transformed into alerts and scores that warn investors about flooding, fires, land-use change, or operational stress. In insurance, LEO data supports both parametric products, where payouts are triggered automatically by measurable events, and conventional claims automation, where insurers use satellite-based damage intelligence to triage losses faster, reduce disputes, and cut fraud. In each case, the commercial product is not the image itself, but a form of trusted proof, risk interpretation, or faster decision-making.

The same logic extends into lending, compliance monitoring, public safety, and emergency operations. Green-loan verification uses satellite-enabled monitoring to help banks check whether borrowers are actually meeting environmental conditions, effectively turning “ground truth” into a service. Remote mines, farms, and infrastructure projects can be supervised continuously through change alerts and exception reporting rather than occasional site visits. LEO-enabled IoT services make it possible to deliver flood early-warning alerts in places where terrestrial telecoms are weak or absent, while broadband constellations can rapidly create “pop-up digital cities” for emergency response, festivals, or temporary worksites. Across all these cases, the key lesson is that LEO's value lies in enabling services that solve real operational, regulatory, financial, and organizational problems, rather than in satellite hardware alone.

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