

The Historical Process and Evolution of Chinese Innovation Intermediary from the 16th Century

Author : Qingrui LI; Julien PENIN; Remy GUICHARDAZ

Université de Strasbourg BETA

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Research Background

- *Innovation Intermediary like **TTOs, RTOs, Incubators and Science Parks** emerged as key intermediaries linking academic and industry (Villani et al., 2017; Siegel et al., 2003).*
- *Not only the bridge, innovation support organization plays **various roles** in different condition.*
- *Chinese history of innovation has followed a path of **leading, falling behind, and catching up**.*
- *Chinese history, policies, and economy differ greatly from Western systems*

Research Gap



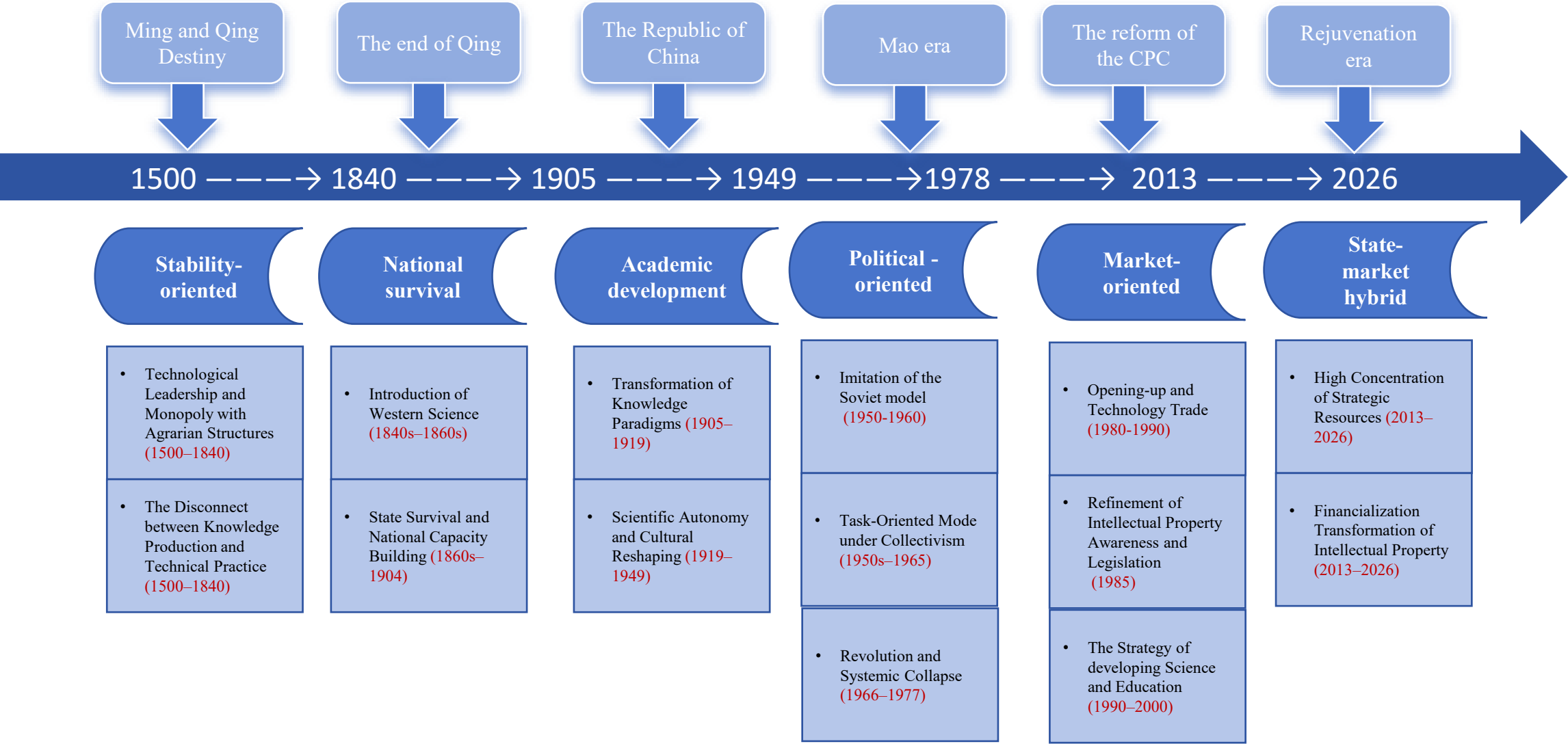
- There has been little historical research on the evolution of innovation **intermediaries**.
- Most historical research on innovation in China begins with the establishment of the People's Republic of China in **1949**.
- Few papers combine **National Innovation System (NIS)** with research on the history of innovation and development

Core Question



How has the Chinese universities and innovation intermediaries started and developed since the 16th century?

Timeline of the Evolution of Chinese Innovation System and Organization (1500–2026)



The Historical Process and Evolutionary Mechanism of Innovation Intermediary in China from the 16th Century

Innovation Intermediary Map

16 th Century-1840 Ming and Qing

- Bureaucratic governance
- Agricultural Economics
- Empirical technology leadership

1840-1904 End of Qing

- The Crisis of Aggression
- The contact of modern science through wars
- The 1st patent law in 1889

1905-1949 The Republic of China

- Unstable government
- Established modern university
- Started organized research activities

NIS

Restrict technology distribution —→ *Introduce new technology to defense* —→ *Connect public and government*

Organization

Technology Monopolist*

- Ministry of Works
- Government-run Workshop

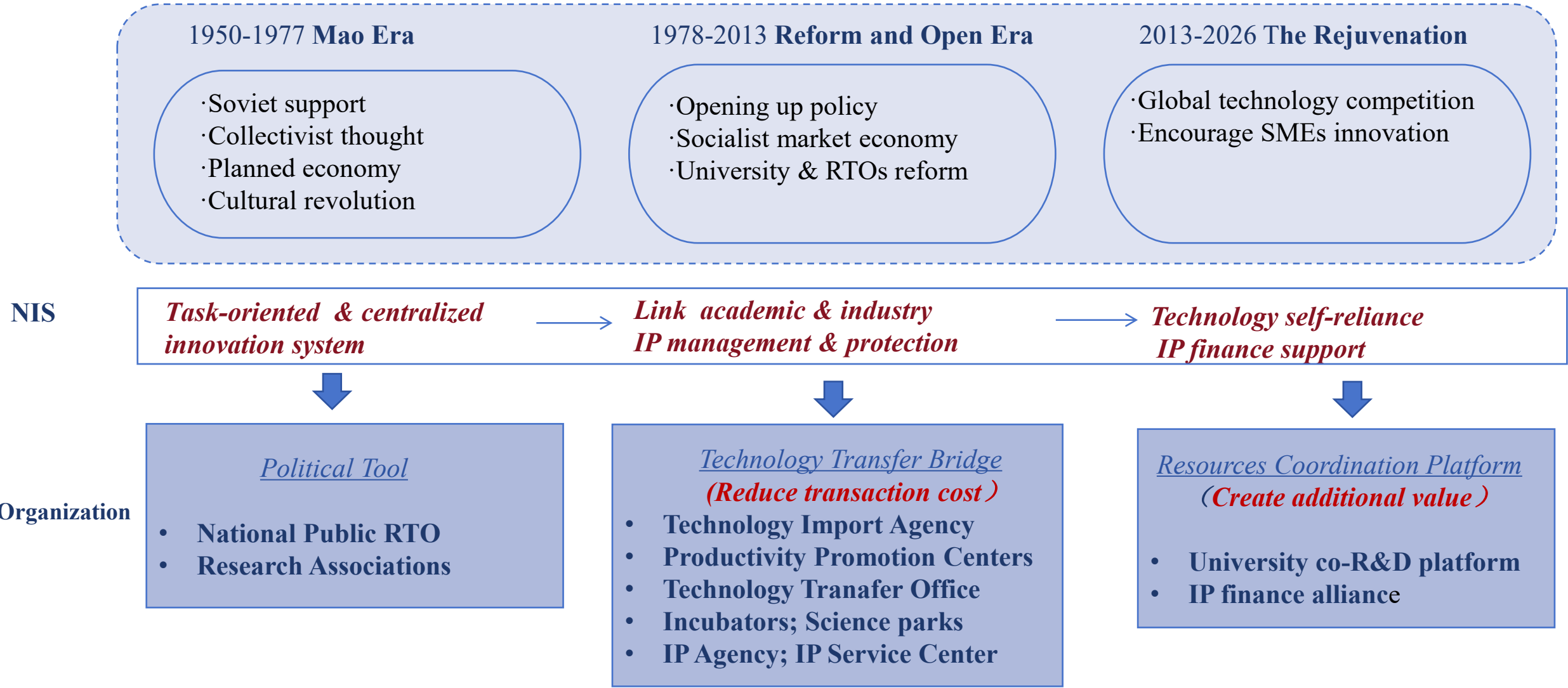
Knowledge Translator

- Western-style Factory
- Informal Science Society

A Buffer Zone

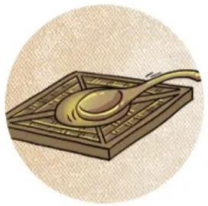
- Formal Science Society
- RTOs

Innovation Support Organisations Map



Needham Question (1974)

Why did China possessing world-leading technology in 16th century, fail to develop the wave of the Industrial Revolution?



Compass



Gunpowder



Paper Making



Printing

Technology transmit through family relationships
(Compared with European Guild)

Empirical technology, not the Science essence (Mokyr, 2002)

Chinese smallholder economy could support themselves
(Similar with the Spain Golden Age)

Strict technical management organization

Ministry of Works

Technology as a Political Resource :

Technology was embedded into the logic of state governance, where controlling technological knowledge strengthened political stability and imperial authority (Chen, 2022; Lei, 2023).



Function

Technology control

- Reported directly to Emperor
- Highly standardised production
- Regulated technology
- Monopoly on salt & iron & weapon tech

Personnel control

- Restricted mobility
 - Recorded workers personal information
 - Prohibited from transmitting expertise
- (vs *European patronage, privileges and censorship*)

Productivity Promotion Centers (PPCs)

What are PPCs?

- Serve SMEs that lack in-house R&D capacity
 - Technical consulting, transfer, certification and training.
 - Connect government, university, SME
- Triple Helix Model (Etzkowitz & Leydesdorff, 1998)*
- A form of public supported **technology diffusion** and technology extension institution.

China vs Europe

Beijing PPC

- Technology diffusion
- Highly state-driven
- Policy-directed
- Top-down network
- Regional

Fraunhofer

- R&D application/transfer
- Decentralized networks
- Market-directed
- Bottom-up
- National

254 → 2,100+

Number of PPCs
1998 → mid-2010s

19K → 427K

Enterprises served
1998 → mid-2010s

¥2.2B → ¥139.1B

Service income
1998 → 2013 (peak)

Source: China Torch Statistical Yearbook (1999–2018)

The catch-up innovation stage, which focuses on industry-academia-research collaboration and the transformation of research results (1978–2012)

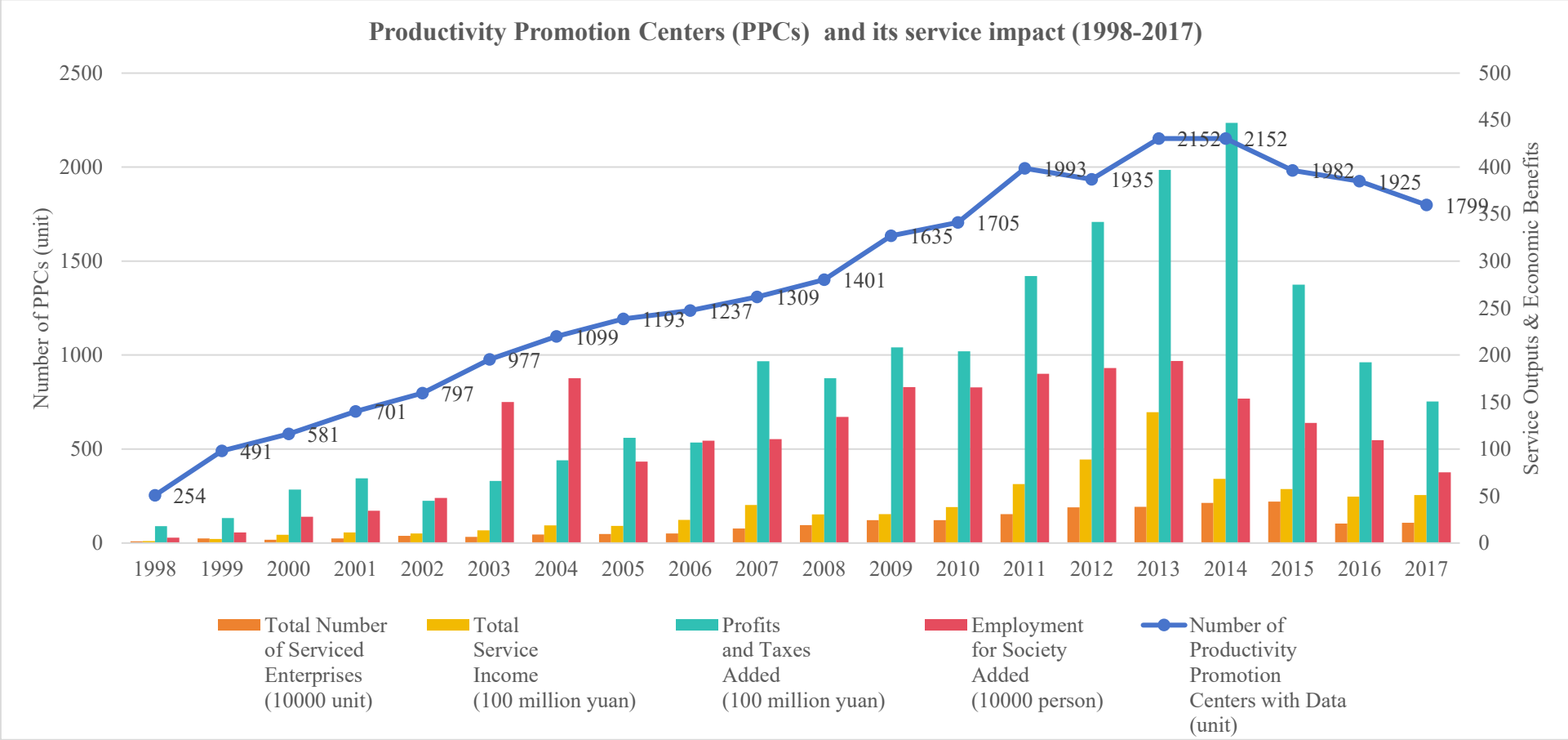


Fig.5.5 Productivity Promotion Centers (PPCs) and its service impact
Note: Left axis applies to "Number of PPCs" (unit). Right axis applies to all other four variables representing service outcomes, with units specified in 10,000 units/persons for enterprise and employment counts, and 100 million yuan for financial/economic values.
Source: the China Torch Statistical Yearbook (1999-2018)

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Intellectual Property protection and management

The establishment of *the Patent Law in 1984* marked Chinese first confirmation of the private property rights attribute of inventions and creations in the form of statutory law.

Intellectual Property Agencies—**Private**

- Translate technology language into legally assets.
- Strategic patent portfolio (Wang et al., 2024).
- Legal Advocacy and Technology Forecasts

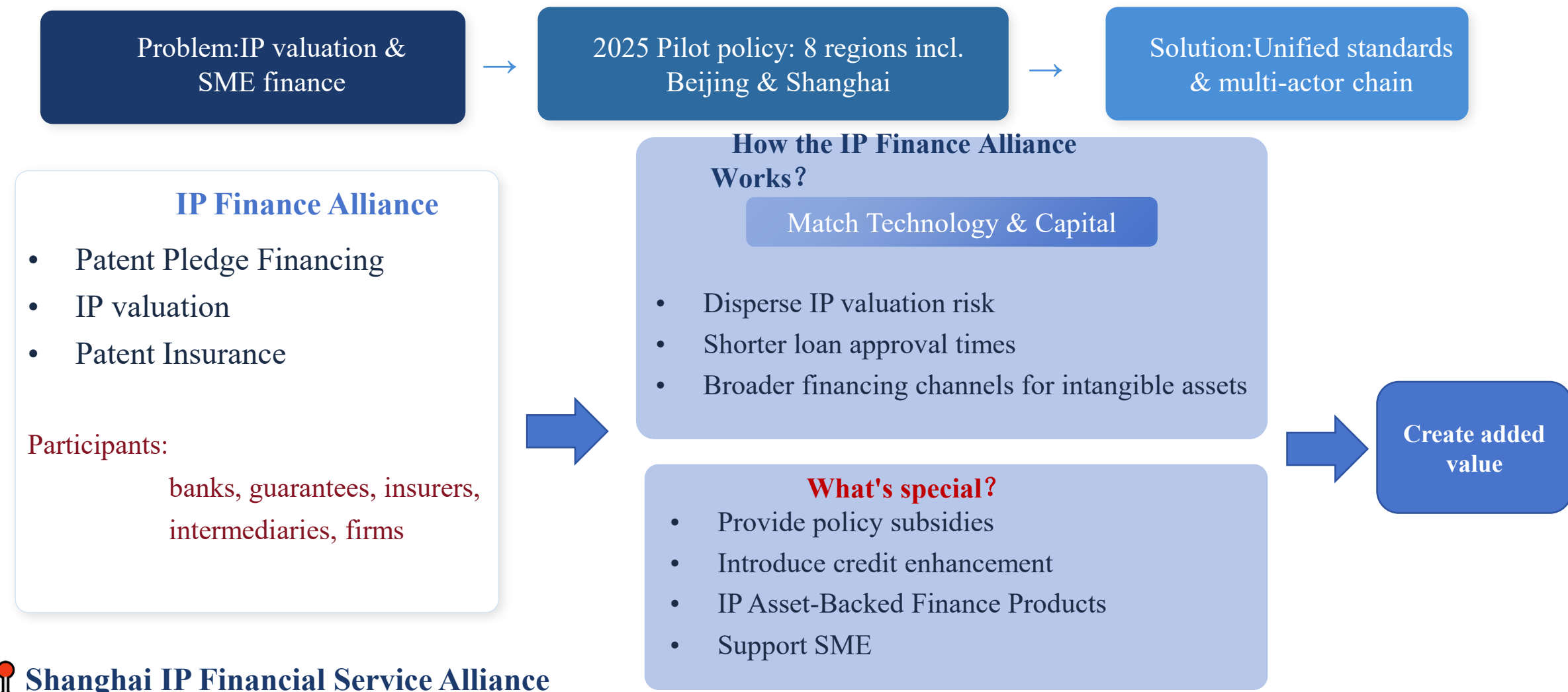
Intellectual Property Protection Centers—**Public**

- Public governance infrastructure
- Reduce costs and uncertainty
- Mediation, coordination, and rapid protection (Atmadja, 2015).



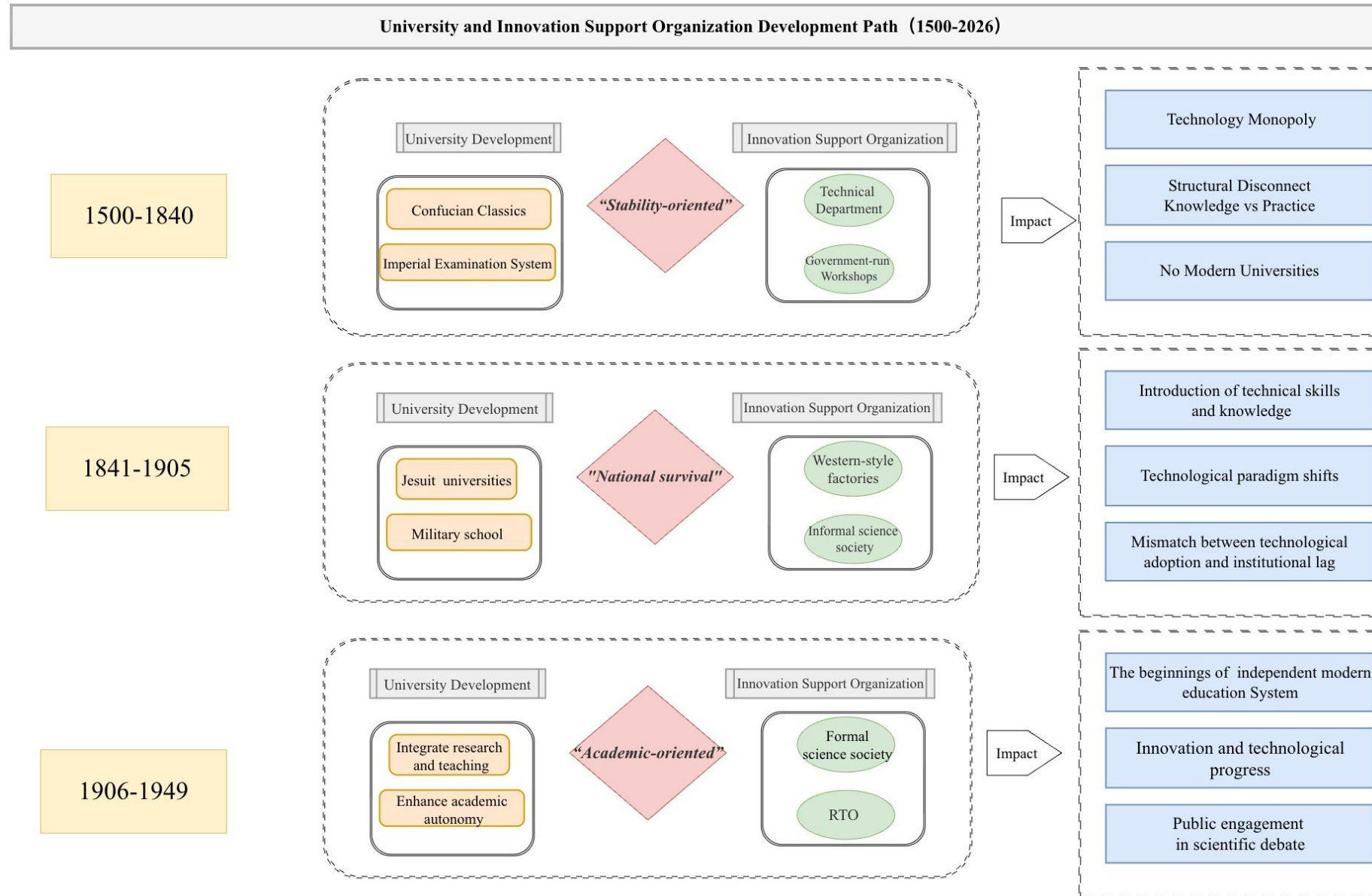
Reduce transaction cost

Endogenous innovation stage and independent research and development (2013–2026)

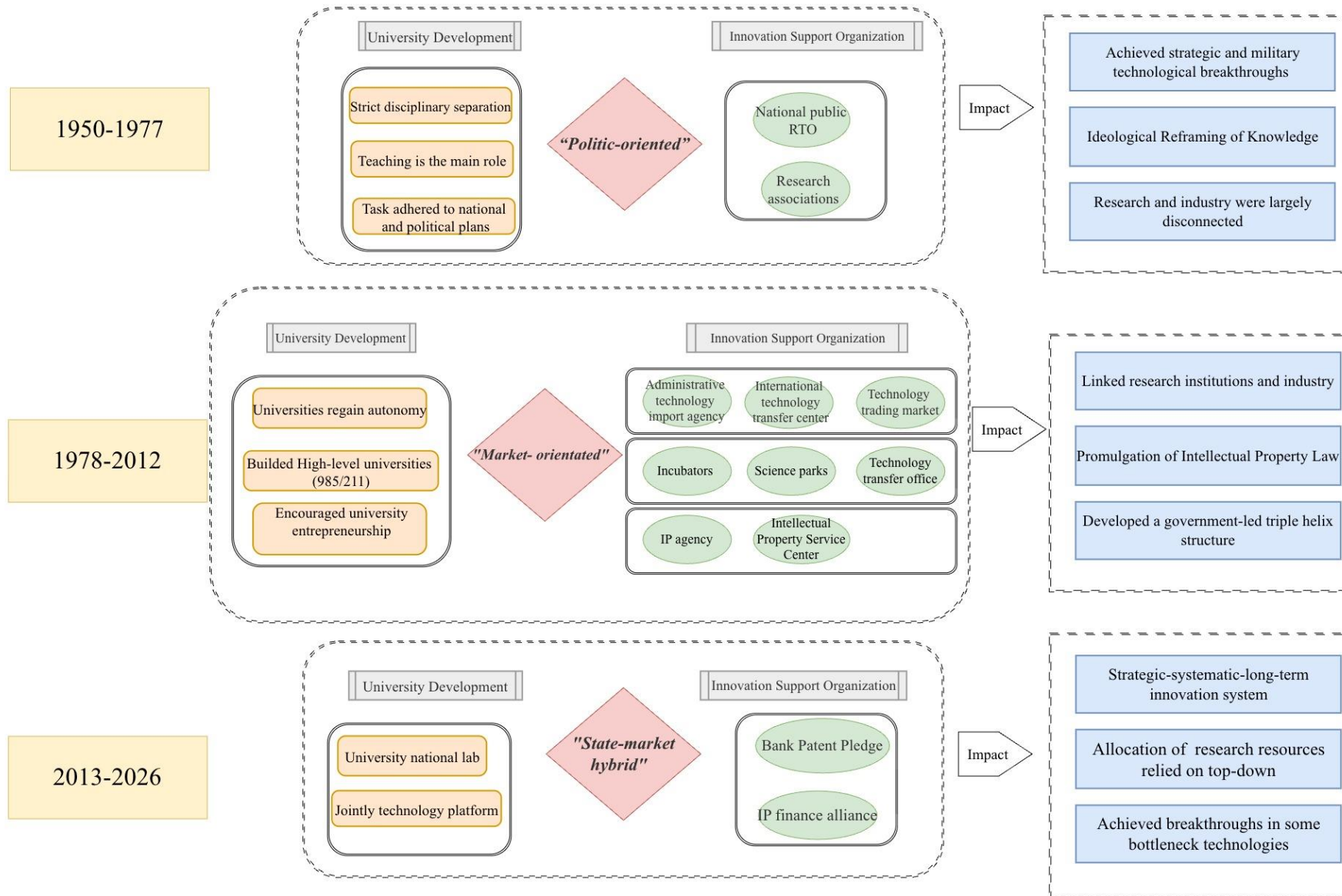


 **Shanghai IP Financial Service Alliance**

University and Innovation Intermediary Development Path (1500-2026)

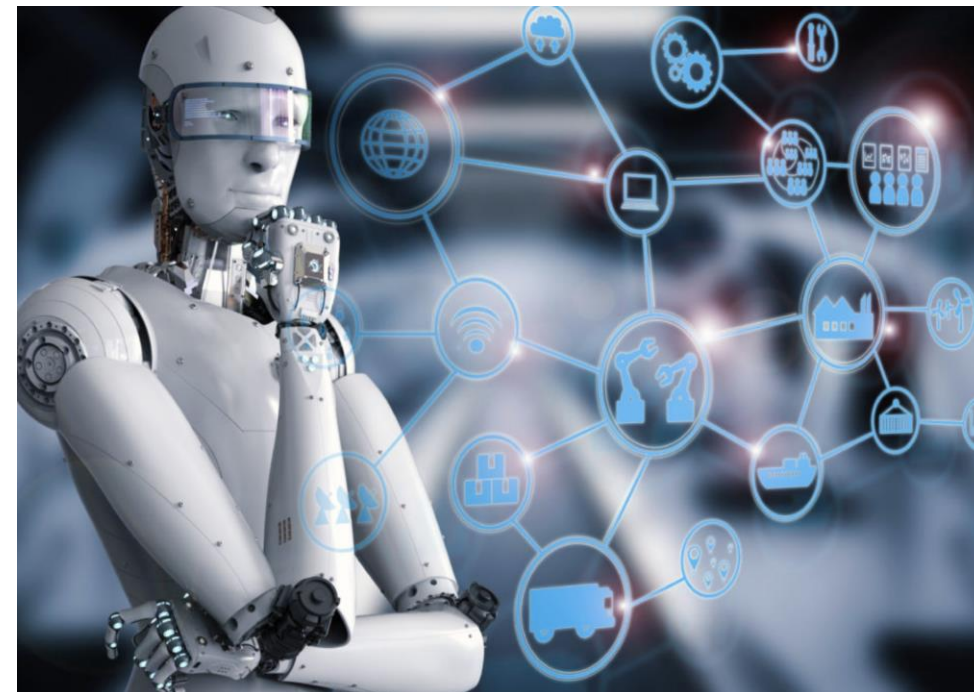


University and Innovation Intermediary Development Path (1500-2026)



Let's guess what the future will bring?

- Move from closed 1-on-1 service to more **open, multi-stakeholder co-creation** platforms (*Open innovation 2.0*)
- The **digitalisation of technology transfer** through big data, semantic AI matching, and automated IP valuation.
- There will be a more **complex intermediary system** and how to coordinate is the big challenge.



Discussion

- **State leadership** has remained a constant, while the governance model evolved from administrative control , central planning, market-oriented and networked coordination.
- Intermediary shifted from **monopolist** to **knowledge dissemination** to **politic tool** to **reduce transaction cost** then **value creation**.
- Intermediary **oscillates** between openness and conservatism, with an overall trend towards greater openness.
- Looking forward, the future development of Chinese innovation system will depend on its ability to **balance strategic coordination with organizational flexibility**.

Thank you for your
questions and suggestions!