China's Digitalized Industry Chains: Input-Output Accounting and Structural Insights

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Motivation & Background

- **The rise of the digital economy in China**

- **Growing importance of industry chain digitalization**

- **Need for integrated statistical frameworks**

Research Objectives

- **Compilation of China's digital economy input-output tables for 2018 and 2020**

- **Analysis of China's digitalized industry chains using these tables**

Framework for Digital IO Table

- **Based on SNA2008 and satellite account theory**

- **Classification: Digital sectors vs. traditional sectors**

- **Core idea: Reassign IO sectors using digital intensity coefficients**

Data Sources & Compilation Strategy

- **Base year: 2020 (and 2018)**

- **Data:**

  IO tables

  Economic Census

  Statistical Yearbooks

- **Estimation: Revenue and investment share coefficients**

Table Structure and Balance Adjustment

- **Structure: Digital vs. traditional sectors**

- **Matrix blocks: Intermediate use, final use, value added, imports**

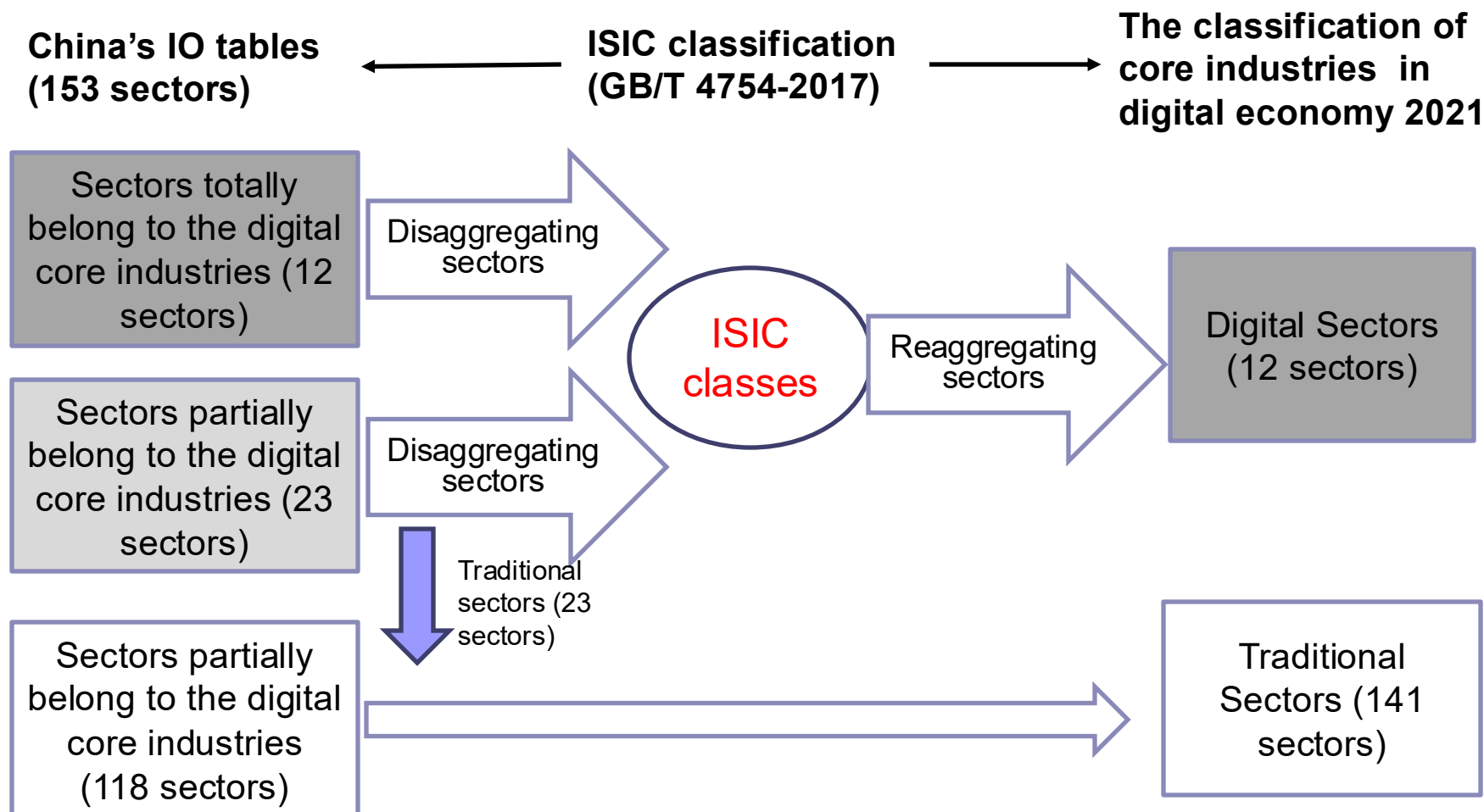- **Balancing process using adjustment coefficients**

d: digital sectors
t: traditional sectors (non-digital sectors)

T^{dd}	T^{dt}		Y_c^d	Y_k^d	Y_{ex}^d
T^{td}	T^{tt}		Y_c^t	Y_k^t	Y_{ex}^t

IM^d	IM^t		Y_c^{im}	Y_k^{im}	Y_{ex}^{im}
V^d	V^t				

Fig 1. Basic structure of digital IO tables

Reconciliation of digital and non-digital sectors for China

China's IO tables (153 sectors) ← ISIC classification (GB/T 4754-2017) → The classification of core industries in digital economy 2021

Sectors totally belong to the digital core industries (12 sectors)

Disaggregating sectors

Sectors partially belong to the digital core industries (23 sectors)

Disaggregating sectors

ISIC classes

Reaggregating sectors

Digital Sectors (12 sectors)

Traditional sectors (23 sectors)

Sectors partially belong to the digital core industries (118 sectors)

Traditional Sectors (141 sectors)

Validation of Compilation

- **Benchmarking against core industry value added**

Table 1 Comparing the core industry value added

Data sources		This paper	Xiang and Wang (2022)	Huang and Yao (2024)	Cai and Niu (2021)	Chen and Zhang (2022)
Year of comparison		2020	2020	2018	2018	2018
Scale of the VA (billion)		9093	7964	5543	7301	5055
Percentage of GDP (%)		8.95	7.84	6.03	7.97	5.52
VA structure	MAPE	—	20.27	106.25	49.72	6.62
	DSIM	—	0.11	0.25	0.27	0.03
	AED	—	0.02	0.06	0.04	0.01

- **Comparison with digitalization indexes**

- **Robust and policy-relevant results**

Defining Digitalized Industry Chains
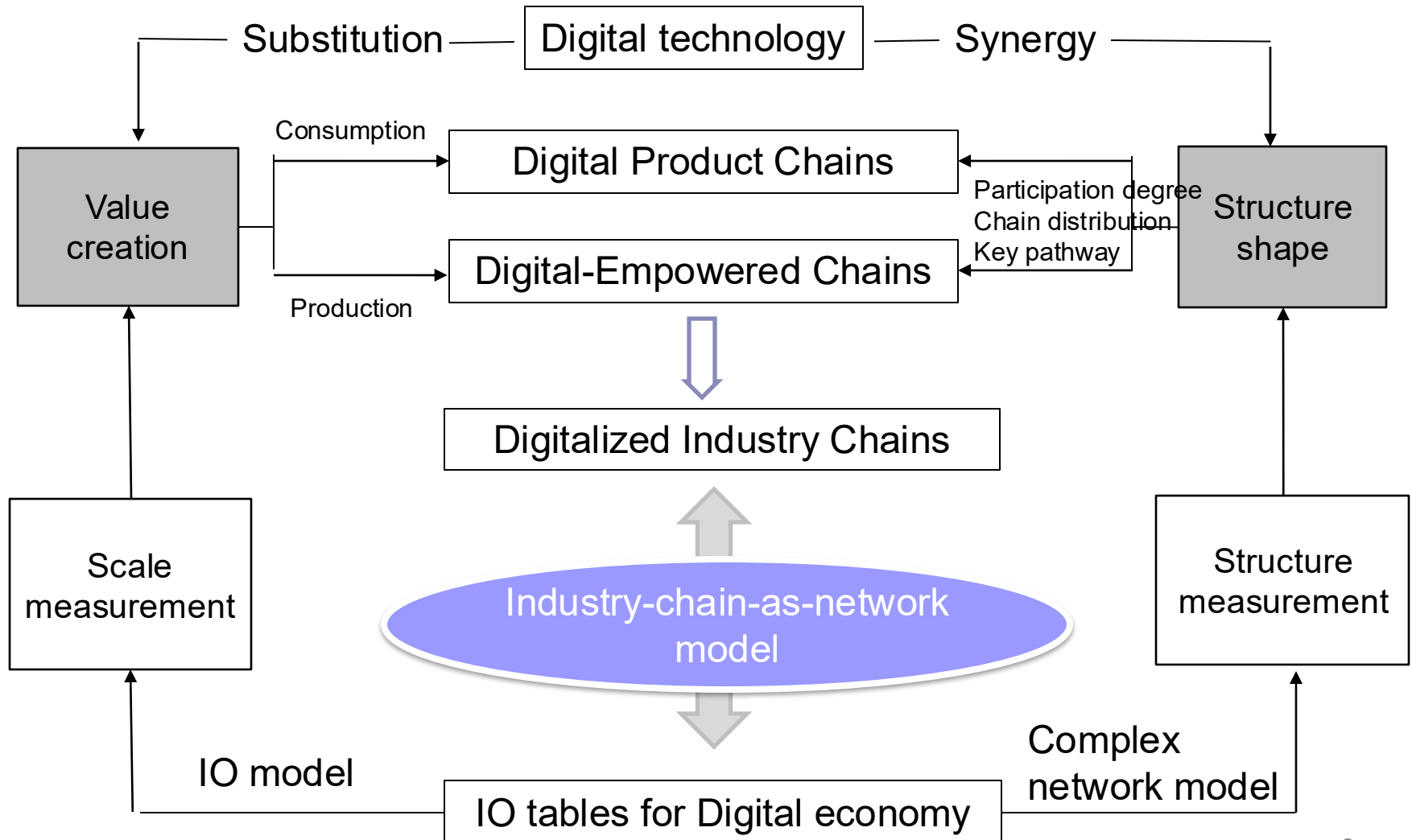
- **Two types:**

    Digital Product Chains

    vs.

    Digital-Empowered Chains

- **Based on production purpose and digital input roles**

Value Creation Mechanisms and Measurement

Network Model Construction

- **Industry-chain-as-network approach**

$$M = (N, \widetilde{A})$$

- **Nodes: Sectors;**

  Edges: Input-output relationships

- **Network properties:**

  Strength, position, key paths

Scale Measurement of digitalized industry chains

■ **VA driven by final products**

$$\begin{pmatrix} V^d \\ V^t \end{pmatrix} = \begin{pmatrix} \widehat{v^d} & 0 \\ 0 & \widehat{v^t} \end{pmatrix} \begin{pmatrix} L^{dd} & L^{dt} \\ L^{td} & L^{tt} \end{pmatrix} \begin{pmatrix} Y^d \\ Y^t \end{pmatrix}$$

■ **VA driven by digital and traditional products**

$$Va^{dc} = \begin{pmatrix} \widehat{v^d} & 0 \\ 0 & \widehat{v^t} \end{pmatrix} \begin{pmatrix} L^{dd} & L^{dt} \\ L^{td} & L^{tt} \end{pmatrix} \begin{pmatrix} Y^d \\ 0 \end{pmatrix} = \begin{pmatrix} \widehat{v^d} L^{dd} Y^d \\ \widehat{v^t} L^{td} Y^d \end{pmatrix}$$

$$Va^{tc} = \begin{pmatrix} \widehat{v^d} & 0 \\ 0 & \widehat{v^t} \end{pmatrix} \begin{pmatrix} L^{dd} & L^{dt} \\ L^{td} & L^{tt} \end{pmatrix} \begin{pmatrix} 0 \\ Y^t \end{pmatrix} = \begin{pmatrix} \widehat{v^d} L^{dt} Y^t \\ \widehat{v^t} L^{tt} Y^t \end{pmatrix}$$

■ **VA of Digital-Empowered Chains**

$$Va^{dp} = \begin{pmatrix} \widehat{v^d} L^{dt} Y^t \\ 0 \end{pmatrix}$$

Structure Measurement of digitalized industry chains

■ **Participation degree of digital sectors**

$$p_i^c = b_i / \sum_{s \in N} b_s$$

■ **Chain position distribution of digital sectors**

$$p_i^f = \sum_{\tilde{a}_{uv} \in U_i} b_{uv} / \sum_{\tilde{a}_{uv} \in D_i} b_{uv}$$

■ **Key pathway of digitalized industry chains**

$$Va_M^{dc} = \begin{pmatrix} \widehat{v^d} & \mathbf{0} \\ \mathbf{0} & \widehat{v^t} \end{pmatrix} \begin{pmatrix} M^{dd} & M^{dt} \\ M^{td} & M^{tt} \end{pmatrix} \begin{pmatrix} \widehat{Y^d} & \mathbf{0} \\ \mathbf{0} & \mathbf{0} \end{pmatrix} = \begin{pmatrix} \widehat{v^d} M^{dd} \widehat{Y^d} & \mathbf{0} \\ \widehat{v^t} M^{td} \widehat{Y^d} & \mathbf{0} \end{pmatrix}$$

Key Results - Scale

- **2020 Value Added: 13.86 trillion CNY**

- **13.63% of total industry chains**

- **9.54% annual growth (2018–2020)**

Table 2 Value added of Digitalized industry chains in China   **Trillion CNY**

Year	VA by Digitalized chains			Traditional chains	Total GDP
	Digital products	Digital-empowered	Sub-total		
2018	8.31	3.25	11.55	80.66	92.21
	9.01%	3.52%	12.53%	87.47%	
2020	10.05	3.81	13.86	87.78	101.64
	9.89%	3.75%	13.63%	86.37%	
Annual growth rate	10.00%	8.34%	9.54%	4.33%	4.99%

Key Results – Structure of Digitalized Chains

- **Digital sector participation: 10.05%**

- **Distributed across value chain stages**

- **Different structures between chain types**

Table 3　Distribution Structure of Value-Ad...

No.	Digital product sectors	Scale (Trillion CNY)
1	Computers	0.7580
2	Communication & Radar Equipment	1.5068
3	Digital Media Devices	0.3570
4	Smart Devices	0.0850
5	Electronic Components & Equipment	0.6663
6	Other Digital Products	0.2204
7	Digital Products Wholesale	0.0301
8	Digital Products Retail	0.0364
9	Digital Products Leasing	0.0000
10	Digital Products Repair	0.0020
11	Software Development	1.8256
12	Telecom, Broadcasting & Satellite Transmission Services	0.7111
13	Internet-Related Services	0.2628
14	Information Technology Services	0.0913
15	Other Digital Technology Application Services	0.0351
16	Internet Platforms	0.0589
17	Internet Wholesale & Retail	0.0900
18	Fintech (Financial Technology)	0.1282
19	Digital Content & Media	0.3315
20	Digital Infrastructure Development	0.0257
21	Data Resources & Property Rights Trading	0.0985
22	Other Digital Factor-Driven Industries	0.9846

Table 4　Source Composition of Value-Added in Digital Product Industry Chains

No.	Source sectors of VA	2018 Scale (Trillion CNY)	2018 Percent (%)	2020 Scale (Trillion CNY)	2020 Percent (%)	Annual growth rate (%)
1~6	Digital Product Manufacturing	1.4445	17.39	1.4022	13.95	-1.47
7~10	Digital Product Services	0.0620	0.75	0.0684	0.68	5.07
11~15	Digital Technology Application Industries	2.1133	25.44	2.8581	28.44	16.29
16~22	Digital Factor-Driven Industries	0.8120	9.78	0.9558	9.51	8.49
23~27	Agriculture, Forestry, Animal Husbandry & Fishing	0.1467	1.77	0.1919	1.91	14.36
28~33	Mining	0.1834	2.21	0.1952	1.94	3.18
34~48	Food, Beverage & Tobacco Processing	0.1060	1.28	0.1351	1.34	12.90
49~62	Textiles, Apparel & Leather Goods	0.1762	2.12	0.2296	2.28	14.13
63、64	Coking, Coal & Petroleum Processing	0.0617	0.74	0.0636	0.63	1.54
65~75	Chemical Industry	0.2335	2.81	0.2540	2.53	4.30
76~82	Non-Metallic Mineral Products	0.0733	0.88	0.0778	0.77	3.04
83~88	Metal Mineral Processing	0.2963	3.57	0.3444	3.43	7.81
89~112	Non-Digital Machinery Manufacturing	0.2297	2.77	0.2541	2.53	5.18
113~115	Other Manufacturing	0.0622	0.75	0.0791	0.79	12.75
116~118	Electricity, Gas & Water Utilities	0.1668	2.01	0.1947	1.94	8.02
119~124	Construction	0.0097	0.12	0.0130	0.13	15.98
127~138	Transportation, Storage & Postal Services	0.3165	3.81	0.3071	3.06	-1.49
125、126、139、140	Commerce & Catering Services	0.6559	7.90	0.7549	7.51	7.29
141~143	Finance & Insurance	0.3545	4.27	0.5237	5.21	21.55
144	Real Estate	0.3925	4.73	0.6142	6.11	25.09
145~163	Other Services	0.4089	4.92	0.5328	5.30	14.15

Key Results – Network Structure
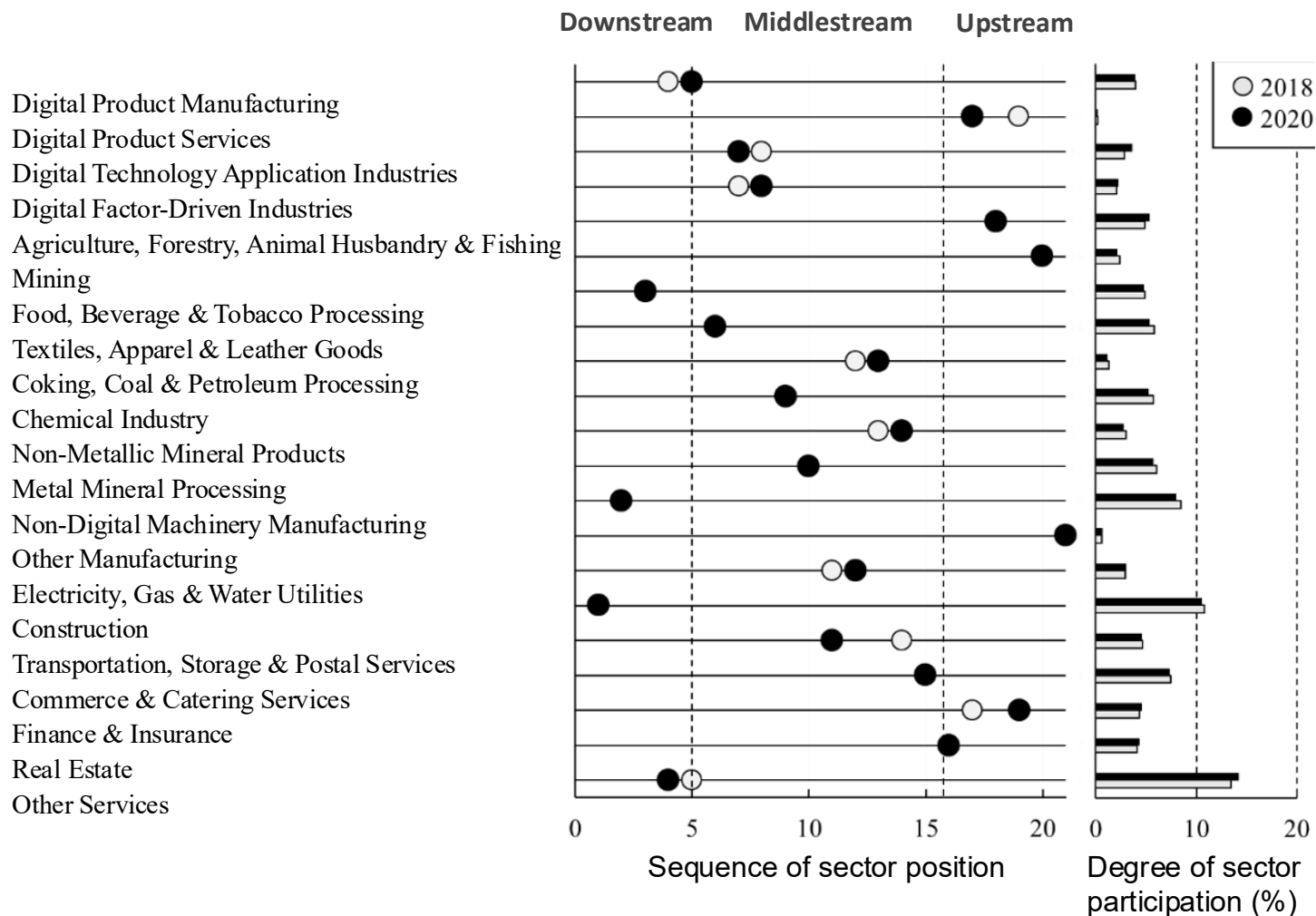
Fig 2. China's Full Industrial Chains Network Structure
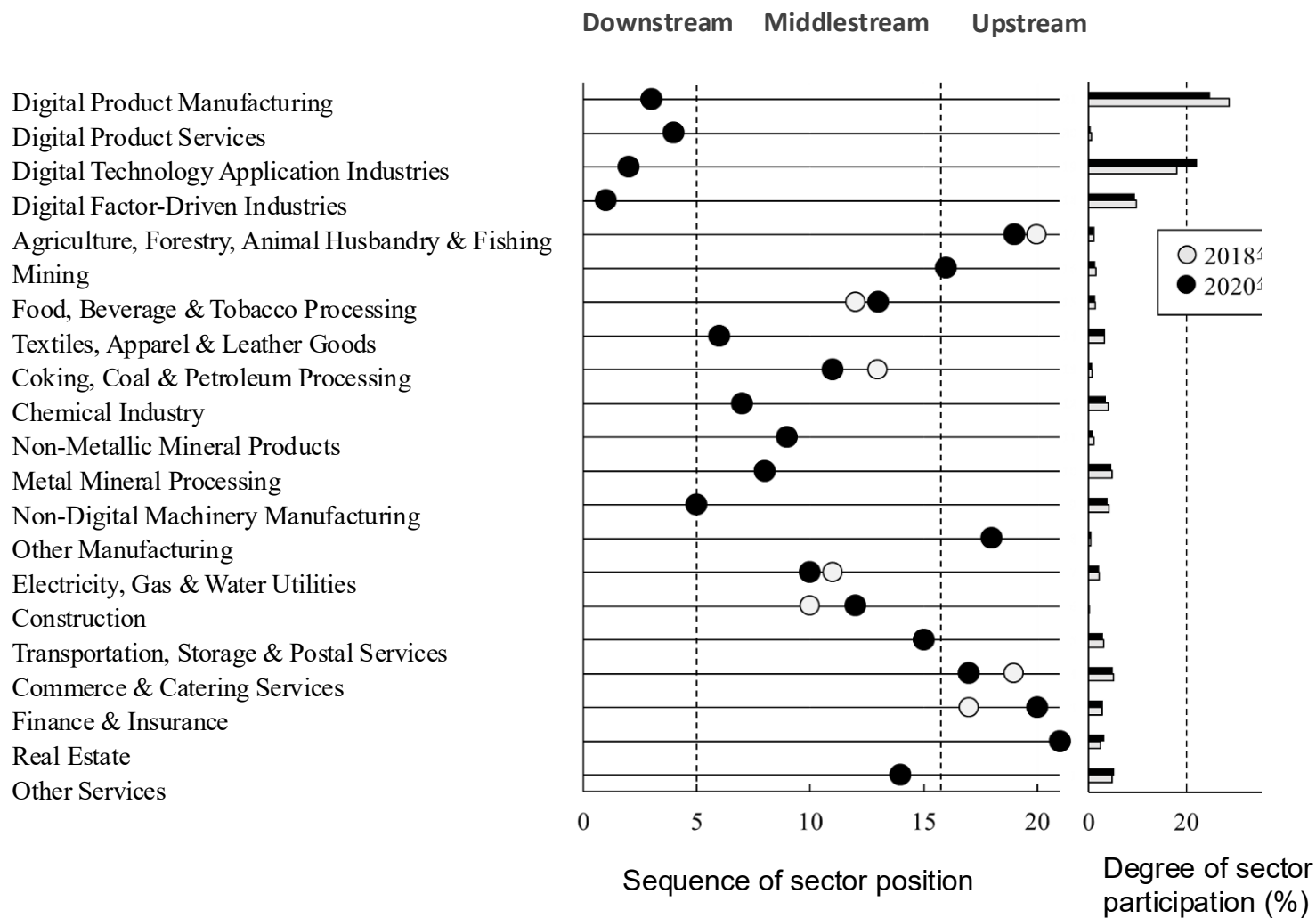
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Key Results – Network Structure

Downstream   Middlestream   Upstream

- Digital Product Manufacturing
- Digital Product Services
- Digital Technology Application Industries
- Digital Factor-Driven Industries
- Agriculture, Forestry, Animal Husbandry & Fishing
- Mining
- Food, Beverage & Tobacco Processing
- Textiles, Apparel & Leather Goods
- Coking, Coal & Petroleum Processing
- Chemical Industry
- Non-Metallic Mineral Products
- Metal Mineral Processing
- Non-Digital Machinery Manufacturing
- Other Manufacturing
- Electricity, Gas & Water Utilities
- Construction
- Transportation, Storage & Postal Services
- Commerce & Catering Services
- Finance & Insurance
- Real Estate
- Other Services

○ 2018
● 2020

Sequence of sector position

Degree of sector participation (%)

Fig 3. Industrial Chains Network Structure of Digital Products

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Key Results – Key pathway

2018

2020

Sectors of Primary input

Sectors of final use

Sectors of final use

Pathway of VA
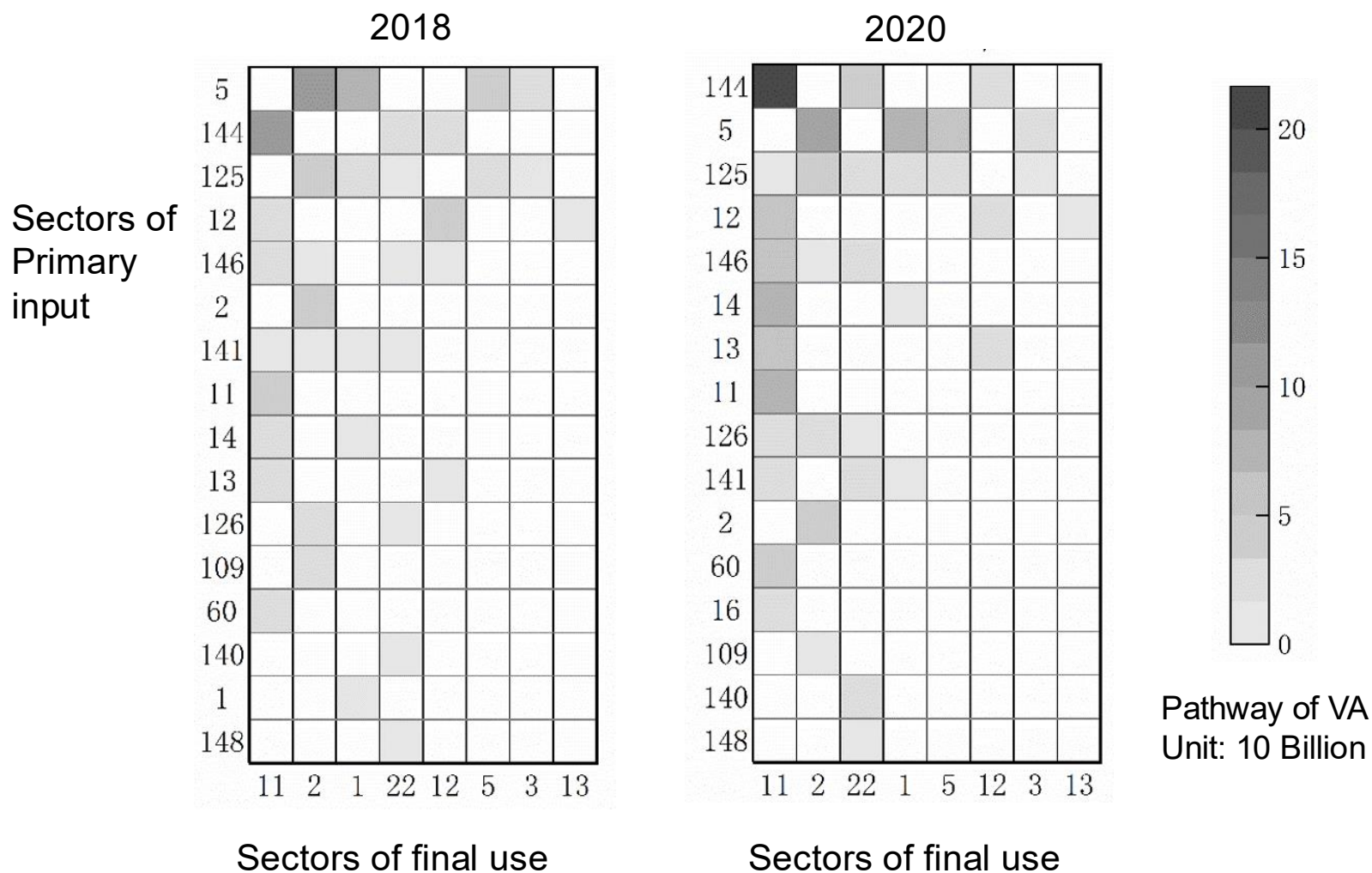Unit: 10 Billion

Fig 4. Key pathway of Industrial Chains of Digital Products

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Policy Implications

- **Support integrated accounting standards**

- **Promote digital investment across sectors**

- **Align IO statistics with digital policy**

Future Research Directions

- **Update with post-pandemic IO data**

- **Integrate global value chain frameworks**

- **Analyze digital transformation resilience**

Thank You / Q&A

- **Thank you for your attention**

- **Questions and feedback welcome**