

Path Analysis of Digital Economy and Reconstruction of International Trade Rules Driven by Artificial Intelligence

Chen Chen ¹, Yihan Dong ², Mayuyue Fan ^{3,*}, Baoqi Yu ⁴

¹ Suzhou University Affiliated High School, Suzhou, China

² Xi'an Gaoxin No.1High School, Xi'an, China

³ Shanghai Shangshi Cambridge Foreign Language School, Shanghai, China

⁴ Sedbergh School, Fuzhou, China

* Corresponding Author Email: vinaaa10@outlook.com

Abstract. With the accelerated digital transformation of global economic trade, the deep integration of the digital economy and traditional trade have emerged. As a core technology, Homo sapiens artificial intelligence (AI) has begun to permeate the fields of international trade and the digital economy extensively. While it enhances trade efficiency and fosters innovation in related models, it also introduces new challenges regarding the adaptation of economic and trade rule systems. Against this backdrop, this paper systematically examines theoretical logic, practical evolution, and future trends of the reconstruction of digital economy and international trade rules. First, it analyzes the mechanisms by which AI reshapes trade cost structures and competitive models, clarifying the inherent logic of rule iteration. Second, through case studies of digital trade rule disparities e.g., in the U.S., Europe, etc. and regional agreement practices, it dissects the evolutionary path of these rules from exploration to formalization. Finally, it proposes pathways for rule reconstruction, including multilateral coordination, regional cooperation, and platform participation, providing references for related research and practice.

Keywords: Digital economy, international trade rules, artificial intelligence.

1. Introduction

The digital transformation of the global economic and trade market is profoundly altering the landscape of international trade. The fusion of the digital economy and traditional trade has given rise to new features such as virtual market expansion and cross-border online service innovation. The widespread application of Homo sapiens AI technology serves as the core driver of this transformation. In international trade, applications such as machine Homo sapiens transportation and intelligent broadcasting have reduced labor costs and improved import-export efficiency. In the digital economy, AI has optimized operations for online shopping platforms e.g. Taobao, Amazon and enhanced price fluctuation predictions for commodities like gold, accelerating the maturation of virtual markets.

However, the innovation of Homo sapiens AI technology also introduces new challenges for international trade and the digital economy in terms of rule adaptation. Issues such as sovereignty disputes over cross-border data flows, copyright definition of AI-generated content, and liability allocation for intelligent trade intermediaries pose challenges to traditional rule systems. Therefore, examining the relationship between Homo sapiens AI and the reconstruction of digital economy and international trade rules holds significant theoretical and practical importance.

This paper follows the research approach below: First, it traces the theoretical development of international trade rules from traditional trade scenarios to digital economy adaptation, clarifying the inherent logic of rule iteration. Second, it reviews the evolutionary path of rules from exploration to gradual formalization in the practice of Homo sapiens AI-enabled digital economy and trade, analyzing multi-stakeholder participation, rule innovation practices, and existing mechanisms. Finally, it constructs a systematic analytical framework encompassing theoretical, practical analysis, and trend prediction, offering a comprehensive perspective on the reconstruction of international trade

rules in the digital economy era. The findings of this study can serve as a reference for relevant management and research Homo sapiens personnel, thus carrying practical significance.

2. Research Status

2.1. Theoretical Logic

AI's algorithm dominance and data learning mechanisms fundamentally alter trade cost structures and sources of comparative advantage. Its efficient data processing capability makes data a key production factor, sparking disputes over cross-border data flows, ownership definition, and profit distribution, thereby driving rule reconstruction centered on data governance [1].

As a general-purpose technology, AI exhibits characteristics of increasing returns to scale and declining marginal costs, dimensioning traditional trade competition models. This necessitates rule adaptations to new economic forms, such as adjusting tax systems to align with digital service profit distribution models, innovating intellectual property rules to address ownership issues of Homo sapiens AI-generated outputs, and balancing innovation incentives with fair competition [2].

The rise of virtual goods, digital service trade, and platform intermediaries disrupts the framework of traditional physical trade rules. Cross-border data flows challenge customs supervision, tax collection, and other rules, compelling nations to reconsider foundational standards like trade definitions and transaction location confirmation, and to construct rule systems adapted to the digital economy.

2.2. Practical Evolution

Global digital trade rules exhibit a multi-element Game pattern. The U.S. promotes free data flow through agreements like United States-Mexico-Canada Agreement (USMCA), opposing data localization to consolidate its digital industry advantage. The European Union (EU), with General Data Protection Regulation (GDPR) at its core, emphasizes privacy sovereignty, restricting cross-border data flows to protect user rights. China explores a balance between security and openness, exemplified by the Hainan Free Trade Ports cross-border data pilot, promoting orderly data flow while ensuring security. Regional agreements serve as testing grounds for rule innovation, with Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) incorporating clauses like non-discrimination for digital products and prohibitions on data localization, providing regional practice samples for global rules [3].

Core disputes over cross-border data flows focus on localization versus free flow. Countries like Russia enforce laws mandating local storage of critical data to safeguard sovereign security, while the U.S. advocates free data flow to expand its commercial reach, reflecting competition over digital economic sovereignty and interests. In algorithm governance, the black box of AI decision-making e.g., discriminatory trade credit assessments raise fairness concerns, prompting the European Union (EU) to promote rules on algorithm explainability [4]. In intellectual property, disputes over copyright ownership of AI-generated content and training data ownership frequently arise, with traditional rules struggling to cover all scenarios. Digital service taxes have shifted from unilateral imposition by countries like France to Organization for Economic Co-operation and Development (OECD) multilateral coordination, remissioning tax imbalances caused by light-asset digital enterprises profiting Cross-regionally.

Divergences exist in defining the liability of cross-border e-commerce platforms. The EU imposes stringent supervisory responsibilities. e.g., auditing merchants for false sales, while the U.S. favors limited exemption. Judicial jurisdiction disparities, increasing corporate compliance costs. Competition over technical standards intensify, with 5G and AI algorithms becoming invisible rules. China, the EU, and the U.S. vie for digital trade right to speak by promoting technical alliance standards e.g., Chinas 5G scene applications, the EUs AI ethics guidelines [5]. Countries promote the improvement of the rule system amid disputes through diversified collaboration involving World

Trade Organization (WTO) “negotiations + domestic” legislation such as Chinas E-Commerce Law + industry self-regulation such as platform data security conventions.

3. The Impact of AI-Driven Digital Economy on International Trade Rules

3.1. Transformation of Trade Forms and Content

AI shifts international trade from a good-dominated model to an integrated data + services + intelligence model.

Data has become a core trade commodity, with AI training data, medical imaging data, and other datasets creating value through cross-border transactions. For example, European hospitals export tumor imaging datasets to Asian tech companies for training cancer diagnosis algorithms, with such transactions growing at an annual rate exceeding 30%. However, the non-rivalrous and easily replicable nature of data renders “traditional tariffs + physical supervision” rules ineffective, necessitating new frameworks for data sovereignty, cross-border flow security, and profit distribution.

Intelligent trade intermediaries are reshaping processes. AI-driven cross-border e-commerce platforms e.g., Amazons intelligent product selection system automatically match supply and demand while optimizing logistics, with 60% of global small and medium-sized foreign trade enterprises relying on them for business operations in 2024. AI-powered customs clearance systems e.g., Chinas Single Window AI module have reduced clearance times from 24 hours to 3 hours. However, new rules are needed to clarify legal liabilities for AI decisions e.g., accountability for misjudged customs declarations and data usage permissions e.g., boundaries for commercial use of user information [6].

The tradability of digital services has significantly increased. Remote AI diagnostics, cross-border industrial internet services, and similar offerings have overcome geographical limitations, with the global remote AI healthcare service market exceeding 50 billion in 2023. Yet, the intangible and instantaneous nature of these services challenges traditional rules on origin determination and trade statistics.

3.2. Reconfiguration of the Competitive Landscape of International Trade

Technical barriers have replaced traditional tariffs as a core competitive tool. AI algorithm patents, data security standards and other construction of a "digital moat": the United States holds 70 per cent of the world's core AI algorithm patents, and through patent cross-licensing to form a technology alliance, restricting application by non-allied countries; The European Union has set a "data compliance certification" threshold based on the GDPR, and offshore companies need to invest high costs to adapt to the rules.

AI infrastructure gaps exacerbate divergence in trade participation. With mature AI technology and equipment, developed countries have quickly adapted to the new form of digital trade, developing countries, due to the lack of intelligent customs declaration systems and insufficient algorithmic application capacity, have been marginalised in global trade, creating trade inequality due to the "technological divide" [7].

3.3. Crisis of Adaptability of Traditional International Trade Rules

Rules of origin face the challenge of "digital ambiguity". While traditional goods (e.g., clothing) can be identified by the place of origin of raw materials and processing, the "digital origin" of AI products (e.g., programmes incorporating algorithms and data from multiple countries) is difficult to define, and the rapid iteration of algorithms makes the rules frequently invalid.

Tariffs and non-tariff barriers are taking on a different form. Traditional tariffs have been replaced by "data localisation requirements", "algorithmic transparency reviews", etc.: Russia's requirement that critical data must be stored on local servers, and the EU's requirement that firms disclose their AI decision-making logic or be barred from entering the market, are nominal safeguards but hidden barriers to trade that are not regulated by conventional rules [8]. These measures, while nominally safeguarding security, are in fact hidden trade barriers that are not regulated by traditional rules.

4. Possible Paths and Practical Explorations for Reconstructing the Rules

4.1. Multilateral Coordination Pathways

In the reconstruction of global digital trade rules, the establishment of a dedicated multilateral coordination mechanism is crucial. Consideration can be given to setting up a "digital trade council" as a special negotiation mechanism to provide a regular communication platform for countries to coordinate their differences in the field of digital trade. At the same time, a tiered reform model of "plurilateral consultation + multilateral acceptance" should be promoted, such as drawing on the experience of the Joint Statement Initiative (JSI), whereby plurilateral agreements are first reached by some countries on specific digital trade issues, and then progressively accepted by a wider range of countries, so as to improve the efficiency of rulemaking. In addition, a period should be reserved for developing countries to catch up with AI technology, taking into account the lagging development of developing countries in the field of AI technology, and giving them a certain amount of buffer time, so as to help them improve their technological level and better integrate into the global digital trade system [9, 10].

4.2. Strengthening Regional Cooperations

Regional cooperation is an important force in promoting the reconstruction of digital trade rules. The "digital chapter" template in RTAs has an important role as a model, e.g. the CPTPP's digital clause on open rules for AI services provides clear norms for intra-regional trade in AI services and promotes the development of intra-regional digital trade. Cross-regional rule docking is also indispensable, such as the mutual recognition mechanism between DEPA and the ASEAN Framework Agreement on the Digital Economy, which helps to reduce conflicts between different regional rules and lower the transaction costs for enterprises [11, 12]. Meanwhile, the establishment of a regional AI technology standards alliance, like the synergistic case of the EU, the US, and Japan in terms of AI code of ethics, can promote the harmonisation of AI technology standards in the region.

4.3. Construction of Rules for Platform Companies and Technology Alliances

Platform enterprises and technology alliances are playing an increasingly important role in the construction of digital trade rules. Global e-commerce platforms can jointly formulate AI governance conventions, such as Amazon, Al and other enterprises to jointly establish common standards for cross-border data compliance, unify standards for data protection, transaction dispute handling, etc., to reduce differences in rules between platforms, regulate AI applications and data flows within the platforms, and safeguard consumer rights and interests and data security. The AI for Good initiative of the International Telecommunication Union (ITU) is committed to realising the convergence of technical standards and trade rules, for example, incorporating AI device safety standards into trade inspection requirements, avoiding technical barriers and rule conflicts, and promoting the benign application of AI technology in the field of trade. The mutual recognition system of AI service qualifications led by industry associations is also of great significance, such as the certification standards of the Global AI Ethics Alliance, which provides enterprises with guidelines for adapting to the rules and establishes industry norms, which will help to improve the quality and credibility of AI services, and promote the circulation of AI services globally [13-15].

Through multilateral coordination, regional cooperation and the joint efforts of platform enterprises and technology alliances, it is possible to promote the reconstruction of digital trade rules, form a fairer, more reasonable and efficient global digital trade order, and promote the healthy development of the global digital economy.

5. Conclusion

This paper explores the reconfiguration of national trade rules by the AI-driven digital economy. The AI-driven digital economy is profoundly reshaping the shape of international trade and promoting

the transformation of the rule system from traditional physical trade to digital trade. At the theoretical level, data has become a core element and AI has changed the competition mode, which requires the rules to be reconstructed around data governance and innovation incentives; at the practical level, the differences between the rules of the United States, Europe and China, the experiments of regional agreements, and the participation of platforms show the evolution trend of the rules from "government-led" to "pluralistic co-rule". The evolution of rules from "government-led" to "pluralistic and shared governance".

In the future, the reconstruction of rules should address new challenges such as the regulation of AI-generated content and "algorithmic tariffs", and balance innovation and security, sovereignty and cooperation. Relying on the "Digital Silk Road", China should export the "Digital Infrastructure + Rule Adaptation" model, actively participate in the WTO e-commerce negotiations and OECD digital tax coordination, and change from "rule follower" to "co-constructor", helping to change from "rule follower" to "co-constructor". China should actively participate in the WTO e-commerce negotiations and the OECD digital tax coordination, and change from a rule follower to a co-constructor, so as to help build a fair and open global digital trade rule system.

Authors contribution

All the authors contributed equally and their names were listed in alphabetical order.

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