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Toward a Unified Definition of Digital Trade: A PRISMA-ScR Based Scoping Review and Conceptual Synthesis

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The rapid digitalization of global trade is transforming traditional boundaries between goods, services, and data. Despite its economic significance, the term 'digital trade' lacks a consistent and unified conceptual definition across international institutions, academia, industry and regulatory frameworks, leaving important normative and regulatory concepts insufficiently defined. This study explores the definitional ambiguity surrounding digital trade through a systematic scoping review using the PRISMA-ScR framework. By analyzing 20,631 records from the Dimensions database, key institutional documents from the WTO and OECD and academic research, the study maps the conceptual evolution of digital trade over three decades and identifies critical gaps in current governance and measurement practices. The 39 core definitions were extracted and synthesized comparatively across four critical dimensions: value chain scope, unit of measurement, governance orientation, and mode of delivery. This systematic deconstruction revealed conceptual fragmentation driven by technical obsolescence and disparate national perspectives on digital sovereignty. To resolve these inconsistencies, the study develops a tri-pillar synthesis framework composed of functional determinacy, statistical consistency, and a governance foundation. Based on this framework, this study proposes a unified definition of digital trade.

JEL Classification: F13, F14, O33
Keywords: digital trade, e-commerce, cross-border data flows, digital economy, trade measurement, global trade governance

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1. INTRODUCTION

Digital technologies have become as indispensable as air in our daily lives, underpinning how we communicate, manufacture and consume. The development of digital technologies has reshaped how goods, services and data move across borders and accelerated the pace of these flows (OECD, 2025a). The structure of the global economy is being transformed as the ways of doing business change and participation broadens, making what is described as a new era of digital globalization (Manyika *et al*., 2016). The diffusion of digital technologies has accelerated productivity growth in firms and facilitated the transformation of manufacturing industries (Tu *et al*., 2025). As enablers of the global economy, digital technologies and services facilitate new business models, make connections, transactions, and accessible information through the Internet (OECD, 2022). WTO (2018) noted that the expansion of digital technologies is expected to further transform international trade, identifying artificial intelligence (AI), the Internet of Things (IoT), 3D printing, and blockchain technology as potential technologies that could reshape how we trade, who participates in trade and what can be traded. The development and implementation of advanced technologies such as artificial intelligence accelerate the change in the digital economy. AI can serve as an effective driver of inclusive, trade-led growth by reducing trade costs and enabling small businesses to participate in global markets (WTO, 2025). Driven by borderless digital transmissions, digital trade, so called electronic commerce (e-commerce), has evolved into a fundamentally global phenomenon, operating within a virtual space that bypasses the limitations of territorial borders.

Whereas international trade has traditionally centered on merchandise, it is increasingly shaped by cross-border flow of intangible assets, including data, software, and most notably digitally delivered services exports and e-commerce. The beginning of the 1990s saw global digital trade value at near-zero levels, but it has since escalated to a significant economic scale (Paris, 2003). The volumes of these are estimated using various scopes. It is estimated that global e-commerce expanded from USD 19.3 trillion in 2012 to USD 27.7 trillion in 2016, with the business to business (B2B) transactions accounting for more than 86 percent of the total (USITC, 2017). E-commerce sales generated by businesses across 43 developed and developing countries were USD 25 trillion in 2021, representing a 15 percent increase from the pre-pandemic period 2019 (UNCTAD, 2024a). In the same year, world merchandise exports amounted to USD 22.3 trillion, while commercial services trade totaled USD 6.3 trillion (WTO, n.d.-a; WTO, n.d.-b). The digitally ordered exports were estimated around USD 3 trillion in 2022 (UNCTAD, 2024b). Electronic commerce is widely recognized as a catalyst that has accelerated the pace of global economic integration (Fariselli *et al*., 1999).

This raises a fundamental question: how should digital trade transactions be defined? What is digital trade? Despite the growing importance of digital trade, there is a lack of a consistent and unified definition of trade (Aaronson, 2019; Barefoot *et al*., 2018; Fu *et al*., 2025; López González and Jouanjean, 2017; Larionova and Shelepov, 2021; Li and Wang, 2024; Lund and Manyika, 2016; Meltzer, 2019; Kwak, 2022; Patrignani, 2024; Rahman and Ramos, 2013; USITC, 2014; Wen *et al*.,

2023). The absence of a unified definition is not accidental but structurally driven by multiple factors. Specifically, rapid technological evolution continuously redefines the scope of digital trade, often outpacing existing frameworks. This complexity is further compounded by blurring boundaries between goods and services, which complicates traditional trade classifications. Moreover, divergent regulatory philosophies, particularly concerning digital sovereignty, lead to conceptual gaps between nations. Ultimately, the coexistence of narrow and broad conceptualizations further exacerbates definitional fragmentation. There is no universally accepted definition of data flows, yet there is a tendency to interpret them in a broad and inclusive manner — as the movement of data that forms part of the delivery of a product or service across national borders, even though such flows do not correspond to a single commercial transaction (Burri, 2021).

As interest in the use of digital trade grows substantially, especially with the recent development of AI and other digital technologies, the need to clearly define digital trade has become even more urgent. Across international and national institutions, various interpretations of digital trade exist, each reflecting differences in scope and focus; however, the absence of a consistent and unified definition leads to conceptual ambiguity. This absence of definitional clarity is not merely academic; it directly influences how trade is measured, regulated, and governed. In the absence of harmonized definitions and shared normative frameworks, regulatory authorities face significant hurdles for the effective international protocols aimed at mitigating obstacles to cross-border data flows (Aaronson, 2019). Quantifying the exact expansion of e-commerce continues to be a complex task, as disparate conceptual frameworks and diverse metrics are employed across different industrial sectors and research reports (Michielsen *et al*., 2025). It remains difficult to develop a standardized definition (Burri and Chander, 2023).

While the significance of digital economy grows, academic research focusing on the foundational definition of digital trade is limited. Zwass (1996) restructured e-commerce into three meta-levels and divided into seven hierarchical structures based on the functions.[1)] Ngai and Wat (2002) provided an early mapping of the multidisciplinary e-commerce landscape by analyzing 275 articles of 9 journals, but their study has limitations in comprehensiveness. Heman (2010) identified the transition of digital trade norms by systematically structuring the terminology of digital trade and providing a comprehensive synthesis of its definitions within Regional Trade Agreements (RTAs) of OECD member countries. Lee *et al*. (2007) examined the evolution of electronic commerce (EC) research by analyzing 1,103 articles published over a decade (1996-2005). By categorizing these works into six e-commerce specialty journals, four major information systems journals, and four marketing journals, the authors identified a clear functional divergence. Lee *et al*. (2007) found that the

[1)] Three meta-levels are “Products and Structures, Services and Infrastructure” and seven hierarchical structures are “electronic marketplaces and electronic hierarchies, products and systems, enabling services, secure messaging, hypermedia/multimedia object management, public and private communication utilities and wide-area telecommunications infrastructure” (Zwass, 1996, p. 6).

specialized e-commerce journals played a pivotal role in expanding and redefining their domain through a diverse array of conceptual frameworks and multidisciplinary backgrounds. OECD (2025b) presents its efforts to update the definition of e-commerce, reaffirming its core principles while refining the guidance to enhance clarity, adaptability and statical usability, building on the OECD's work since 2001 to establish a statistical definition of e-commerce, which has not yet achieved global harmonization. This numerical and geographic restriction highlights a need for a more expansive, systematic approach to capture the full evolution of digital trade.

This paper addresses a fundamental question: (1) how have the conceptual boundaries of digital trade evolved?; (2) what are the structural patterns of divergence leading to the current definitional ambiguity problem?; and (3) how can these fragmented perspectives be synthesized into a unified definition of digital trade?

This study aims to explore the conceptual evolution of digital trade by systematically examining how its definitions have been changed across academic literature and international institutions. By identifying the core elements in the various frameworks, the research proposes a synthesized, unified definition aimed at achieving global definitional alignment. Clarifying the concept of digital trade is essential for improving statistical measurement, regulatory coordination, and international trade negotiations. Ultimately, this study serves as the groundwork for a more coherent and integrated approach to digital trade policy and global governance in the data-driven era.

This study contributes to literature in three ways: first, it provides a comprehensive mapping of the evolution of digital trade conceptualization; second, it identifies four structural dimensions of conceptual fragmentation; and lastly, it proposes a synthesis framework which is a basis for a unified definition of digital trade.

2. RESEARCH DESIGN AND METHODOLOGY: SCOPING REVIEW AND PRISMA-SCR

The multidisciplinary nature of digital trade has historically led to a scattered body of literature, making it difficult to confine the field to a single academic discipline (Ngai and Wat, 2002). The study adopts a scoping study approach to systematically collect and synthesize existing definitions and conceptualizations of digital trade across international organizations, academic literature and policy documents. A scoping study is a research method used to *map* the extent, range and nature of existing literature in areas where concepts are broad or inconsistently defined, drawing on reviews of primary research. This approach is suitable for identifying key themes, clarifying conceptual boundaries and revealing gaps (Arksey and O'Malley, 2005).

It is methodologically suitable for research domains characterized by conceptual ambiguity of digital trade, as it enables a comprehensive examination of definitional variation and their underlying rationales. To address this fragmentation and capture the full breadth of the field, this study adopts

the "Preferred Reporting Items for Systematic Reviews and Meta-Analysis Extension for Scoping Reviews (PRISMA-ScR)" methodology for transparency in source identification, screening and inclusion (a.c. Tricco *et al*., 2018).

While the PRISMA framework has been used as a research methodology within the medical and health sciences to ensure the transparency of clinical evidence, its application is expanding to other disciplines to enhance reporting standards. For instance, Na *et al*. (2022) assessed the level of compliance with PRISMA items among systematic reviews, and Park *et al*. (2022) noted its use in maintaining reporting consistency and structural integrity within the field of radiology. Despite its proven efficacy in these specialized fields, it is difficult to find academic research where this systematic methodology has been applied to define or conceptualize the domain of digital trade.

By utilizing this robust framework, we systematically identify and map the evolving definitions and conceptualizations of digital trade, ensuring a holistic understanding of the current theoretical state-of-the-art.

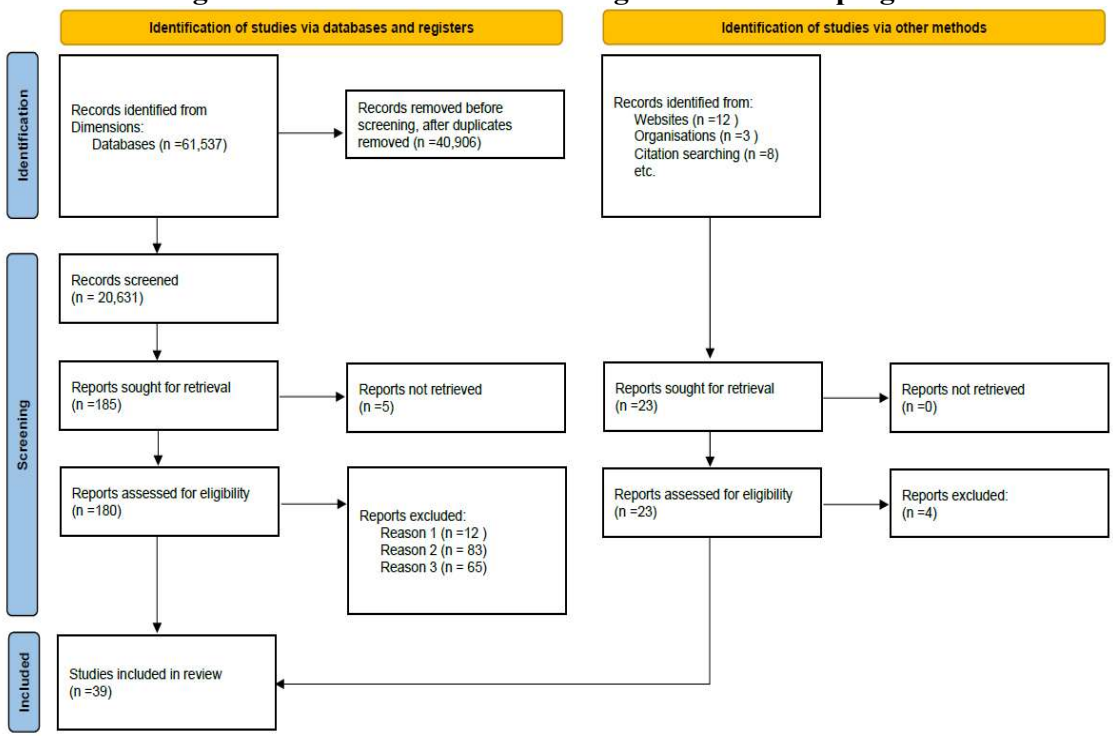
2.1. Data Sources and Search Strategy

As noted above, digital trade has been defined in various ways, and a comprehensive review of existing definitions including related terms such as e-commerce is a necessary first step in this research. Given that literature often blurs the distinction between the two, this review treats 'digital trade' and 'e-commerce' as equivalent terms to capture all relevant conceptual frameworks identified through the PRISMA-ScR process.

An initial exploratory search was conducted using both the Scopus and the Dimensions. However, considering the purpose of this research, the Dimensions database was ultimately selected as the data source. The Dimensions dataset has broad coverage of peer-reviewed research outputs across multiple disciplines and document types (Guerrero-Bote *et al*., 2020; Thelwall, 2018), which is suitable for mapping the diverse and fragmented conceptual and definitional debates on digital trade. The extraction of the dataset was conducted in 2025.

In addition to database search of Dimensions, relevant documents were identified through manual searches of official websites of international organizations. The process is reported using the PRISMA 2020 flow diagram for new reviews that included searches of databases and other sources (Page *et al*., 2021).

Figure 1 PRISMA 2020 Flow Diagram for the Scoping Review



Note: Adapted from "The PRISMA 2020 statement: An updated guideline for reporting systematic reviews," by M. J. Page *et al*. 2021, 372, p. 5. CC BY 4.0.

2.2. Selection Criteria and Screening Process

An initial search to identify literature related "digital trade" yielded 115,390 records from the Dimensions. The terms "digital trade", "e-commerce", and "electronic commerce", were used in combination with trade-related words capturing cross-border and international trade contexts. This approach reflects the fact that digital trade was initially discussed under the concept of e-commerce in early literature. To ensure higher degree of quality control, the search was limited to publications classified as research articles, review articles, and research chapters between 1998 and 2026, reflecting the period following the launch of the WTO Work Program on Electronic Commerce. Due to the limitations in language filtering within Dimensions, the language restrictions were applied during the screening stage, and only English-language publications were included for analysis. Including the criteria of inclusion and exclusion, the search led to a total of 53,465 articles from Dimensions database (Table 1).

Table 1 The 1st Search Inclusion and Exclusion Criteria and Results

Criteria	Filters	Documents
Keyword	"digital trade", "e-commerce", "electronic commerce", "international trade", "cross-boarder"	
Restriction	Publications	115,390
Year	1998-2026	114,766
Document type	Research article, review article, research chapter	53,465
Total documents		53,465

For the second search, more targeted search was conducted to narrow down the articles containing explicitly in definitional and conceptual discussions. This search incorporated keywords related to definitions and conceptualization to identify literatures addressing the conceptual foundation of digital trade. The publication type is restricted to the article and chapter. With the criteria shown in Table 2, the search resulted in a total of 20,631 articles from the Dimension database after removing duplication.

Table 2 The 2nd Search Inclusion and Exclusion Criteria and Results

Criteria	Filters	Documents
Keyword	"digital trade", "e-commerce", "electronic commerce", "international trade", "cross-boarder", "trade policy", "definition", "conceptualization", "conceptual framework", "typology", "taxonomy"	
Restriction	Publications	61,537
Year	1998-2026	61,368
Document type	Research article, review article, research chapter	22,432
Publication type	Article, chapter	20,732
Duplicate removed (in Endnote)		20,631
Total documents		20,631

The 1st and 2nd database searches were conducted as part of the identification stage. Following the removal of duplicate records, title and abstract screening was conducted using EndNote to identify studies relevant to the definitional and conceptual analysis of digital trade. This process aimed to determine whether the publications explicitly discussed definitions, conceptual frameworks, or the scope and boundaries of digital trade. Studies that did not engage with definitional issues and instead focused on empirical analysis, technological implementation, or operational aspects were excluded. The language restrictions were applied, and only English language studies were advanced to the full-text eligibility assessment.

Following a full-text eligibility assessment and the strategic integration of institutional documents, 20 core definitions were finalized for analysis for in-depth analysis. These represent the primary evolutionary milestones of the field, capturing the conceptual transition from early e-commerce to the digital economy.

In addition to the systematic database search conducted in Dimensions, a supplementary manual search was conducted via Google Scholar and institutional repository based on the websites, organizations and citation searching to capture relevant conceptualizations that may not have fully indexed in the Dimensions databases. This reference-based search included highly cited academic papers, government reports and publications from the selected international organizations such as WTO, OECD and IMF that define digital trade or e-commerce. By synthesizing these 19 definitions derived from grey literature sources, the study established a comprehensive empirical foundation. This dataset of 39 definitions enables a comparative analysis of the digital trade landscape, which is examined in detail in the following chapter.

3. ANALYSIS OF THE CONCEPTUAL LANDSCAPE OF DIGITAL TRADE

By analyzing the 39 finalized definitions, this chapter explores the evolutionary of the field. The conceptual architecture of digital trade has changed over the past three decades. Rather than remaining a fixed concept, the definition has transitioned from a focus on the technical medium of internet-based transactions to a comprehensive understanding of digital ecosystems and cross-border data flows.

To ensure a comprehensive scope, the analysis distinguishes between peer-reviewed journal articles from the Dimension and grey literature, the latter of which includes institutional reports as well as scholarly outputs like working papers and theses identified through manual searches. The selected sources are categorized into two distinct groups: (1) Dimensions, (2) Manual searches. This inclusive approach captures both the theoretical debates in mainstream academia and the evolving because pragmatic insights often found in non-traditional academic and policy-oriented sources.

3.1. Phase I: The Early Conceptualization Stage (1998-2011)

During its foundational stage, as shown in the 14 definitions among total 39 summarized in the table, the academic discourse was primarily focused on the emergence of “Electronic Commerce.” Definitions from this era, notably those pioneered by the OECD (1998) and OECD (1999), focused on the technological connectivity through open networks. While the WTO’s 1998 definition of electronic commerce may be overly broad and not fully representative of current legal consensus among members, it underscores an early institutional recognition of how profoundly digitalization intersects with global trade frameworks (Slok-Wodkowska and Mazur, 2021). The debate was largely

divided into broad and narrow interpretations, primarily concerned with whether a transaction was completed entirely online or merely initiated via the internet. As highlighted by researchers like Mitchell (2001) and Capineri and Leinbach (2004), the central analytical challenge was reconciling traditional trade categories with the rapid obsolescence of ICT hardware and software.

Table 3 Phase I. Definitions of Early Conceptualization Stage (1998-2011)

No	Author, Year	Category	Core Definition	Analytical Points	Definitional Clarity Challenge
1	OECD (1998)	Dimensions	"… that of commercial transactions occurring over open networks, such as the Internet. Both business-to-business and business-to-consumer transactions are included … To date, the provision of hardware and software, as well as new intermediariary services are major sources of the activity considered under the broad definition of electronic commerce" (OECD, 1998, p. 3).	Data transmission focus, broad definition	Technological obsolescence, and functional overlap
2	WTO (1998)	Manual search	"electronic commerce" is understood to mean the production, distribution, marketing, sale or delivery of goods and services by electronic means" (WTO, 1998, p. 1).	Broad definition, value-chain functional perspective	Measurement difficulties
3	OECD (1999)	Dimensions	"Some include all financial and commercial transactions that take place electronically, including electronic data interchange (EDI), electronic funds transfers (EFT), and all credit/ debit card activity. Others limit electronic commerce to retail sales to consumers for which the transaction and payment take place on open networks like the Internet. The first type refers to forms of electronic commerce that have existed for decades and result in trillions of dollars worth of activity every day. The second type has existed for about three years and is barely measurable" (OECD, 1999, p. 28).	Broad and narrow (Non-proprietary protocols based, the Internet related) definitions	Technical specificity, obsolescence, and dichotomy, and measurement inconsistency
4	Fraser *et al.* (2000)	Manual search	"A useful definition of e-commerce is the use of the Internet for the exchange of information of value. More specifically, orders and payments between businesses and between business and consumer. In essence, e-commerce is the secure trading of goods,	Broad definition, value and information perspective, emphasis on security and trading	Ambiguity of 'value' and internet technology, missing data and platforms

No	Author, Year	Category	Core Definition	Analytical Points	Definitional Clarity Challenge
			information or services and, in the main, conducted using Internet technologies" (Fraser *et al*., 2000, p. 3).		
5	Globerman (2001)	Dimensions	"We define e-commerce as any economic transaction where the buyer and seller come together through the electronic media of the Internet, form a contractual agreement concerning the pricing and delivery of particular goods or services, and complete the transaction through the delivery of payments and goods or services as contracted" (Globerman, 2001, p. 765).	Narrow definition, process-based perspective	Operational strictness, GATS/GATT[2] boundary issues
6	Mitchell (2001)	Dimensions	"… conducting business online (over networks and through computer systems). This includes buying and selling online, electronic funds transfer, business communications (including by telephone, facsimile, and internal data networks), and using computers to access business information resources" (Mitchell, 2001, p. 686).	Narrow definition, alignment with WTO norms	Technical specificity and obsolescence
7	Rai (2003)	Dimensions	"Electronic commerce in simple terms means business conducted via electronic means, which may include telephones, fax, television or the internet" (Rai, 2003, p. 1)	Broad definition, electric mean perspective	Technological obsolescence, statistical challenge
8	Turban and King (2003)	Manual search	"E-commerce describes the process of buying, selling, or exchanging products, services, and information via computer networks, including the Internet." (Turban and King, 2003, p. 3).[3]	Broad definition, process and network focus	Lack of conceptual boundaries, measurement difficulties
9	Capineri and Leinbach (2004)	Dimensions	"E-commerce implies transactions for a service, which is completed using the Internet from selection to purchase and delivery or it involves 'distribution services' in which a product, whether a good or a service, is selected and purchased on-line but delivered conventionally" (Capineri and Leinbach, 2004, p. 646).	Broad(delivery) and narrow(process)	Delivery based dichotomy, distribution ambiguity, GATS/GATT boundary issues

[2] General Agreement on Trade in Services (GATS), Global Agreement on Tariffs and Trade (GATT).

[3] In detail, Turban and King (2003) also defined the e-commerce from a collaboration as "the facilitator for inter-and intra-organizational collaboration" and a community perspective as a provider which bring "a gathering place for community members, to learn, transact, and collaborate" (Turban and King, 2003, p. 3).

No	Author, Year	Category	Core Definition	Analytical Points	Definitional Clarity Challenge
10	Davis (2004)	Dimensions	"The foundation for an e-commerce definition rests on the words 'electronic' and "commerce…very broad indeed, and very difficult to measure" (Davis, 2004, p. 292).	Ultimate broad definition	Operational inefficacy
11	Eurostat (2004)	Manual search	"Transactions conducted over Internet Protocol-based networks and over other computer-mediated networks. The goods and services are ordered over those networks, but the payment and the ultimate delivery of the goods or service may be conducted on or off-line. Orders received via telephone, facsimile and non-interactive e-mails are not counted as electronic commerce" (Eurostat, 2004, p. 112).	Narrow definition, order-and IP based, separation of payment and delivery, exclusion of analog media	Ambiguity of 'interactive', lack of data and platform, GATS/GATT boundary issues
12	Braga (2005)	Dimensions	"… e-commerce to take place whenever a commercial transaction is conducted online, even if its realization requires physical delivery of the product" (Braga, 2005, p. 543).	Transaction-centric broad definition	Ambiguity on realization
13	Turban (2009)	Manual search	"Electronic Commerce is the process of buying, selling, transferring, or exchanging products, services, and/or information via computer networks, including the Internet … can also be defined from the following perspectives: business process, service, learning, collaborative, and community" (Turban, 2009, p. 4).	Extremely broad definition, holistic approach, inclusion of knowledge-based economy, interconnectivity perspective	Loss of conceptual boundaries, measurement difficulties
14	Chaffey (2011)	Manual search	"E-commerce should be considered as all electronically mediated transactions between an organization and any third party it deals with … non financial transactions such as customer requests for further information would also be considered to be part of e-commerce … e-commerce transactions between organizations can be considered from two perspectives: sell-side from the perspective of the selling organization and buy-side from the perspective of the buying organization" (Chaffey, 2011, p. 10).	Broad definition, supply chain perspective, inclusion of non-financial transactions	Measurement difficulty, ambiguity of trade and general economic activities

3.2. Phase II: The Shift Toward Data-Driven Value Chains (2014-2026)

The second phase represents changes from simple transactional models toward a more holistic "Digital Trade" concept. As shown in the 25 definitions in Table 4, this period emphasizes the economic value of data and the complexity of platform-mediated exchanges. USITC (2015) uses the word "digital trade" instead of e-commerce and describes its concept. Contemporary frameworks, such as those proposed by Lopez-Gonzalez and Jouanjean (2017) and Burri and Chander (2023), argue that digital trade is now defined by the seamless flow of information that underpins global value chains. In this context, data is treated not just as a communication tool, but as a primary tradable asset. However, this expansion has led to conceptual fragmentation, as different jurisdictions adopt varying scopes of "digital sovereignty" to protect their respective economic interests.

One of the findings of this scoping review is the observed temporal gap in the emergence of new definitions between 2010 and 2013. While the preceding decade (1998-2011) was characterized by a surge in defining e-commerce as a technical medium for transactions and the following period (2014-2026) saw a proliferation of data-centric trade concepts, this interval represents a transitional stage. During these years, the conceptual discourse gradually shifted from e-commerce frameworks toward broader discussions of the digital economy and data-driven ecosystems.

Institutional definitions, particularly those of the OECD and WTO, demonstrate a stronger emphasis on operational and regulatory applicability compared to academic definitions. OECD frameworks increasingly focus on statistical clarity through distinctions such as 'digitally ordered' and 'digitally delivered,' while WTO discussions emphasize regulatory coherence and cross-border data flows.

Table 4 Phase II. The Shift Toward Data-Driven Value Chains (2014-2026)

No	Author, Year	Category	Core Definition	Analytical Points	Definitional Clarity Challenge
15	Aydın and Savrul (2014)	Dimensions	"E-commerce is the exchange of goods and services between four broad groups over the Internet. This can happen between businesses and consumers, businesses and businesses, intra-companies, and consumers and consumers" (Aydın and Savrul, 2014, p. 1269).	Actors focused, broad definition	Ambiguity of the internal data flow, measurement inefficacy
16	USITC (2015)	Manual search	"… digital trade as U.S. domestic commerce and international trade in which the Internet and Internet-based technologies play a particularly	Broad definition, process oriented, digital with no boundary	Ambiguity of 'significant role', over-inclusiveness

No	Author, Year	Category	Core Definition	Analytical Points	Definitional Clarity Challenge
			significant role in ordering, producing, or delivering products and services" (USITC, 2015, p.29).		of 'producing', GATS/GATT boundary issues
17	Falk and Hagsten (2015)	Dimensions	"… e-commerce is defined specifically as e-sales — that is, orders firms receive electronically (through EDI or websites)" (Falk and Hagsten, 2015, p. 357).	Narrow and operational definition for empirical analysis	Possible to miss indirect economic benefits generated by digital infrastructure
18	Karch and Rosenthal (2016)	Dimensions	"Electronic commerce, often called e-commerce, is the buying and selling of goods and services over the Internet or other computer networks" (Karch and Rosenthal, 2016, p. 26).	Broad definition, transaction approach, inclusiveness of product type	Ambiguity of networks, GATS/GATT boundary issues
19	Meltzer (2016)	Manual search	"… digital trade includes as a fundamental characteristic the use of the Internet to search, purchase, sell, and deliver a good or service across borders. A more expansive lens could also speak to how Internet access and cross-border data flows enable digital trade" (Meltzer, 2016, p. 8).	Broad and narrow definition, process and data flow inclusiveness	Measurement issue
20	Lopez-Gonzalez and Jouanjean (2017)	Dimensions	"… it encompasses digitally enabled transactions in trade in goods and services which can be either digitally or physically delivered involving consumers, firms and governments" (Lopez-Gonzalez and Jouanjean, 2017, p.2).	Broad definition, process-delivery integrated(multidimensional)	Conceptual elasticity of 'digitally enabled' and over-inclusion risks
21	USITC (2017)	Manual search	"The delivery of products and services over the Internet by firms in any industry sector, and of associated products such as smartphones and Internet-connected sensors. While it includes provision of e-commerce platforms and related services, it excludes the value of sales of physical goods ordered online, as well as	Narrow definition, digital only focused	Exclusion of 'digitally ordered' goods

No	Author, Year	Category	Core Definition	Analytical Points	Definitional Clarity Challenge
			physical goods that have a digital counterpart (such as books, movies, music, and software sold on CDs or DVDs)" (USITC, 2017, p. 33).		
22	Office of the United States Trade Representative [USTR] (2017)	Manual search	"Digital trade is a broad concept, capturing not just the sale of consumer products on the Internet and the supply of online services, but also data flows that enable global value chains, services that enable smart manufacturing, and myriad other platforms and applications" (USTR, 2017, para. 2).	Broad definition, industrial ecosystem perspective	Digitalization of manufacturing and complex of value attribution
23	Aaronson and Leblond (2018)	Dimensions	"We define e-commerce as sales of goods and services online between business and consumers and between businesses" (Aaronson and Leblond, 2018, p. 248).	Narrow definition, transactional perspective	Ambiguity of online, missing market actors
24	Kim (2018)[4)]	Manual search	"Digital trade is a concept encompassing both e-commerce (ordering/delivery) and e-business (firm-level innovation). While e-business focuses on the internal innovation of a single entity, digital trade extends to the digital transformation of the entire global trade process, including ordering, production, and distribution" (Kim, 2018, pp.6-7).	Broad definition, business transitional, process and ecosystem perspectives	Conceptual over-expansion
25	Yatsenko and Dmytriyeva (2018)	Dimensions	"... the term 'electronic commerce'... shall be interpreted more loosely to cover the issues that related to all relations occurring under electronic business activities, contractual and non-contractual ... [including] 'e-services' [and] relations directed to gaining profits ... resulting in origination of property interest and liabilities" (Yatsenko and Dmytriyeva, 2018, p. 94).	Broad definition, contractual perspective	Definitional over-extension and measurement ambiguity

[4)] Author's translation from the original Korean source.

No	Author, Year	Category	Core Definition	Analytical Points	Definitional Clarity Challenge
26	Burri and Polanco (2020)	Dimensions	"… can be construed in two ways — one narrow and one broad. In the former sense, digital trade is plainly equated to commerce in products and services delivered via the Internet. The second aspect is much broader and has to do with enabling innovation and the free flow of information in the digital networked environment…China has promoted a narrow view of digital trade, which focuses on trade in goods online, while the US and others have subscribed for an inclusive approach" (Burri and Polanco, 2020, p. 4).	Broad (innovation and data flow) and narrow (internet delivery focus) operational definition	Conceptual fragmentation driven by digital sovereignty
27	KOTRA (2020)	Manual search	"While there is no internationally codified definition due to the diverse types of industries and transactions involved, digital trade is generally understood to mean 'overall cross-border trade activities (comprising goods, services, and data) utilizing digital technologies such as the Internet and ICT,' including conventional e-commerce (goods-centric)" (KOTRA, 2020, p. 1).[5]	Broad definition, comprehensive integration	Including data as trade components, measurement methos needed
28	Huang and Chen (2021)	Dimensions	"E-commerce is a combination of digital technology and commodity trade, and is an important part of digital trade" (Huang and Chen, 2021, p. 247).	Broad definition	Boundary ambiguity
29	Bureau of Economic Analysis [BEA] (2021)	Manual search	"E-commerce is the remote sale of goods and services over computer networks by methods specifically designed for the purpose of receiving or placing orders. Products purchased through e-commerce are also referred to as "digitally ordered." E-commerce output is measured as the retail or wholesale	Narrow and operation definition for measurement, margin-based approach	Possible fail to capture the full value and data flow

[5] Author's translation from the original Korean source

No	Author, Year	Category	Core Definition	Analytical Points	Definitional Clarity Challenge
			trade margin on digitally ordered goods and services sold over the internet or through some other electronic market such as electronic data interchange" (BEA, 2021, p. 7).		
30	Chung (2022)	Manual search	"While 'e-commerce' has been used in environments where only parts of the transaction — such as negotiation and contracting — occur electronically while the rest, including delivery, remains physical; 'data trade' is used when all stages of the transaction, including delivery, are conducted electronically. In this context, 'digital trade' is generally employed as an overarching term that encompasses both of these aspects" (Chung, 2022, pp. 3-4).[6]	Broad definition, delivery focus, comprehensive concept	Terminology friction of 'data trade' and measurement issue
31	Semerádová and Weinlich (2022)	Dimensions	"E-commerce is a relatively broad term used to describe all business transactions carried out using the Internet, while the main emphasis is on e-shops and activities related to improving customers' online shopping experience" (Semerádová and Weinlich, 2022, p. 1).	Broad definition, experience-based service expansion	Subject boundary of "experience"
32	Liu and Luo (2022)	Dimensions	"It is generally believed that digital service trade refers to the trade of digital products and services delivered through network transmission" (Liu and Luo, 2022, p. 465).	Narrow definition, network transmission focus, intangibility perspective	Omission of ordering, value chain exclusion
33	IMF *et al*. (2023)	Manual search	"digital trade is all international trade that is digitally ordered and/or digitally delivered. Digitally ordered trade… defined the international sale or purchase of a goods or service, conducted over computer networks by methods specifically designed for the	Broad (goods and services included) and specific definition, matrix-based for measurement	Ambiguity on digital service file and physical goods

[6] Author's translation from the original Korean source

No	Author, Year	Category	Core Definition	Analytical Points	Definitional Clarity Challenge
			purpose of receiving or placing orders … Digitally delivered trade, which only covers services, is defined as all international trade transactions that are delivered remotely over computer networks" (IMF *et al*., 2023, pp. 12-13).		
34	OECD (2023)	Manual search	"In policy discussions, the term digital trade is used to refer more broadly to trade in the digital era. Beyond digitally ordered and/or delivered goods and services this includes: i) rising trade across all sectors of the economy due to lower trade costs spurred by rising digital connectivity; ii) digitalisation of trade documents and processes, including at the border; and iii) increased flows of data across international borders in support of international trade transactions" (OECD, 2023, p. 3).	Broad definition, economic impact perspective, connectivity and data flows focus	Difficulty in measuring trade cost
35	Santos *et al*. (2023)	Manual search	"The term electronic commerce (e-commerce) refers to a business model that allows companies and individuals to buy and sell goods and services over the Internet. E-commerce operates in four major market segments and can be conducted over computers, tablets, smartphones, and other smart devices" (Santos *et al*., 2023, para. 7).	Narrow definition, market and actors oriented,	Hardware dependent analysis, technological obsolescence
36	Iino (2024)	Manual search	"…digital trade is a broad concept that has no universally accepted definition but encompasses digitally tradable goods and services, whether delivered digitally or physically; …digital trade is underpinned by data; and …digital trade is often used interchangeably with e-commerce" (Iino, 2024, p. 4).	Broad definition, data focused	Difficulty in distinguishing traditional and digital trade, ambiguity of digitally tradable, measurement issue

No	Author, Year	Category	Core Definition	Analytical Points	Definitional Clarity Challenge
37	Patrignani (2024)	Manual search	"…the term 'digital trade'… refer to a digitally-driven form of trade, different from traditional modes of trade in physical goods" (Patrignani, 2024, p. 1).	Broad definition, future-proof perspective, intangible value focus	Ambiguity of "digitally driven", lack of details and measurement issue
38	Stojkoski *et al*. (2024)	Dimension	"Digital trade is commonly split among digitally and physically delivered trade. In this paper, we adopt a bottom-up definition starting from data on digital firms that includes digital goods, productized services, and transaction fees in digital intermediation platforms" (Stojkoski *et al*., 2024, p. 3).	Broad, narrow and data-driven empirical definition, bottom-up approach	Empirical and measurement challenge, conceptual boundary challenge
39	Alkhaifi (2026)	Dimensions	"E-commerce is electronic commerce, which means using the internet and electronic media to conduct goods and service transactions" (Alkhaifi, 2026, p. 254).	Narrow definition, transaction perspective, simplicity focus	Ambiguity of "conduct"

3.3. Comparative Synthesis and Conceptual Fragmentation

The analysis of the 39 definitions reveals a significant degree of conceptual fragmentation, which complicates both academic research and policy formulation. This fragmentation is primarily driven by inherent ambiguities that pose definitional challenges.

The literature shows a clear divergence in how the scope of digital trade is perceived from academic and policy perspectives. By analyzing the Analytical Points and Definitional Clarity Challenges across literature, this study identified four critical dimensions of fragmentation that obstruct a unified understanding.

3.3.1. Value chain scope: transactional vs. infrastructural

It is distinguished that the primary divergence occurs in whether digital trade is confined to transactional activities via electronic media, as seen in OECD (1998), WTO (1998) and Globerman (2021), who emphasizes the buyers and sellers for contractual agreements. Chaffey (2011) approaches digital trade considering the value chain. In contrast, the recent perspectives have shifted toward an ecosystem view, focusing on data and internet connectivity.

The infrastructural definitions argue that digital trade is inherently enabled by Internet access and cross-border data flow, and the transition from goods to data. While traditional frameworks emphasize the delivery of physical goods ordered online, current discourse recognizes data itself as a commodity and the primary driver of value creation. Meltzer (2016) includes these elements and Iino (2024) notes that digital trade is a broad concept fundamentally supported by data.

The infrastructural view, supported by OECD (2023) capturing the "rising trade across all sectors" due to digital connectivity, faces conceptual dilution. In addition, definitions tied to specific, older technologies (e.g., EDI, Fax, Telephone) result in technical obsolescence, a challenge identified in early OECD (1998), OECD (1999), Mitchell (2001), Rai (2003) and Santos *et al*. (2023) frameworks.

1) Unit of measurement: commercial value vs. functional interaction

Commercial value-focused definitions, such as BEA (2021) and Falk and Hagsten (2015), emphasize "orders received electronically" or "digitally ordered." Conversely, Chaffey (2011) incorporates customer requests for information, while Turban (2009) expand this to "learning, collaborative" activities.

Depending on the functional interactions leads to a lack of conceptual boundaries. As identified by Davis (2004) and OECD (2023), without a focus on commercial value, it is nearly impossible to distinguish digital trade from general online social behavior or economic activities, resulting in significant measurement difficulties. The WTO (1998) definition causes measurement challenges in quantifying the value of marketing within e-commerce, a difficulty similarly happened by Fraser *et al*. (2000) regarding the information value. As Meltzer (2016) and other researchers have mentioned, if digital trade is conceptualized as the delivery of goods and services via the Internet, then most of contemporary trade in services would be under the category of digital trade. From a different approach, IMF *et al*. (2023) expanded the conceptual framework of digital trade by distinguishing precisely between digitally ordered and delivered transactions, for statistical measurement.

2) Governance: market efficiency vs. normative legitimacy

Efficiency-oriented definitions prioritize lowered trade costs accessible via smart devices. Stojkoski *et al*. (2024) focus on the efficiency of the platforms of digital intermediation and the fee of transaction. Normative definitions, however, emphasize digital sovereignty and the flow of information. Burri and Polanco (2020) highlight the normative conflict between a narrow, goods-centric view and an inclusive approach driven by digital sovereignty.

The lack of normative consensus leads to regulatory friction, and this can cause challenges including GATS/GATT boundary issues and legal uncertainty as trade norms struggle to adapt to realities of digital trade.

3) Mode of delivery: digitally ordered (physical delivery) vs. digitally delivered

This dimension addresses the technical nature of the last mile of delivery. In an inclusive definitions, such as those by Braga (2005) and Lopez-Gonzalez and Jouanjean (2017), encompass "digitally enabled" transactions regardless of whether the final delivery is physical or digital. Capineri and Leinbach (2004) emphasized the inclusion of service distribution, and Eurostat (2004) expanded definition of digital trade by including both online and offline delivery.

The U.S.' perspective, represented by USITC (2017) and USTR (2017), adopts a narrower focus on digitally delivered trade. Specifically, USITC (2017) defines digital trade as the products and services delivery over the Internet, explicitly excluding the value of physical goods ordered online. USTR (2017) further reinforces this by focusing on data flows that enable global value chains and online services rather than mere consumer sales of physical products.

Chung (2022) emphasized the "digitally delivered" aspect of digital trade, which include both e-commerce and data trade. In contrast, Iino (2024) defined digital trade including both delivered digitally and physically.

Due to the different approaches of the mode of delivery, there is classification ambiguity between the authorities seeking to distinguish intangible digital value from traditional commodity trade and others. As identified by Burri and Polanco (2020), this led to regulatory divergence, where countries like China focus on ordering online trade of goods while the U.S. subscribes to an inclusive approach toward data and services but excludes physical delivery. This makes it difficult to distinguish digital trade from traditional trade in hybrid products, leading to terminology friction.

A quantitative synthesis of these perspectives further illustrates the divide: as shown in Table 5, most definitions (24 out of 39) adopt a broad value-chain perspective, while fewer definitions explicitly incorporate governance considerations (4 out of 39) or the unit of measurement (3 out of 39). This distribution reveals a structural imbalance in the literature, where most definitions emphasize value-chain perspectives, while statistical and governance dimensions remain significantly underrepresented. This asymmetry is a key driver of conceptual fragmentation.

Table 5 Quantitative Mapping of Conceptual Fragmentation (n=39)

Dimension	Number of Definitions	Representative Examples	Key Issues
Value Chain Scope	24	OECD (1998), Chaffey (2011), OECD (2023)	Transaction vs ecosystem
Unit of Measurement	3	BEA (2021)	Measurability vs interaction
Governance	4	Burri and Polanco (2020)	Digital sovereignty
Mode of Delivery	13	IMF (2023), USITC (2017)	Digitally ordered vs delivered

Note: Each definition was manually coded based on the explicit inclusion of elements corresponding to the four dimensions. When multiple elements were present, definitions were classified into all relevant categories.

The multidimensional divergence identified across these four axes shows conceptual fragmentation of digital trade. Despite exhaustive institutional discourse, a universally accepted and unified definition of digital trade remains absent and these definitional challenges lead to hindering the development of accurate measurement tools and exacerbating regulatory friction in global negotiations. The integrated definition that can harmonize these competing policy orientations. Consequently, the following chapter introduces a synthesized framework designed to establish a cohesive and operative definition of digital trade.

4. CONCEPTUAL SYNTHESIS OF THE DEFINITION

This chapter provides a conceptual synthesis of the definitions of digital trade, based on the comparative analysis of the 39 key definitions across four critical dimensions-value chain scope, unit of measurement, governance orientation, and mode of delivery. Before proposing the new definition, Chapter 4 integrates these disparate elements into a coherent conceptual framework designed to resolve the persistent definitional ambiguity. By synthesizing these structural patterns into a unified theoretical foundation, this synthesis identifies the core elements for a singular, transparent and functional definition of digital trade.

4.1. Synthesis Framework

Each of the four dimensions of conceptual fragmentation identified in Section 3.3 directly corresponds to one of the three pillars of the proposed synthesis framework. Specifically, the ‘value chain scope’ and ‘mode of delivery’ relate to ‘functional determinacy’, while the ‘unit of measurement’ corresponds to ‘statistical consistency’; and the ‘governance’ dimension aligns with the ‘normative and governance foundation’.

This alignment is rooted in the understanding that these dimensions are not isolated flaws but are systematically shaped by the dynamic interaction between various definitional actors and their distinct analytical perspectives. Whether a definition originates from academia, policy-making bodies, or international agreements, its focus is driven by specific priorities such as technological, statistical, or governance perspectives. By recognizing that fragmentation persists due to these divergent institutional needs, the tri-pillar synthesis framework is designed to harmonize these competing viewpoints. Ultimately, this approach bridges the gap between technical functionality, measurability, and regulatory governance, establishing a cohesive conceptual foundation for digital trade.

By narrowing the divide between technical functionality, economic measurability, and regulatory governance, this framework establishes a unified and operative conceptual foundation for digital trade.

Functional Determinacy

The basic actors of digital trade, which originated from e-commerce, are sellers and buyer in the transactional process and infrastructure which includes enabling digital trade. One of the classified aspects among four broad streams[7] of e-commerce taxonomy by Herman (2010) is transaction. Zwass (1996)'s seven hierarchical structure in three meta-levels includes infrastructure as a 1st level of e-commerce function. Regarding technology and delivery, the definition needs to adapt "digitally ordered" and "digitally delivered" to resolve the terminology friction between restrictive and inclusive models, by IMF *et al*. (2023)'s work. This is more resilient approach to avoid technical obsolescence by focusing on the transaction method rather than mentioning specific ICTs.

Statistical Consistency

The framework highlights the transactions characterized by commercial value. As pointed out in the comparative analysis in the previous sectors, statistical measurement is a fundamental reason for definition of digital trade. International organizations such as WTO, OECD, and IMF, *etc*., are making efforts to have a consensus on defining digital trade to know the statistical data which will be a basis for the international regime on digital trade. By removing non-financial social interaction, it ensures verifiable value-added processes and measurement consistency.

The recent OECD (2025b) update further reinforces the importance of statistical consistency by refining the distinction between digitally ordered and digitally delivered trade and providing improved guidelines for measurement.

Normative and Governance Foundation

Understanding digital trade relies on data, the framework integrates secure data flows with cohesive regulatory structures to ensure conceptual and operational clarity. Rukanova *et al*. (2017) identified three dimensions[8] of digital trade infrastructure including governance. Moving beyond the view of digital trade as a technological phenomenon but data flow, this framework provides a normative basis to harmonize regulatory friction and reconcile paradigms of digital sovereignty.

4.2. Unified Definition of Digital Trade

Based on the identified 39 definitions, four conceptual fragmentations are derived and a cohesive tri-pillar synthesis framework is developed (Figure 2). This synthesis integrates functional precision to resolve the technical obsolescence in early models, ensures empirical measurability by filtering for verifiable commercial value and establishes a normative foundation to reconcile the conflicting paradigms of digital sovereignty observed across competing trade regimes.

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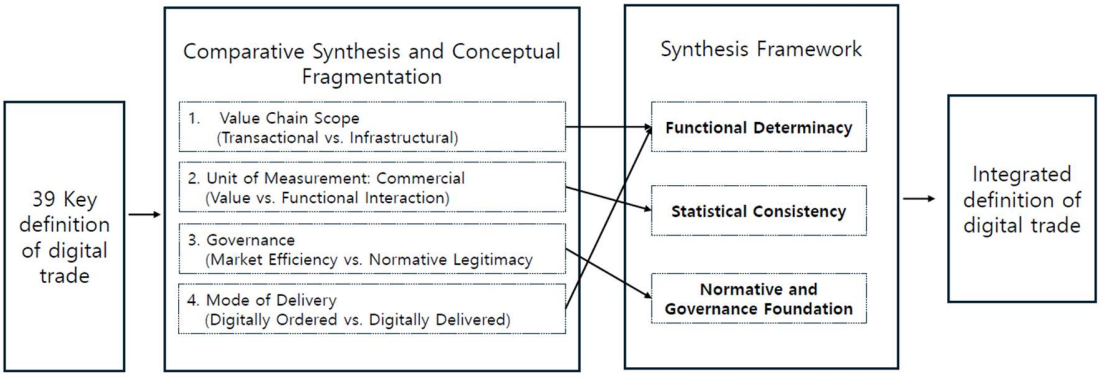
[7] Four broad streams are transaction, market entity, channel and location (Herman, 2010, p. 8).

[8] Three dimensions of digital trade infrastructure are architecture, process and governance (Rukanova *et al*., 2017, p. 9).

Figure 2 Conceptualization Process of Digital Trade



This integrated approach for digital trade conceptualization will capture the holistic and data-driven nature of the digital economy. Based on the comprehensive synthesis of these 39 foundational perspectives, this study proposes the following unified definition on digital trade:

"Digital trade is defined as cross-border trade activity based on infrastructure that supports the generation, transmission, storage, and processing of data, integrating digitally triggered and mediated transactions of goods and services with economically meaningful data flows for the purpose of value creation that are measurable and normative under international trade framework".

5. DISCUSSION

There is a consensus that there is no harmonized definition on digital trade, although the importance of it is growing. The international organizations play pivotal roles in initiating conceptualization and regulatory framework formation, but the fragmentation of definitions is still one of the issues on digital trade. In the era of digital technology, and artificial intelligence, it is necessary to catch-up the speed of development of digital trade.

The comparative synthesis of 39 foundational definitions reveals that digital trade is not one of the simple types of trade, but a dynamic phenomenon characterized by continuous conceptual evolution. The transition from early e-commerce focused on technical connectivity to current digital trade ecosystems centered on data flows proves a paradigm shift in how global value is created and exchanged. This discussion explores the broader implications of these findings through the proposed tri-pillar synthesis framework.

Bridging the gap between goods-centric and data-centric paradigms is one of the primary critical points in the literature on conceptualization. This functional determinacy approach allows the definition to remain relevant despite the rapid emergence of disruptive technologies like AI and

blockchain. Measuring and statistical points of digital trade underpin the reason why the world needs the clear definition of digital trade. Even if the importance of it, the measurement difficulties are cited in nearly every phase of the conceptual evolution analysis. Governance and the reconciliation of digital sovereignty are perhaps the most complex challenges identified in the definition analysis. The debate exists from technical specificity to a governance-based equilibrium, which is crucial for mitigating obstacles to cross-border data flows. Linking the digital sovereignty issue, mode of delivery whether the object is digitally ordered only followed by physical delivery, or pure digital delivery.

Future research should further explore emerging hybrid forms of trade, such as physical goods embedded with digital components. As the proliferation of these smart products continues to erode the traditional demarcation between digital and conventional trade, subsequent studies must evaluate the adaptability of the tri-pillar framework to such multifaceted interactions, ensuring the regulatory and statistical tools remain effective in capturing the full value of cross-border interactions in a digitized global economy. Specifically, subsequent empirical studies should prioritize recalibrating trade metrics to capture the hidden value of digital and service intermediates integrated into industrial outputs, a phenomenon where indirect and implicit digital-service exports often overshadow direct trade figures (Ye and Lee, 2023). Furthermore, it is essential to investigate the evolving roles of data security and intellectual property rights in shaping digital trade governance. Examining these factors, particularly through the lens of the divergent interests between developed and developing economies, will be crucial for establishing a balanced and inclusive global regulatory equilibrium.

6. CONCLUSION

This study systematically addressed the persistent ambiguity surrounding the definition of digital trade by analyzing 39 key definitions through a systematic scoping review. By tracing the conceptual evolution from 1998 to 2026, the research identified critical structural patterns of divergence.

The finding indicates that the absence of universally accepted definition remains the primary barrier to a coherent global digital trade regime. In response, this study conducted a comprehensive comparative analysis across four dimensions-value chain scope (transactional vs. infrastructural), unit of measurement (commercial value vs. functional interaction), governance (market efficiency vs. normative legitimacy), and mode of delivery (digitally ordered (physical delivery) vs. digitally delivered). Based on this multidimensional analysis, the research derived a tri-pillar synthesis framework, which harmonizes these fragmented perspectives by prioritizing functional determinacy, statistical consistency, and a normative and governance foundation. This framework serves as the basis for the proposed unified definition: *"cross-border trade activity based on infrastructure that supports the generation, transmission, storage, and processing of data, integrating digitally triggered*

and mediated transactions of goods and services with economically meaningful data flows for the purpose of value creation that are measurable and normative under international trade framework".

This newly proposed definition provides a strategic rational for policy alignment. For international organizations like the WTO and OECD, this framework offers a consistent terminology to resolve classification conflicts between GATT, based goods, and GATS, based services. For national authorities, it provides a basis for creating regulatory frameworks that safeguard digital sovereignty without obstructing the innovative potential of cross-border data flows.

While this study provides a comprehensive conceptual synthesis, it is limited by its primary focus on theoretical and the specific scope of the literature retrieved. Notably, a temporal gap in new definitions was observed between 2012 and 2013, which likely reflects a transitional phase in global trade discourse from traditional e-commerce to data-driven digital ecosystems. Future research should aim to validate this unified definition through comparative empirical studies across different industrial sectors and geographic regions. In addition, an analysis of WTO dispute cases is necessary, as these conflicts vividly expose the legal vulnerabilities from definitional fragility. Furthermore, research is needed to explore the implication for industry-specific innovation policies based on statistical evidence. As AI and emerging digital technologies continue to reshape the global economy, the institutional significance of definitional clarity is becoming even more important. In-depth academic research will remain essential to underpin the development of a robust, AI-driven digital trade ecosystem.

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