

Closing the Legal-Technical Gap in Digital Trade

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Abstract

As digital trade continues to reshape the global economic landscape, the key objective of this study is to bridge a significant Legal-Technical gap characterised by the discord between rapid technological advancements and slower-evolving legal frameworks. This paper delves into the complexities of this gap and emphasises the need for a holistic approach to understand and address the multifaceted challenges it presents to businesses, policymakers, and the broader international trading system. This research offers a novel theoretical foundation for exploring and bridging the Legal-Technical gap in digital trade. Initially, it discusses the integration of legal and technical knowledge systems, which leads to the emergence of specific transdisciplinary knowledge as described by Andrew Sage's Theory of Systems. Subsequently, it explores the acquisition of universal knowledge about these systems through Herman Dooyeweerd's multi-aspectual philosophy. Furthermore, it proposes the development of a transdisciplinary knowledge representation using Fritz Zwicky's Morphological Method. Our analysis reveals that focusing on lingual, social, economic, and aesthetic aspects enables the prioritisation of critical factors essential for enhancing legal-technical functionality.

Keywords

Digital trade • Trade Law • System of systems • Dooyeweerd's aspects • Morphological approach

Introduction

The digitisation of international trade, a key element of global economic strategy, is transforming traditional commerce through advanced technologies like Artificial Intelligence (AI)¹, Distributed Ledger Technologies (DLTs)², and immersive realities like Virtual Reality (VR)³ and Augmented Reality (AR).⁴ This shift from conventional “e-commerce” to a more complex, data-driven “digital trade” raises intricate legal challenges, such as data governance.⁵ Nations grapple with balancing open digital trade and data sovereignty, resulting in a fragmented regulatory landscape that underscores the varied approaches to data governance, from liberal data flow policies to stricter privacy and security measures.⁶

The Challenge of Digital Trade


In navigating the complexities of digital trade, a critical issue arises. The Legal-Technical gap inherent in the sector leads to considerable legal and digital fragmentation. This gap is exacerbated by digitalisation, which introduces new policies with

- 1 Goldfarb, Avi, and Daniel Treffer, “Artificial Intelligence and International Trade.” In *The Economics of Artificial Intelligence: An Agenda*, 463-92: University of Chicago Press, 2018.
- 2 Shope, Mark L., “Distributed Ledger Technology in International Trade: Rethinking the Role and Necessity of the Customs Declaration.” *Stan. J. Blockchain L. & Pol'y* 5 (2022): 114.
- 3 Erer, Deniz, and Elif Erer, “Industry 4.0 and International Trade: The Case of Turkey.” In *Agile Business Leadership Methods for Industry 4.0*, 69-84: Emerald Publishing Limited, 2020.
- 4 Belu, Mihaela Gabriela, Ramona Iulia Dieaconescu, Dorel Mihai Paraschiv, and Ioan Popa. “The Impact of Implementing New Technologies in International Trade and Logistics.” R. Pamfilie, V. Dinu, L. Tăchiciu, D. Pleșea, C. Vasiliu eds (2021): 284-93.
- 5 Jones, Craig Allen McGee, “Critical Success Factors for Data Governance of Cross-Border E-Trade Data among Asean Member States.” *Journal of Asian Economic Integration* 3, no. 1 (2021): 38-60.
- 6 Kerknawi, Lawrence, and Alexander Mäkelä, “Building a Forward-Looking Eu Policy Strategy on Blockchain. College of Europe Policy Brief# 12.18, September 2018.” (2018). Cao, Shoufeng, Xavier Boyen, Felicity Deane, Thomas Miller, and Marcus Foth, “Enabling Cross-Border Trade in the Face of Regulatory Barriers to Data Flow—the Case of the Blockchain-Based Service Network.” In *Blockchain for Industry 4.0*, 285-303: CRC Press, 2022. Branstetter, Lee, JJ Schott, and CI Cathleen, “Tpp and Digital Trade.” *Trans-Pacific Partnership: An Assessment* 104 (2016): 309.

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far-reaching implications for international trade.⁷ For example, policies that block access to websites or regulate cross-border data flows can significantly impact trade dynamics. While physical goods like vehicles and industrial machinery adhere to clear and predictable trade rules, the data they generate and depend upon does not, allowing data policies to inadvertently influence trade in these goods. Previous efforts to bridge this gap have primarily offered normative recommendations for the World Trade Organisation (WTO)⁸, yet they lack a robust theoretical foundation for understanding the nature of this gap and its practical application. There is a notable scarcity of comprehensive studies that provide a sound theoretical approach to effectively understanding and addressing this vital issue.

In this conceptual paper, we provide a theoretical foundation by introducing Andrew Sage's concept of transdisciplinary knowledge⁹, the philosophy of Herman Dooyeweerd¹⁰, and Fritz Zwicky's concept of the morphological representation space.¹¹ Andrew Sage is considered the "founding father" of Systems Science in the US, who initiated research on Families of Systems and Systems of Systems in the context of their integration. Herman Dooyeweerd is a notable Dutch philosopher known for his multi-aspectual theory.¹² Dooyeweerd's philosophy, particularly his proposition of 15 distinct but interrelated aspects of reality, offers a unique lens through which the complexities of digital trade can be understood and addressed. This approach provides a holistic framework that transcends the conventional dichotomy between legal and technological domains. Fritz Zwicky is a modern Renaissance scholar who proposed as the holy grail of modern science a morphological approach to the process of knowledge acquisition leading to the creation of a multidimensional representation space in the form of a "morphological box." When the contributions of these three world-changing scholars are integrated, they create a conceptual foundation for closing the Legal-Technical gap in the digital trade.

We propose to explore the following research question: *How can the three major aspects of the Legal-Technical gap, namely 1. knowledge integration, 2. attributes identification, and 3. building a transdisciplinary knowledge representation, be analysed to bridge the gap between the legal and technological realms in the context of digital trade?* This paper aims to delve into this question, offering a fresh perspective on reconciling the technological advancements and legal frameworks that define the modern digital trade landscape.

Paper Outline

The rest of this paper is structured into five main sections. The Background and Contextual Overview provides an overview of digital trade and the Legal-Technical gap. Theoretical Framework Introduction discusses Andrew Sage's concept of transdisciplinary knowledge, Dooyeweerd's philosophical framework, and Fritz Zwicky's concept of representation space. The third section explores the practical application of Dooyeweerd's philosophy in digital trade, leading to research implications and future research directions. The fourth section discusses future inquiries, and the conclusion highlights the value of a Dooyeweerdian perspective in addressing the Legal-Technical gap.

Background and Contextual Overview:

Digital Trade and Trade Law

Digital trade, evolving from e-commerce, encompasses both online transactions and physical trade facilitated by digital technologies. This multifaceted concept lacks a universal definition but broadly includes trades digitally ordered or delivered, extending to both virtual and physical realms. Chen and Gao define it as digitally ordered or delivered transactions, while the

7 Azmeh, Shamel, Christopher Foster, and Jaime Echavarri, "The International Trade Regime and the Quest for Free Digital Trade." *International Studies Review* 22, no. 3 (2020): 671-92.

8 Porges, Amy, and Alice Enders "Data Moving across Borders: The Future of Digital Trade Policy." 2016. Deane, Felicity, Emily Woolmer, CAO Shoufeng, and Kieran Tranter, "Trade in the Digital Age: Agreements to Mitigate Fragmentation." *Asian Journal of International Law* (2023): 1-26.

9 Sage, Andrew, "4, 4 Transdisciplinarity Perspectives in Systems Engineering and Management." *Transdisciplinarity: Recreating integrated knowledge* (2002): 158.

10 Dooyeweerd, Herman, "A New Critique of Theoretical Thought, Vol. 2: The General Theory of the Modal Spheres." The Presbyterian and Reformed Publisher Company: Phillipsburg, NJ, USA, 1955.

11 Arciszewski, Tomasz, and Jagna. Kisielnicka, "Morphological Analysis, Problem, Method, Solution, Methods of Creative Problem Solving Vol. I, A. Goralski." WPN Publishing House, Warsaw, 1977. Arciszewski, Tomasz, "Morphological Analysis in Inventive Engineering." *Technological Forecasting and Social Change* 126 (2018): 92-101. Zwicky, Fritz, "Discovery, Invention, Research through the Morphological Approach." (1969).

12 Joneidy, Sina, and Andrew Basden, "Exploring Diversity in a Field: An Application of Dooyeweerd's Philosophy." *Philosophia Reformata* 83, no. 2 (2018): 149-76. Joneidy, Sina, and Maria Burke, "Towards a Deeper Understanding of Meaningful Use in Electronic Health Records." *Health Information & Libraries Journal* 36, no. 2 (2019): 134-52.

OECD offers a more encompassing view, describing it as digitally enabled transactions of goods and services, deliverable either digitally or physically.¹³

Digital trade law initially focused on electronic commerce under the WTO's General Agreement on Trade in Services (GATS), but it now encompasses broader challenges brought by digital transformation. Recognising the internet's profound impact on trade, the WTO's Work Programme on Electronic Commerce suggested necessary revisions in rules for goods, services, and intellectual property. However, the absence of a clear negotiating mandate within the WTO led to unresolved questions regarding the classification and regulation of digital offerings.¹⁴

In response, nations have shifted towards bilateral and regional preferential trade agreements to navigate the complex regulatory environment of digital trade.¹⁵ This has created a dynamic yet fragmented landscape, focusing on data governance and digital transaction rules, such as electronic contracts, signatures, and paperless trading.¹⁶

This fragmented landscape underpins a significant challenge in digital trade: the Legal-Technical gap. This gap arises from the disconnect between the swift pace of technological advancements and the more gradual evolution of legal frameworks, creating gaps and uncertainty across various domains of digital trade. This gap manifests in several critical areas, illustrating the need for a nuanced understanding and strategic bridging of this gap.

Legal-Technical Gap in Digital Trade

A pronounced Legal-Technical gap is evident, stemming from the rapid pace of technological advancements contrasted with the slower evolution of legal frameworks. This disconnect presents a range of challenges for businesses and regulatory bodies. The manifestations of this gap, which we will elaborate on, include legal compliance challenges, reactive legal frameworks, and issues related to paperless trade and legal recognition.

The first indication of the Legal-Technical gap is legal compliance challenges in digital trade, which include the need to modernise trade agreements to reflect the impact of digital technology.¹⁷ Governments face dilemmas in balancing the opportunities of digital trade with managing the impact of cross-border data flows for other policy objectives such as privacy and cybersecurity.¹⁸ The soft legal nature of certain provisions and loose exceptions under digital trade chapters pose challenges.¹⁹ Privacy protection and identity management in the digital economy are not yet at an acceptable level in Europe. Global IT compliance issues arise due to the complexity of statutes, legal regulations, and corporate policies in cross-border business relations. Companies dealing in digital products face unique legal challenges due to the ease of reproduction and copying.²⁰ An illustrative example of legal compliance challenges is the General Data Protection Regulation (GDPR) in the European Union. GDPR's stringent requirements for data protection, consent, and cross-border data transfer have imposed significant compliance burdens on companies globally. Businesses must navigate its complex rules on data handling, rights to erasure, and breach notifications, often necessitating substantial changes to their operational practices and digital infrastructure to avoid hefty penalties and reputational damage.

Second, the Legal-Technical gap is accentuated by the reactive nature of legal frameworks, which struggle to keep pace with the rapid advancements in digital trade. Technology's swift evolution, especially in digital realms, has surpassed international law's regulatory capacity.²¹ Disruptive technologies and increased information flows necessitate continual legal adaptation.²²

13 Ferencz, Janos, and Frédéric Gonzales, "Barriers to Trade in Digitally Enabled Services in the G20." (2019). Chen, Ying, and Yuning Gao, "Comparative Analysis of Digital Trade Development Strategies and Governance Approaches." *Journal of Digital Economy* 1, no. 3 (2022): 227-38.

14 Chander, Anupam, "The Internet of Things: Both Goods and Services." *World Trade Review* 18, no. S1 (2019): S9-S22.

15 Short, Michael, Kate Baucherel, Farzad Rahimian, Sina Joneidy, Nana Akua Adu-Amankwa, Behzad Parniani, Andrew Roughan, and Arutyun Arutyunyan, "Digital Trade Technology and Policy-Barriers and Opportunities: A Scoping Report for a Centre for Digital Trade and Innovation." (2022).

16 Burri, Mira, and Rodrigo Polanco, "Digital Trade Provisions in Preferential Trade Agreements: Introducing a New Dataset." *Journal of international economic law* 23, no. 1 (2020): 187-220.

17 Peng, Shin-yi, "771c29digital Trade." In *The Oxford Handbook of International Trade Law (2e)*, edited by Daniel Bethlehem, Donald McRae, Rodney Neufeld and Isabelle Van Damme, 0: Oxford University Press, 2022.

18 Abdelrehim Hammad, Ahmed Arafa, Asif Khan, and Nishan-E Soomro, "Digital Economy Barriers to Trade Regulation Status, Challenges, and China's Response." *International Journal of Social Sciences Perspectives* 8, no. 2 (2021): 41-49.

19 Fichtner, J Royce, and Lou Ann Simpson, "Legal Issues Facing Companies with Products in a Digital Format." In *Digital Product Management, Technology and Practice: Interdisciplinary Perspectives*, 32-52: IGI Global, 2011.

20 Schultze-Melling, Jyn, "It-Compliance—Challenges in a Globalizedworld." *Computer law review international* 9, no. 5 (2008): 142-47.

21 Burri, Mira, "The International Economic Law Framework for Digital Trade." *Zeitschrift für Schweizerisches Recht* 135 (2015): 10-72. Janow, Merit E, and Petros C Mavroidis, "Digital Trade, E-Commerce, the Wto and Regional Frameworks." *World Trade Review* 18, no. S1 (2019): S1-S7. Latifah, Emmy, and Moch Najib Imanullah, "The Roles of International Law on Technological Advances." *Brawijaya Law Journal* 5, no. 1 (2018): 102-16.

22 Magalhães, Matheus L Puppe, "Disruptive Technologies and the Rule of Law: Autopoiesis on an Interconnected Society." *Brazilian Journal of Law, Technology and Innovation* 1, no. 1 (2023).

Moreover, the complexity and cross-border nature of these innovations challenge national legal confines²³, leaving existing frameworks insufficient for addressing digitalisation, trade secrecy, and data trading complexities.²⁴ This scenario underscores the urgent need for legal systems to evolve and align with the current data-driven economic landscape.

The World Trade Organisation (WTO) is often seen as playing catch-up in the digital era, with even cutting-edge agreements like the Digital Economy Partnership Agreement (DEPA) between Chile, New Zealand, and Singapore grappling with the pace of technological change. While DEPA builds on the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), it advances into new realms, such as digital identities, seeking technical interoperability, and protection standards. Yet even these advanced frameworks are subject to continual revision and critique, underscoring the persistent challenge of aligning rapidly evolving digital technologies with the slower pace of legal adaptations.

Third, paperless trade and its legal recognition are more specific indications of a Legal-Technical gap. The UK's Electronic Trade Documents Act (ETDA) 2023 marks a pivotal step in legal adaptation to technological advancements, particularly in digital trade. Enacted with effect from 20th September 2023, it legalises digital versions of international trade documents, such as bills of lading, giving them the same legal standing as traditional paper documents under English law.²⁵ This move rectifies previous deficiencies where electronic documents lacked legal equivalence, hindering the full utilisation of digital solutions. Despite the technological capabilities for paperless operations existing since the early 1990s, the ETDA's recent implementation underscores the ongoing effort to close the gap between fast-moving technological innovations and slower-evolving legal recognitions, highlighting the persistent Legal-Technical gap in digital trade.

Attempts in Addressing the Legal-Technical Gap

Addressing the Legal-Technical gap in digital trade, the literature primarily provides normative and prescriptive recommendations at a macro level.²⁶ Deane et al. suggest reforming Free Trade Agreements to bridge the global data divide, advocating for a collaborative international approach.²⁷ They emphasise the significance of cross-border data flows and advocate for reconciled global data governance to equitably benefit all participants in digital trade, particularly highlighting the impact on smaller economies.

In contrast, Altman et al. offer a more empirical perspective by focusing on GDPR's "singling out" concept.²⁸ They promote a hybrid legal-technical approach to reconcile technical measures with legal frameworks, aiming for more effective privacy and regulatory compliance strategies. This approach, rooted in interdisciplinary collaboration, seeks to align technological capabilities with legal obligations, thereby addressing what appears to be beneficial and applicable in digital trade.

Building on the hybrid legal-technical paradigm, Altman et al. argue for the necessity of "hybrid legal-technical concepts" in effectively regulating new technologies in complex domains. They advocate for the development of these concepts using multidisciplinary theorising, facilitating cross-domain collaboration between legal and Information and Communication Technology (ICT) fields. By promoting the explicit incorporation of these hybrid concepts, they aim to add nuance to regulatory practices and ensure that technological infrastructures are regulated in a way that respects both legal standards and technological innovation. Their approach culminates in advocating for co-design methodologies to simplify concepts that meet both legal and technical objectives, offering a framework for coordinating these domains.

Altman et al.'s work illustrates the potential of a hybrid approach to address the Legal-Technical gap in digital trade. This approach seeks to reconcile the often-disparate domains of law and technology, providing a path forward for more effective and responsive regulatory environments.

Calling for an Alternative Approach

While Agarwal et al. and Deane et al. offer normative recommendations for addressing the Legal-Technical gap in digital trade at a macro level, their high-level advice lacks the depth and theoretical underpinning necessary to fully comprehend the nature of this complex issue. This raises the question: can Altman et al.'s hybrid legal-technical approach, which advocates for a

23 Durkin, Allison, Patricia Anne Sta Maria, Brandon Willmore, and Amy Kapczynski, "Addressing the Risks That Trade Secret Protections Pose for Health and Rights." *Health and human rights* 23, no. 1 (2021): 129.

24 Greenstein, Stanley, "Preserving the Rule of Law in the Era of Artificial Intelligence (AI)." *Artificial Intelligence and Law* 30, no. 3 (2022): 291-323. Janeček, Václav, and Gianclaudio Malgieri, "Commerce in Data and the Dynamically Limited Alienability Rule." *German Law Journal* 21, no. 5 (2020): 924-43.

25 Goldby, Miriam A., "The Electronic Trade Documents Act 2023 and the 2003 Amendments to Article 7 of the Uniform Commercial Code: Do They Do the Same Thing?." Available at SSRN 4517265 (2023).

26 Agarwal, Binit, and Neha Mishra, "Addressing the Global Data Divide through Digital Trade Law." *Trade Law & Development* 14, no. 2 (2022): 238-89.

27 Deane, Felicity, Emily Woolmer, CAO Shoufeng, and Kieran Tranter, "Trade in the Digital Age: Agreements to Mitigate Fragmentation." *Asian Journal of International Law* (2023): 1-26.

28 Altman, Micah, Aloni Cohen, Kobbi Nissim, and Alexandra Wood, "What a Hybrid Legal-Technical Analysis Teaches Us About Privacy Regulation: The Case of Singling Out." *BUJ Sci. & Tech. L.* 27 (2021): 1.

nuanced blend of legal and technical elements, provide a more substantial understanding and solution to the Legal-Technical gap in digital trade?

Considering this approach, it is essential to reflect on whether employing a solution akin to the nature of the problem—essentially “fighting fire with fire”—can lead to effective resolutions or might inadvertently reinforce the issue. Arguments for the usefulness of “hybrid” approaches blend legal and technical elements to bridge the gap or mitigate issues. However, while such a multidisciplinary approach can uncover nuances and foster collaboration across legal and ICT domains, it may not fully address the breadth of the Legal-Technical gap without a solid theoretical foundation and consideration of additional dimensions such as economic, social, and communication factors.

Therefore, we argue for a theoretical underpinning that not only understands the nature of the Legal-Technical gap but also appreciates the diversity of contributing factors. We propose situating the Legal-Technical gap within the realm of Information Systems (IS) research due to its inherent multidisciplinary nature and the fundamental role of ICT in digital trade. Drawing lessons from critiques of the socio-technical approach in IS²⁹, we suggest that a dualistic approach like the legal-technical might miss the complex, multifaceted nature of digital trade. Just as socio-technical approaches may reflect biases of certain socio-political regimes, a legal-technical approach might overlook the rich phenomenology of information, cultural nuances, and ethical considerations inherent in digital trade.

Drawing insights from the critiques of the socio-technical approach, the complexity of digital trade demands a more nuanced understanding that transcends the binary of legal and technical considerations. This necessitates the need for 1) a unified, transdisciplinary approach that effectively blends distinct knowledge systems in legal and technical domains and 2) a richer, more holistic approach through a universal knowledge framework. This should acknowledge the multidimensional nature of digital trade and its diverse impacts on various stakeholders, prompting a deeper inquiry into the nature of the Legal-Technical gap, and 3) constructing a knowledge representation that transcends traditional disciplinary boundaries.

To fully grasp and effectively address the multifaceted challenges of digital trade, it is crucial to view the issue through multiple lenses. Central to this exploration is Herman Dooyeweerd’s philosophical approach and his multi-aspectual theory. Complementing this core philosophy, Andrew Sage’s Theory of Systems and Fritz Zwicky’s Morphological Method offer additional perspectives for understanding and representing transdisciplinary knowledge. This approach provides a comprehensive framework, with Dooyeweerd’s philosophy at its heart, enriched by insights from engineering and systems theory.

Theoretical Framework Introduction:

Andrew Sage’s Concept of Transdisciplinary Knowledge

Sage has conducted extensive studies of systems and their evolution. In particular, he was focused on the transformation of “Families of Systems” into “Systems of Systems” and of the bodies of knowledge associated with these two kinds of systems. His new concepts can be explained best considering infrastructure systems in a given urban area.

When such an area is considered, all infrastructure systems operating separately create a “Family of Systems” (Set of Systems) (Figure 1).

They include, for example, Transportation Systems, Water Distribution Systems, Fire Systems, Security Systems, etc. Each separate system (An element of a set) is associated with a different body of specialised domain knowledge. When an urban emergency takes place affecting several separate systems (for example, a burst water pipeline and a flooded junction), specialists from all involved domains must be used to acquire and interpret the necessary knowledge coming from various related domains. Each specialist has only his/her domain knowledge, including a separate terminology, meaning that even the same terms may have different meanings in various domains, and communication among specialists is usually difficult and sometimes even impossible. Their knowledge, taken together, is called “Interdisciplinary Knowledge” and is a product of “fusion.”³⁰

When the same area is considered again, but all infrastructure systems operate together, they create a “System of Systems” (Figure 2).

29 Howcroft, Debra, and Eileen M Trauth, “The Choice of Critical Information Systems Research.” *Information systems research: Relevant theory and informed practice* (2004): 195-211. Basden, Andrew, “On Using Spheres of Meaning to Define and Dignify the Is Discipline.” *International Journal of Information Management* 30, no. 1 (2010): 13-20.

30 Arciszewski, Tomasz, “Inventive Engineering: Knowledge and Skills for Creative Engineers.” CRC Press, 2016.

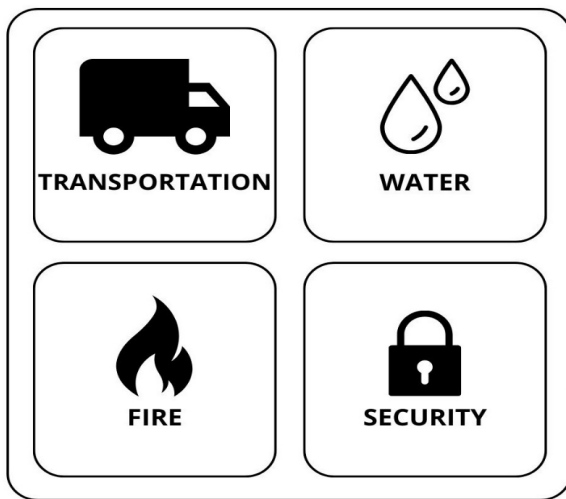


Figure 1. Family of systems.

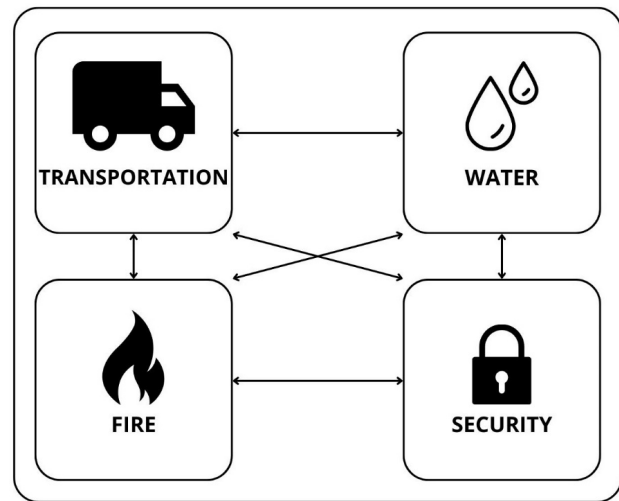


Figure 2. System of systems.

In this case, the individual systems are integrated together; they interact and are connected by a complex network of feedbacks. Their integration requires acquiring “integrative knowledge” or “transdisciplinary knowledge” in accordance with Sage. This knowledge must be acquired from the individual bodies of domain knowledge as a product of integration. Such a product is equivalent to the sum of all bodies of involved domain knowledge but can be understood without the help of domain specialists. In other words, it has lost its domain context with respect to interdisciplinary knowledge. As a result of this change, when an urban emergency takes place, the available transdisciplinary knowledge is sufficient without a need to engage specialists from all domains involved, but obviously, a new kind of expert is required; a transdisciplinary expert understanding the new transdisciplinary knowledge which just emerged.

Other examples of transdisciplinary knowledge include “Bioengineering,” which is the integration of biology and engineering, or “Neuropsychology,” which is the integration of neurology and psychology. Only recently, these transdisciplinary areas simply did not exist, only their root bodies of knowledge, but as a result of the evolution of science they have gradually emerged, and today they exist as independent sciences.

In the above context, as we have today legal knowledge and engineering knowledge, the progress of the digital trade requires the emergence of new transdisciplinary knowledge. It will probably be called “legal engineering,” and it will become the key to the advancement of digital trade.

Dooyeweerd’s Aspects of Everyday Life

In seminal works such as “A New Critique of Theoretical Thought” and “In the Twilight of Western Thought,” Dutch reformational philosopher Herman Dooyeweerd introduced his theory of aspects. This theory elucidates 15 modal aspects, representing distinct modes of our everyday experiential functioning. These aspects range from the numerical and spatial to the pistic (faith) aspect, each embodying a unique dimension of reality (Table 1).

To aid in comprehending these aspects, consider Table 1, which provides an intuitive understanding of each aspect’s core and the potential good it can manifest in our temporal reality. While Dooyeweerd himself did not categorise the aspects in this manner, this grouping can offer clarity and insight for our current discourse.³¹

Dooyeweerd’s mature systematic philosophy posits these 15 mutually irreducible but coherently interconnected modal aspects. These aspects are not specific entities but rather represent different modes of the universal “how” that shape our theoretical view of reality. Each thing, entity, event, attribute, value or relation in our world displays all these aspects to some degree, a concept referred to as ‘sphere universality.’

31 Basden, Andrew, *The Foundations of Information Systems: Research and Practice*. Routledge, 2017. Basden, Andrew. *Foundations and Practice of Research: Adventures with Dooyeweerd’s Philosophy*. Routledge, 2019.

Table 1. Dooyeweerd's Aspects.

Aspect	Meaning	Good
Mathematical Aspects		
Quantitative	One, several many; more and less	Reliable amount
Spatial	Here, there, between, around, inside and outside	Simultaneity, continuity
Kinematic	Flowing & going	Change
Pre-Human Aspects		
Physical	Forces, energy and matter	Irreversible persistence and causality
Biotic / Organic	Living as organisms in an environment	Sustained being and functioning that is not wholly controlled by the environment
Sensitive / Psychic	Feeling and responding	Interactive engagement with world
Aspects of Human Individual		
Analytical	Conceptualising, clarifying, categorising and cogitating	Independence from the world; Conceptual and theoretical thinking
Formative	Deliberate creative shaping of things	Achievement, innovation
Lingual	Expressing, recording and interpreting	Intelligible externalisation of our intended meaning; Referring beyond to whole web of meaning
Social Aspects		
Social	We, us and them; relating, agreeing and appointing	Togetherness
Economic	Managing limited resources frugally	Sustainable prosperity
Aesthetic	Harmonising,, enjoying, playing, beautifying	Delight that seems non-necessary
Aspects of Structures of Society		
Juridical	Due: appropriateness, debt and reward, structures of policy and legality	Due for all
Ethical	Attitude; self-giving love	Extra goodness, beyond the imperative of due
Pistic / Faith	Vision, commitment, certainty and belief aspiring, trusting, worshipping	Courage, hope and openness to the Divine; change in the attitude and direction of society

Understanding Qualifying Aspects

Bergvall-Kåreborn in her article on systems design, emphasises the significance of identifying the qualifying aspect of entities in information systems analysis.³² This concept helps analysts discern a thing's 'destination' or inherent purpose, fostering clarity and revealing potential issues when things are misaligned with their intended roles. For instance, misinterpreting hospitals as primarily economic entities instead of biotic or ethical could degrade care quality over time. While deviation from a thing's qualifying aspect can be temporarily useful, persistent and widespread misalignment risks widespread, non-localised damage due to reality's interconnected nature.

Each Aspect's Interaction with Others

In Dooyeweerd's philosophy, no aspect exists in isolation; each actively interacts with others, illustrating the interconnectedness of reality. This interaction is evident in how the lingual aspect allows the expression of meanings pertaining to various aspects - for example, 'friend' (social) or '7' (quantitative). Similarly, the analytical aspect can discern differences or similarities across multiple aspects, like quantities, words, social roles, or beliefs. This inter-aspect outreach highlights the dynamic and integrated nature of reality across all aspects.

Neighbouring aspects

An aspect seems to exhibit greater affinity to its neighbours than to those further away in the sequence. This means that, from one point of view, it is often difficult to tell if something is qualified by one aspect or the next, and each aspect anticipates

32 Bergvall-Kåreborn, Birgitta, "The Role of the Qualifying Function Concept in Systems Design." *Systemic Practice and Action Research* 14 (2001): 79-93.

those later than it, especially its next neighbour. But also, there seem to be sharp differences between neighbouring aspects, which can help us distinguish them.³³ Take analytic and formative aspects as an example. Their affinity in the analysis involves both, and both usually deal with discrete things. Their difference is that analytically distinguished things have no relationship to others; with the formative aspect, things have a relationship with others, which leads to structures. Analytical thought separates and categorises, possibly into linear lists; formative thought relates and processes into complex structures.

This introduction to Dooyeweerd’s philosophy sets the stage for exploring its application in the context of digital trade, particularly in addressing the Legal-Technical gap by enabling us to underscore the interconnectedness and the dynamic interplay between the different aspects. They highlight that while each aspect is distinct and irreducible, they are also integrally related, forming a coherent and interconnected whole. This understanding is crucial in applying Dooyeweerd’s philosophy to complex, multidimensional issues, such as those encountered in digital trade, where various aspects must be considered in relation to each other.

Fritz Zwicky’s Concept of Representation Space

In the previous section on Dooyeweerd’s aspects of everyday life, the concept of Dooyeweerd’s aspects was introduced. These attributes need to be incorporated into the knowledge representation space in order to be used for practical purposes in knowledge-based systems. For engineering purposes, the best representation of knowledge is probably in the form of a morphological table, as proposed by Zwicky and used in various areas of structural engineering.

As far as knowledge representation space is concerned, Zwicky has made four fundamental assumptions :

1. A concept (actual or abstract) may be described by a finite number of symbolic attributes/descriptors/aspects and their values.
2. Such a description should be at least necessary and sufficient to identify all known concepts and to distinguish between them.
3. Each symbolic attribute identifies a different feature of a given concept.
4. All symbolic attributes and their values can be presented in a systematic way by a single table (called a morphological table) with a number of rows and columns. Such a table becomes the problem’s knowledge representation space.

An example of a morphological table is provided below in Table 2.

Table 2. Morphological table.

Attribute <i>A_i</i>	Values					
	<i>A_{i1}</i>	<i>A_{i2}</i>	<i>A_{i3}</i>	<i>A_{i4}</i>	<i>A_{i5}</i>	...
A1	A11	A12	A13			
A2	A2	A2	A2	A2		
A3	A3	A3				
A4	A41	A42	A43	A44	A45	A46
...
<i>A_j</i>	<i>A_{j1}</i>	<i>A_{j2}</i>	<i>A_{j3}</i>	<i>A_{j4}</i>		

The added value of integrating Dooyeweerd’s theory of aspects with Andrew Sage’s systems theory and Fritz Zwicky’s concept of representation space can be discerned through the lens of Dooyeweerdian aspects and their characteristics: Sage’s theory of system of systems is enriched by Dooyeweerd’s aspectual characteristic of ‘reaching out,’ as each aspect extends to others. For instance, in digital trade, this integration manifests in the interplay between diverse knowledge domains like Software (formative), Haulage (kinematic), Wildlife (biotic), Energy (physical), and Law (juridical). The irreducibility of Dooyeweerd’s aspects to each other aids in developing a morphological table. This approach ensures a holistic selection of attributes and values and examines distinctions and overlaps between them, thereby enriching the analysis.

33 Basden, Andrew. Foundations and Practice of Research: Adventures with Dooyeweerd’s Philosophy. Routledge, 2019. Keene, Timothy, “Kuyper and Dooyeweerd: Sphere Sovereignty and Modal Aspects.” Transformation 33, no. 1 (2016): 65-79.

However, the empirical examination of the integration of Dooyeweerd's theory of aspects, Sage's systems theory, and Zwicky's representation space in the context of digital trade is beyond the scope of this conceptual paper and is an area ripe for future research.

Application of Dooyeweerd's Aspects in Bridging the Gap between Legal and Technical Aspects:

Central to our paper, this section will explore how Dooyeweerd's aspects can be applied to provide a foundation for understanding the gap and the Dooyeweerdian aspects that can play a crucial role in bridging this gap. In this section, we include hypothetical examples and case scenarios where this philosophical approach could offer insights as we want to showcase the applicability of this philosophy.

Bridging Legal-Technical Gap:

Bridging the Legal-Technical gap in digital trade through Dooyeweerd's philosophy involves understanding and integrating the modal aspects that lie between the formative (technical) and juridical (legal) aspects. These intervening aspects – lingual, social, economic, and aesthetic – provide a multidimensional framework that can harmonise technological and legal considerations. The breakdown of how this bridging can occur is as follows:

Lingual Aspect:

The lingual aspect, according to Dooyeweerd, involves symbolic signification, where meaning is intentionally set down in a form separate from us, persisting beyond our presence. This aspect encompasses expressing, recording, and interpreting meaning, both in explicit and tacit forms, evident in various forms of communication like notes, gestures, writing, and conversation, referencing a broad web of meanings.

In the context of digital trade, this aspect enables focusing on the importance of clear communication and documentation, essential in both technology and law. Effective communication strategies can ensure that legal and technological domains are not only aligned but are also mutually informative. For example, the way data is represented and how privacy policies are communicated, ensuring legal compliance and technological efficiency.

Lingual Aspect Enabled by Formative Aspect

In a digital trading platform, the formative aspect involves the technological infrastructure and the way the platform is built and operates. The role of the lingual aspect is to influence how technology is used to communicate a clear and relevant document to all parties involved along the digital trade supply chain. This can also be seen in how the platform encodes data for trade transactions. The symbols, terms, and codes used for representing trade data are rooted in the technological framework (formative aspect) but gain their specific meaning and significance in the lingual aspect. For instance, the use of standardised trade symbols or acronyms that are universally understood in the trading community exemplifies this relationship. These symbols facilitate clear, efficient communication and ensure that the data represented by the technology is meaningful and accessible to users from different domains of expertise.

Lingual Aspect Enabling Social Aspect

Moving from the lingual to the social aspect, the symbols and language used on the digital trading platform shape social interactions. A lot of time in the trade communities where stakeholders with different interests are involved, having a shared language of understanding is key for glueing different parties together. In this context, the lingual aspect (symbolic signification) anticipates the social aspect by setting the foundation for social communication and interactions within the digital trade environment and hub for stakeholders.

For example, a digital trade platform's design may include features for user feedback, reviews, or forums for social interaction and community building to address similar challenges. The features of a shared dashboard, while technically rooted (formative), become part of the social fabric of the platform, influencing how users interact, form communities, and build trust. In the case of the UK ETDA Act, one empirical research would be to investigate how the terms of the ETDA Act have implications beyond just the world of international trade as it is meant to speak to a new paradigm for the whole business of contracting, transacting and trusting in our modern societal structures.

Social Aspect

The social aspect, as conceptualised by Dooyeweerd, revolves around the idea of ‘connection’ or ‘togetherness’, encompassing social interaction and the formation of institutions. It is about being among others, associating, agreeing, and appointing roles within social structures, reflecting a sense of companionship and collective identity. This aspect emphasises human interconnectedness, moving beyond individualistic or class-based views and focusing on collaborative and communal dimensions of society.

In the context of digital trade, the social aspect can be experienced in stakeholder engagement. This is achieved by involving various stakeholders, including legal experts, technologists, economists, and even end-users of digital platforms, in the development and implementation of neutral digital technology that ensures legal requirements are met and social needs are addressed. Ensuring that technological solutions adhere to social norms and legal regulations and fostering trust and acceptance among users are key areas to bridge the gap between technical and legal.

Social Aspect Enabled by Lingual Aspect

In digital trade, the social aspect, focusing on community associations, agreements, and appointments, is enabled by the lingual aspect, which underpins communication and documentation. For instance, the terms of the ETDA Act influence societal structures and expectations, thereby shaping how trade terms and agreements are communicated. This includes language choice in contracts and transactional documents, as well as trust-building mechanisms within digital platforms. Changes in social norms and values, as prescribed by the Act, necessitate modifications in the articulation and presentation of trade information, aligning it with evolving societal expectations.

Social Aspect Enabling Economic Aspect

The social aspect anticipates the economic aspect by setting the stage for how economic transactions are conducted and perceived. The Act’s implications on societal structures, like more accountable supply chains and enhanced visibility for ESG (Environmental, Social, and Governance) compliance, drive economic changes. For instance, the increased social emphasis on transparency and accountability leads to the adoption of digital trade practices that prioritise and showcase good provenance and ESG compliance. These practices not only align with immediate economic benefits, such as reduced prices, but also foster longer-term societal benefits like efficient usage of scarce resources such as fuel consumption and energy usage in trade. The social expectations and norms thus directly influence economic activities, guiding how digital trade is structured to deliver broader societal benefits.

Economic Aspect

The economic aspect, as defined by Dooyeweerd, centres on “Frugality,” emphasising the careful management of limited resources for sustainable prosperity. This aspect focuses on recognising and respecting resource limits and promotes careful stewardship rather than merely concentrating on financial metrics, production, or consumption. It involves a broader understanding of value, extending beyond the purely symbolic worth of objects.

Economic Aspect Enabled by Social Aspect

In digital trade, the social aspect, emphasising community, trust, and cooperation, profoundly shapes the economic domain. For instance, the implementation of the ETDA is significantly influenced by societal demands for equitable and trustworthy digital trade systems. Social expectations and norms dictate economic strategies and priorities, leading to a focus on fair and accessible digital trade practices. This societal influence drives the establishment of public and private ownership models and unbiased system delivery, ensuring that economic activities align with the collective values and needs of various communities, from small and medium-sized enterprises (SMEs) to large corporations.

Economic Aspect Enabling Aesthetic Aspect

The aesthetic aspect, concerning harmony and integration, is anticipated by the economic aspect’s focus on sustainable viability. In digital trade, this relationship is evident in the design of financial regulatory systems that integrate property rights and liabilities into digital records. The economic necessity of creating systems that are financially viable and protect users’ interests anticipates the aesthetic need for coherent and integrated systems. For example, the decision to use stablecoins or fiat currencies (CBDC) in digital settlements is an economic consideration that anticipates the aesthetic goal of creating a harmonious, well-automated, and user-friendly system. The aesthetic design factors that provide assurance to users are

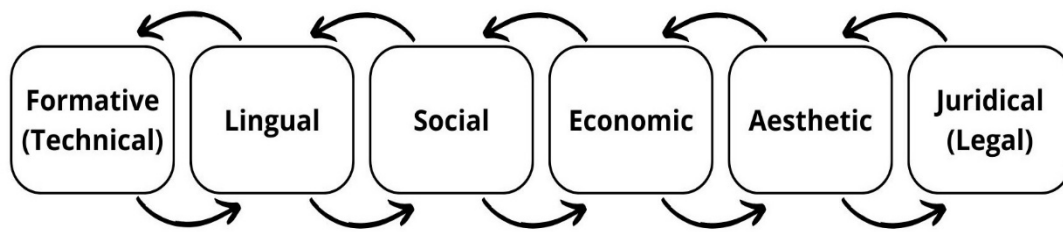


Figure 3. Legal-Technical Bridge through Dooyeweerd's aspects.

inherently influenced by the underlying economic mechanisms, ensuring that the digital trade system is not only economically sustainable but also aesthetically coherent and user-oriented.

Aesthetic Aspect

The aesthetic aspect is primarily about creating harmony, akin to a symphony, and involves harmonising and orchestrating. It encompasses coherence, contrast, surprise, and suggestiveness, often arising from nuanced surprises. This aspect also includes enjoyment, leisure, fun, rest, interestingness, and amazement. It goes beyond simple dramaturgy or display, focusing on the richness of experience and interaction rather than mere sameness, uniformity, or idle inactivity.

Aesthetic Aspect Enabled by Economic Aspect

The integration of the aesthetic aspect with economic considerations is crucial in digital trade. Economic viability, focusing on cost efficiency and value creation, directly influences the aesthetic design of digital platforms. A well-designed platform that elegantly balances legal compliance and user-friendliness can lead to significant cost savings, especially by minimising legal disputes and enhancing user engagement. The economic aspect drives the necessity for a platform that is not only functionally efficient but also economically sustainable. This balance ensures that the platform is appealing to users, increases adoption rates, and becomes a viable economic entity, thereby reinforcing the importance of aesthetic considerations in economic decision-making.

Aesthetic Aspect Enabling Juridical Aspect

The aesthetic aspect plays a pivotal role in anticipating and aligning with the juridical aspect of digital trade. By focusing on harmony and coherence, the design of digital trade platforms can intuitively guide users through processes that are compliant with legal regulations. This approach involves integrating legal requirements into the user interface in a way that is both seamless and intuitive, highlighting necessary information like terms of trade and privacy policies without overwhelming the user. Such a design not only ensures legal compliance but also enhances the user experience by giving justice to them, making adherence to legal norms a natural and unobtrusive part of the platform's functionality. This harmonious integration underscores the potential of aesthetic design to prefigure and support legal requirements effectively.

In this section, we illustrated how considering Dooyeweerd's aspects allows for a holistic approach to addressing the Legal-Technical gap in digital trade. Figure 3 visualises the Legal-Technical Bridge, demonstrating the interconnectivity and influence of each aspect. A technological solution (formative aspect) must adhere to legal compliance (juridical aspect) and simultaneously incorporate effective communication (lingual aspect), social responsibility (social aspect), economic viability (economic aspect), and coherent design (aesthetic aspect). Dooyeweerd's philosophy promotes an all-encompassing framework, ensuring that each aspect is integrated rather than isolated, leading to more unified and enduring solutions in digital trade, harmonising technology, and legal frameworks.

Implications and Future Directions:

Dooyeweerd's philosophy offers a solid theoretical foundation to discern the nature of the Legal-Technical gap by understanding which aspects are most relevant in digital trade research. The Legal-Technical gap is multi-aspectual and extends beyond merely lingual, social, economic, and aesthetic aspects. These aspects provide a starting point for researchers and practitioners in digital trade to investigate and address the gap, enhancing legal-technical functionality.

Dooyeweerd's aspects provide a framework to understand the interrelationships between factors shaping legal-technical functionality. This framework helps researchers and practitioners identify which aspects of these factors are primarily meaningful and their immediate neighbouring aspects. In the dynamic and complex environment of digital trade, having a focus on lingual, social, economic, and aesthetic aspects allows for prioritising critical factors for enhancing legal-technical functionality.

The exploration of the Legal-Technical gap in digital trade through Dooyeweerd's aspects—particularly the interplay between the formative, lingual, social, economic, aesthetic, and juridical aspects—drives the implications for research constructs such as communication, trust-building, financial management, and cohesiveness in a global digital marketplace. These aspects influence the identified critical areas.

Communication

The lingual aspect, focusing on symbolic signification and the externalisation of meaning, plays a critical role in shaping digital trade communication. It highlights the need for clear, precise, and legally sound communication strategies in the digital trade realm. By integrating the formative aspect (technological infrastructure) with the lingual aspect (communication and documentation), businesses can develop communication models that are technologically advanced and compliant with diverse legal standards, fostering effective international engagement.

Building Trust

The social aspect, emphasising human interconnectedness and communal relationships, is vital in building trust in digital trade environments. It interrelates with the juridical aspect, which governs legal norms and principles like data privacy and consumer protection. When these aspects work in harmony, they foster a business environment that respects cultural and social norms while adhering to ethical data management and privacy laws, thus enhancing trust among users.

Financial Implications

The economic aspect's focus on managing resources frugally intersects with the formative aspect (technology implementation) and the juridical aspect (legal compliance). This intersection is crucial for SMEs facing financial strains due to the Legal-Technical gap. By understanding these interrelations, research can develop cost-effective compliance mechanisms that balance economic viability with technological advancement and legal adherence.

Cohesiveness and Integration

The aesthetic aspect, dealing with harmony and integration, becomes crucial when considering the cohesiveness of global operations. It ensures that the technological solutions (formative aspect) are not only legally compliant (juridical aspect) but also aesthetically pleasing and functionally integrated. This holistic approach, considering all relevant aspects, leads to operational efficiency and strategic coherence in global digital trade environments.

Considering these Dooyeweerdian aspects in their interconnectedness, researchers and practitioners in digital trade can address the challenges posed by the Legal-Technical gap more thoroughly.

Future Research

This section proposes key questions for future empirical research to deepen our understanding of the Legal-Technical gap in digital trade.

To explore how technological infrastructures can be designed and implemented to naturally align with evolving legal standards, thus reducing the compliance burden and fostering innovation within legal constraints, by applying formative and juridical aspects in technological compliance, we propose the following research question: *How can the integration of formative (technological) and juridical (legal) aspects in digital trade platforms lead to improved compliance mechanisms?*

To investigate how digital trade platforms can utilise effective communication to navigate cultural differences, thereby fostering trust and understanding among a diverse user base in various legal environments and bringing lingual and social aspects together in fostering cross-cultural communication and trust, we propose: *What strategies can be developed to enhance communication and build trust in digital trade, considering the intricate interplay between the lingual (communication and symbolism) and social (community and relationships) aspects?*

Future research could focus on developing strategies for creating digital trade interfaces and experiences that are not only economically viable but also aesthetically appealing, enhancing user engagement and satisfaction and thus employing economic and aesthetic aspects in user experience design. Aligned with these aspects, we propose: *How can the economic*

aspect of resource management be harmonised with the aesthetic aspect of design to create cost-efficient, user-friendly, and legally compliant digital trade platforms?

To create holistic frameworks or models that consider all these aspects in unison, thereby more effectively addressing the Legal-Technical gap and fostering a balanced, sustainable approach to global digital trade, we propose: *What models can be developed to encapsulate the interrelationships among the formative, lingual, social, economic, aesthetic, and juridical aspects of digital trade?*

These proposed research directions encourage a multidimensional approach to understanding and addressing the complexities in digital trade, emphasising the significance of considering multiple aspects and their interrelations for developing more coherent, adaptable, and legally compliant digital trade practices.

Conclusion

This conceptual paper has explored the interrelated aspects of closing the Legal-Technological Gap in digital trade. Its focus has been on three areas. First, the area of integration of the legal and technical knowledge systems leads to the emergence of specific transdisciplinary knowledge in accordance with Andrew Sage's Theory of Systems. The second area is Herman Dooyeweerd's philosophical framework, particularly his theory of aspects encompassing 15 distinct modal aspects, to address the Legal-Technical gap in the context of digital trade. Through hypothetical examples and elucidations of Dooyeweerdian concepts like sphere universality, aspects affinity and interrelationships, we have demonstrated this philosophy's applicability in providing an integrative paradigm. Finally, the paper proposes building a transdisciplinary knowledge representation using the morphological method developed by Fritz Zwicky, a task left for future empirical research.

The analysis of the interrelations between the formative, lingual, social, economic, aesthetic, and juridical aspects reveals fresh insights into the multifaceted gap in digital trade. It highlights the need for simultaneous attention to technological infrastructure, communication strategies, trust-building mechanisms, resource management, coherent design, and legal compliance. This understanding can equip stakeholders to pursue more harmonised, sustainable solutions that balance technological innovation and legal adherence.

Our exploration sets the groundwork for further research on developing and testing frameworks encapsulating Dooyeweerd's aspects to tackle operational challenges around communication, trust-building, finances, and strategic coherence. It opens avenues for investigating aspectual interplays in context-specific issues like cross-border data flows. This paper signifies the promise of reformational philosophy in addressing complex multidimensional problems at the intersection of technology, law, and society.

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