



Reignite Multilateralism
via Technology

D5.2 Overview on two-way impact of digital technologies vis-à-vis multilateralism

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Background of the REMIT project

The REMIT project aims to “**Reignite Multilateralism via Technology**”. A reigniting that not only reacts to China’s rise as a systemic technology rival or Russia’s resurgence as a technology abuser or the dominance of large U.S.-based digital platforms, but that sets a clear vision for the future — one in which Europe plays a leading role.

Coordinated by Maastricht University, the REMIT project brings together leading European researchers from nine partners from Belgium, Estonia, Finland, Germany, Italy, the Netherlands, Romania and the United Kingdom. The goal is to develop recommendations, clear understanding of the status quo and innovative methodologies that support effective policies to revitalize global democratic structures.

REMIT aims to re-mobilize a transnational collective spirit that addresses global problems through technology, because

1. Technology has strong effect on economic competitiveness
2. Technology is important to national security including threats to democratic principles
3. Technology is crucial to the solutions for global challenges

By focusing on technology and the policy areas that emerge from the REMIT researchers’ expertise, the project provides the needed analysis and the theory building to support the EU. The four technology areas are also instrumental in finding solutions to all important challenges, including climate, digital transitions, the rise of inequalities, ageing and disabilities, migrations, health pandemics, and information disorder. Ultimately, REMIT intends to design policy recommendations that will give a remit to reignite multilateralism via technology.

The detailed objectives of the REMIT project are:

» **Objective 1:** To define the EU’s role in leading the renewal and defence of multilateralism starting with the global governance of technologies in four crucial policy areas (digital, health bio, security and defence, and financial technologies). The lack of comprehensive, multilateral tech regulations represents material national security threats to the EU and its allies by allowing others (especially China) to set the rules for the digital future.

» **Objective 2:** To provide evidence-based advice to reinforce European institutions in the field of technology that work and propose innovative, multilateral-governance constructs for those that do not.

» **Objective 3:** To develop policy recommendations and scenario testing workshops offered to relevant EU administrators, important regional groups, and national officials.

» **Objective 4:** To share knowledge among stakeholders and to communicate policy recommendations. REMIT will recommend policy action for the European Union that further re-conceptualizes multilateralism in the four technology areas.

The REMIT project is carried out from March 2023 until February 2027 and has a total budget of almost €3 million, of which €2.6 million is funded by the EU’s Horizon Europe research and innovation program and €370k is provided by the UK government through the UK Research and Innovation fund (UKRI). The project is being carried out by internationally recognized researchers from Maastricht University, Universitatea Babes Bolyai, Universitaet Bremen, KU Leuven, Luiss Libera Universita Internazionale Degli Studi Sociali Guido Carli, Erasmus University Rotterdam, the Finnish Institute for International Affairs and the University of Tartu. In addition, Virtual Routes (formerly the European Cyber Conflict Research Initiative, ECCRI) joins the consortium as an associate partner, receiving funding from UKRI.



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List of abbreviations and definitions

Abbreviation	Definition
ACF	Advocacy Coalition Framework
AI	Artificial intelligence
DNS	Domain Name System
FLOSS	Free/libre/open-source technologies
ICANN	Internet Corporation for Assigned Names and Numbers
IETF	Internet Engineering Task Force
IoT	Internet of things
LLM	Large language model
QKD	Quantum key distribution
RAN	Radio access network
SCoT	Social construction of technology



Executive summary

This report, Deliverable 5.2 of the REMIT project's Work Package 5 (WP5), presents an analytical framework developed to explore the reciprocal relationship between strategic digital technologies and multilateral governance efforts. In developing this framework, WP5 aims to facilitate a systematic understanding of how digital technologies both shape and are shaped by global governance structures.

As a tool for analysing the structural interdependencies between digital technologies and the international system, the framework is designed to support WP partners in the selection, scoping, and research design of specific case studies that explore these governance dynamics in detail as part of the WP's next research Task 5.3.

The report builds on the preceding Deliverable 5.1, which assessed the strategic and symbolic value of digital technologies through the lens of specific states' strategic goals. While D5.1 focused on the value digital technologies hold for states, this report shifts the analytical perspective to view digital technologies as structural influences within the broader international system. In doing so, it extends the analysis from state-centric concerns to a systemic understanding of the interplay between technology and global governance.

To this end, the report first outlines the theoretical foundations for the structural approach to digital technologies and the international system; it then explores the key structural properties of digital technologies and their social construction; next, it introduces the central framework and avenues for its integration with the Advocacy Coalition Framework (ACF), which serves as common reference across the research work packages of the REMIT project. To illustrate how the framework can be applied to specific technologies and to guide WP5 partners in the development of their case studies during the next phase of the project, the report provides four guiding examples for key digital technologies: 5G/6G communications networks, quantum technologies, cyber surveillance technologies, and the internet Domain Name System (DNS).



Introduction

Within the REMIT project, Work Package 5 (WP5) focuses on advancing a systematic understanding of the nature of digital technologies, considering them as both influences on and the subject of global governance efforts. By developing analytic capabilities to assess these interdependencies, WP5 contributes to the project's overall goal to develop theoretically supported recommendations to strengthen multilateral approaches to technology governance.

Within WP5, Task 5.2 is the development of an analytical framework to facilitate the study of the two-way influences between strategic digital technologies and multilateralism. This report, Deliverable 5.2, fulfils Task 5.2 by proposing a framework for understanding the relationship between key structural properties of digital technologies and those of the international system.

This report also supports Task 5.3 (case studies of specific digital technologies), by showing how to apply this framework to the selection, scoping, and research design of these case studies. To this end, it also provides four guiding examples of the framework applied - in brief - to particular digital technologies: 5G/6G communications networks; quantum technologies; cyber surveillance technologies; and the internet Domain Name System (DNS).

This report builds on an earlier report (Deliverable 5.1) completed to fulfil Task 5.1 in WP5, assessing the strategic and symbolic value of digital technologies. D5.1 discussed key properties of all strategic assets, noting distinct dynamics in digital technologies around interoperability and standardization, network effects, and capability and control. D5.1's focus on the concepts of strategic value and strategic assets tied its analysis to the perspective of specific states: in other words, assets, including digital technologies, are valuable for states because they fit into or help them achieve their strategic goals.

While this report addresses some of the same features of digital technologies discussed in D5.1, it does not focus on how those features provide strategic value to states. Instead, it approaches digital technologies and the international system as two interacting structures, each with properties that influence the other. This change of analytical perspective - from digital technologies offering strategic value for states to digital technologies as structural influences on the international system overall - means that this report complements and extends the analysis of D5.1 in a new direction.

This report is organized as follows. The next section provides the theoretical foundations for the structural approach adopted here regarding both digital technologies and the international system. The subsequent section examines key structural properties of digital technologies and the extent to which these properties are socially constructed, before introducing the central framework and a related



theory, the Advocacy Coalition Framework (ACF), which is used across the REMIT project. The final section sets out four guiding examples for applying the framework to specific digital technologies.

1. Theoretical foundations

This section builds the theoretical foundations for understanding the two-way relationship between digital technologies and multilateralism. It first provides a definition of multilateralism and its place in the international system, then introduces a structural approach to digital technologies. Finally, it extends this structural approach to the relationship between digital technologies and multilateralism.

1.1 Multilateralism and the international system from a structural perspective

Multilateralism can either be defined narrowly as any coordinated interactions between three or more states, or more expansively as a set of formal institutions involving many - or most - states (such as the UN and the WTO; for a third interpretation see Maull 2020). Multilateralism in either definition can be descriptive (multilateral processes and institutions *do* exist) or normative (they *should* exist, and moreover they *should* work towards certain ends). The EU treats multilateralism as one of its core goals, suggesting a more normative interpretation (Council of the European Union 2009; O’Sullivan 2021; European Commission 2021). In outlining its approach, the European Commission emphasises the importance of inclusiveness as a precondition for “ensuring the relevance of the multilateral system and preserving its legitimacy” (European Commission 2021). Arguing for the meaningful participation of civil society, the private sector, and other non-state voices, the EU has widely adopted a multistakeholder understanding of multilateralism to transcend traditional multilateral setups limited to states.

Both multilateralism as a normative approach and multilateralism as a descriptive object are one aspect of the broader international system. As highlighted by the EU’s multistakeholder approach to multilateralism, the international system includes non-state as well as state actors, and myriad other forms of relationships and interactions in addition to multilateral ones. Non-state actors are crucial to understanding digital technologies, and multilateral interactions take place in the context of wider diplomatic relationships. This theoretical section will therefore focus on the relationship between digital technologies and the international system in general, rather than multilateralism specifically. It will note implications for multilateralism where relevant, and then the following sections will apply these theoretical foundations to specific examples of multilateralism.



The international system can be seen as a structure, with properties that change over time (Wendt 1987); indeed, one of those properties is the extent to which that system is multilateral (Ruggie 1992; Telò 2023). One of the fundamental structural features of the international system is the distribution of power. Between states, power distribution can be unipolar, bipolar, or multipolar; and multilateralism can appear in different forms depending on such power distributions. For example, multilateralism aligned with a global hegemon, as in the US-led 1990s, is very different to multilateralism in the current, more multipolar, order (Woods 2023). Of course, structures can change - and collapse, as in the dissolution of the Cold War bipolar order with the fall of the Soviet Union - very rapidly, meaning that structural features are far from static or permanent.

International Relations (IR) theorists have put forward many nuanced theories of power, moving away from treating it as an attribute solely of unitary state actors, towards including non-state actors, individuals, and diverse organizations or regimes (Barnett and Duvall 2005; Nye 2011). Power theories also no longer only conceptualise power in “hard” military terms, including also soft, economic, and cultural forms of power - often in turn bringing in new actors operating these different levers of power (Goddard, MacDonald, and Nexon 2019). The broadest theories of power see power relations not only as holding between actors (A getting B to do x, in Dahl’s formulation), but in shaping the identities and self-understanding of those actors - in other words, who they are, as well as what they can do (Guzzini 1993; 2013). Theorists examine extreme and sustained inequalities of power using concepts like domination, colonialism, and imperialism (Barkawi and Laffey 2006).

Such massively unequal power distributions demonstrate multilateralism’s intertwined normative and descriptive elements. Most people instinctively feel that coloniality cannot be multilateral, as multilateralism requires some degree of sovereign equality at least in principle, if not in practice (Acharya 2013). However, within these bounds, the narrow approach to multilateralism above allows for multilateral relations within a highly competitive global order, filled with transactional power politics and naked self-interest. In this context, scholars have developed versions of multilateralism - sometimes termed “flexilateralism” (Faure 2018) - that seek to capture how multilateral institutions can adapt to shifting norms of interaction and an atmosphere of much lower cooperation.

However, power is not the only structural feature of the international system. Many IR theorists approach the international system as a *social* structure, applying structural features of all societies (such as shared values and identities, common ontologies and narratives of meaning) also to the international system (Bull 1995). The thinnest possible understanding of such social structures is as norms of interaction developed over time between self-interested states, for example through diplomacy (Checkel 1997). But one can also see values in the international system (such as sovereignty, self-



determination, and fundamental human rights) as thicker properties, possessing their own complex cultural and religious genealogies (Lauren 1998). As with power, values can be ascribed to and promoted by state and non-state entities. Importantly, values interact with power in both directions: they can direct and constrain the exercise of power but can also be strategically deployed to achieve certain ends (Adler-Nissen 2013).

There are other structural features of the international system, which intersect with both power and values. Many IR theories examine the connection between the social structure of the international system and the physical structure of the natural world underlying that social structure; for example, by examining the influence of natural geography on the causes and conduct of war (Diehl 1991). As the physical characteristics of the world are changing rapidly through climate change, these influences are only likely to increase in the coming years (Koubi 2019). However, most IR theories caution against too easy an “externalization” of seemingly separate features like natural geography; as we discuss further below, these often turn out to be just as socially constructed as power or values. But this takes us ahead of ourselves; for now, the key point is that understanding the relationship between digital technologies and multilateralism first requires us to acknowledge key structural features of the international system of which multilateralism is a part.

1.1 Digital technologies from a structural perspective

Technologies, in the broadest sense, enable actors to do things differently. Technology enables new kinds of activity, produces new kinds of objects, or makes existing activities and objects more efficient and effective (L. Mumford 1966). Technological development is local, meaning that new technologies are invented in a particular place (or places), by specific groups of people (sometimes simultaneously). In terms of power, the combination of localised invention and demonstrable advantage creates incentives for actors without that technology to try to access or adopt it, and for actors with that technology to control and guarantee its supply, as well as to use it as a “strategic asset”, for bargaining and negotiation or for exploitation and coercion (Ding and Dafoe 2021).¹ Ultimately, the ownership of and ability to operate new technologies provides significant *relative* power to actors in the international system, both state and non-state (Lieber 2005).

But technologies do not simply provide commercial or strategic advantage. The problems that technologies solve arise within societies with assumptions about who should do what and how (Layton

¹ A more detailed discussion is included in REMIT Deliverable 5.1, on which this report builds.



1988). In other words, technologies are embedded in cultural systems and imbued with symbolic properties and social associations, which complicate, constrain and disrupt “pure” strategic interactions (Coker 2018). Such cultural and social factors play a role both in technological development and adoption, with values such as fairness and equality central to many technological debates. They also play a role in the development and distribution of the knowledge and skills needed to operate such technologies, which is another frequent point of strategic competition (Herrera 2006).

Moving to digital technologies (those relying on binary computation), such technologies are now ubiquitous, with computation embedded in a wide range of everyday devices and forming the basis for global networks of communication and data exchange. Digital technologies usually have long, complex, supply chains and dependencies, relying on other forms of communication (e.g., radio and telecom networks), reliable power (e.g., electricity grids), and many rare or difficult-to-obtain materials for their manufacture. Nearly all these dependencies and supply chains are international, meaning that states and other actors can quite easily use control over chokepoints in those supply chains to exercise power, for strategic or value-based reasons, over others’ access to and operation of digital technologies (Schermer 2024). Some analysts suggest that such exercise of power tends to be disruptive, as it is easier to interrupt global capital and data flows than to secure them (Wiig and Silver 2019), but there are equally many cases where states seek to preserve such flows to exploit them (Burgess 2022).

Actors can of course use digital technologies themselves as levers of power: for example, by performing calculations that enable the launch of satellites or more accurate missiles; or by enabling remote disruption of digital data or operations. However, nearly all such uses depend on features of digital technologies that are best thought of as structural properties, rather than as belonging to an individual object. So cyber-attacks are not the launch of a “cyber missile” - an object - but the exploitation of a digital technological structure - the internet - that opens new vulnerabilities and opportunities for influence (Fischerkeller, Goldman, and Harknett 2022). We must therefore approach digital technologies in a very similar way to the international system itself; as a set of structures with certain properties, shaping the way in which actors achieve their ends, as well as helping them achieve those ends.

This structural approach to digital technologies is multilayered, as different digital technologies create overlapping and interdependent structures. For example, the internet (which itself builds on physical communications networks in the form of subsea cables), is a prerequisite for cloud computing. Cloud computing, in turn, is a prerequisite for the widespread adoption of large language model-based artificial intelligence (AI). AI, in turn, is necessary to interpret the results of quantum computation. Each of these structures has different properties, but they are arranged in what is best termed a “stack”. Usually used to refer to the different layers of the internet itself, the term “stack” has been usefully employed by



some theorists to capture the fragility and precariousness of such overlapping technological fields (Bratton 2016). While we refer occasionally to digital technologies overall as a structure, we will more frequently refer to one technology (or, more accurately, a technological field, including its social, scientific, and other elements) as part of this wider stack.

1.3 Digital technologies and the international system

The structure of digital technologies is overlaid on top of other social and economic structures. The supply chains and dependencies mentioned above follow and mirror long-standing economic connections and power relationships, such as strategic alliances or imperial/colonial influences (Mainwaring and Aldrich 2021).

Comparing digital and international political structures is a good starting point for understanding the two-way relationship between digital technologies and multilateralism. The key insight is that digital and political structures (including, at the largest scale, the international system itself) can exhibit similar structural properties. For example, like the international system, digital technologies can centralize or distribute power between different actors (or nodes, as the components of a digital structure are not necessarily human or corporate agents). Another example is that some digital structures, like some arrangements of the international system, are far more resilient than others. In both these cases, we can use a single concept (centralization, resilience) to refer to very different things, although with sufficient commonalities to justify the shared language.

A more extended example will help to make this clear. The international financial inter-bank messaging network, SWIFT, has both technological and governance elements (Figure 1 below). The technological elements operate in a linear fashion, with a series of steps to pass through before a transaction occurs. This is a highly centralized, and not very resilient, design: if any step fails, then the transaction also fails. Included in these steps is a check whether the transaction violates any existing financial sanctions, which connects the technological network to its governance elements. 21 of the 25 members of the board of directors that governs the application of the sanctions check are from “Western” states, including the US as global hegemon (at the time of SWIFT’s major growth) and its allies.² So the social - governance - elements of this technology also suggest significant centralization.

² The remaining four directors represent SWIFT shareholders from China, Hong Kong, Singapore, and South Africa.



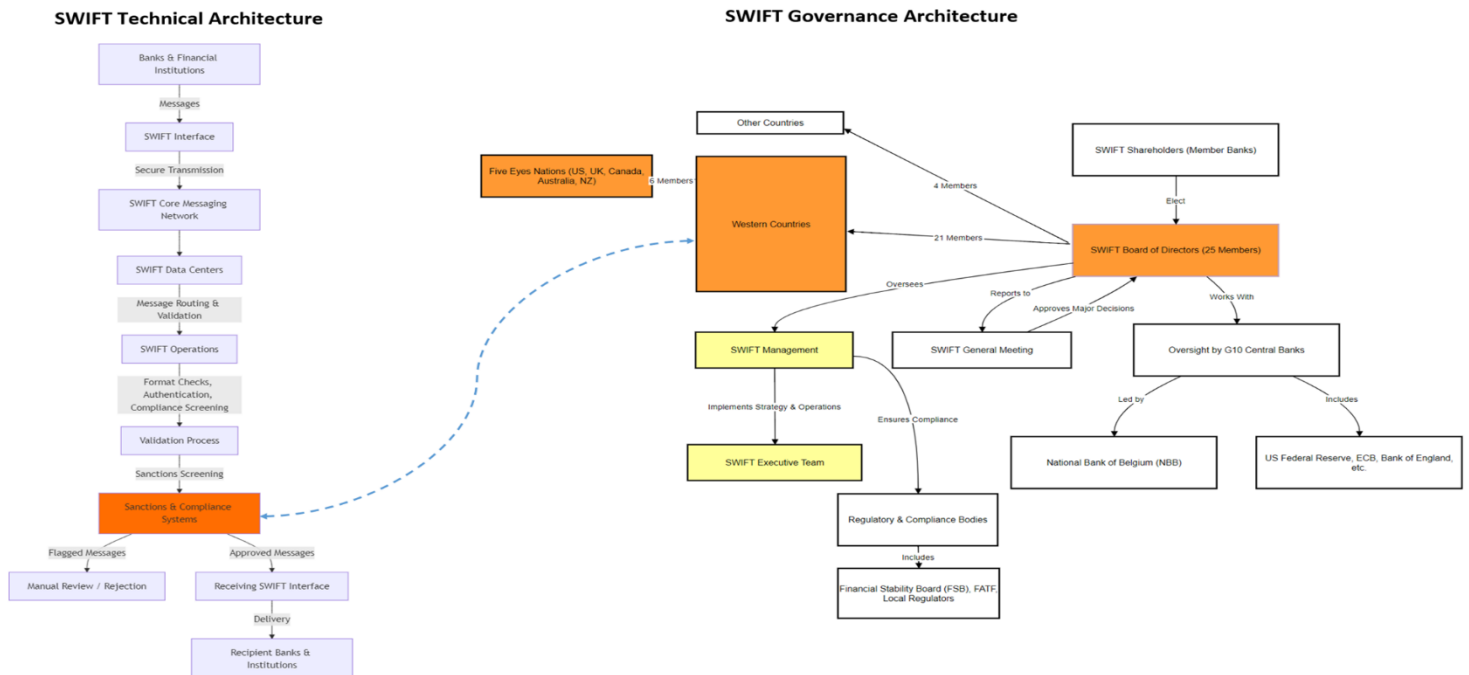


Figure 1: SWIFT international financial transactions system showing the correspondence of centralisation in the technological system and in the governance system

Contrast the SWIFT network with its conceptual opposite, a permissionless blockchain-based cryptocurrency (schematically depicted in Figure 2). Such currencies are based on entirely decentralized ledgers (a record of transactions), the opposite of the centralized ledger that sits at the centre of SWIFT. For permissionless blockchain architectures, all participants can add to the ledger, and each participant has its own copy, which adds others' activities automatically (and has a technological process to ensure "consensus"). This architecture is very resilient (it can suffer outages to or destruction of almost all nodes), but very difficult to control; indeed, even permissionless blockchains, like Bitcoin, usually end up introducing some centralization through other means (such as mining power). Ultimately, these two cases - SWIFT and permissionless blockchains - demonstrate the social and technological elements of digital technologies can create vastly different structural properties with clear parallels to the international system (in this case, levels of centralization).



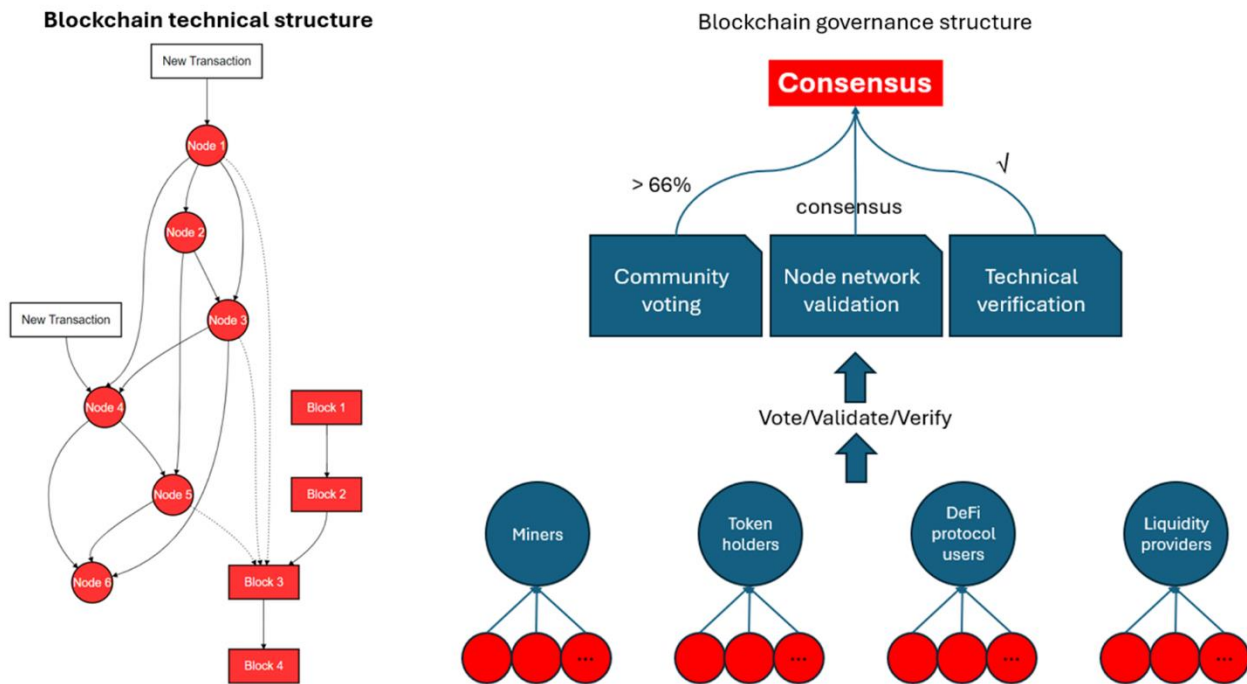


Figure 2: Permissionless blockchain showing the correspondence between full distribution and decentralisation in the technological system and in the governance system

In other cases, structural properties of digital technologies echo those of the international system but with less obvious parallels. For example, a digital system can have various degrees of compartmentalization or modularity. As levels of globalization and conformity with international economic norms might increase or decrease in the international system over time; the latter can therefore be thought of as analogous to digital compartmentalization and modularity respectively.

Where we can use the same or similar labels for structural properties of digital technologies and the international system, a natural question arises regarding their relationship: do the structural properties of one correspond to the structural properties of the other? By correspondence, we mean a mapping between the elements and relations in the international system and those around a specific digital technology, such that the structure of relations is preserved. To take power as an example, Nye and Keohane argue that power comes in three shapes: coercive power, conditioning power and convincing (or soft) power (Keohane and Nye 1977). Each has related social structures that are involved in the exercise of such power, and to exercise coercive power, the international system must be relatively centralized. However, for Farrell and Newman, coercive power is only effective because it can exercise control on critical technologies, such as the SWIFT network, and such control is only possible if that



technology is centralized, for example through a central oversight point or exclusive access hubs. In this way, centralization of a technological structure corresponds to centralization of power in the international system.³

In contrast, there might be tension or contradiction between structural properties of digital technologies and the international system, rather than correspondence. The current multipolar diffusion of power in the international system encourages states with sufficient technological and organizational capacity to resist the centralization of financial and other digital infrastructures. One example might be the prevalence of telecom infrastructure manufactured by Chinese companies in US networks during a period of increased rivalry: such shared technological dependence is in tension with protectionist and increased security demands for “decoupling” (World Economic Forum 2024). In fact, increasing awareness about the vulnerabilities that one-sided dependence can create has been one of the driving forces behind initiatives to develop what the EU calls strategic autonomy (Damen 2022). While most coverage of data localization efforts examines their conscious rejection of the centralization of power in US-headquartered multinational cloud providers in the name of national (“digital”) sovereignty (Fratini and Musiani 2024; Svantesson 2020), localization efforts can also spread beyond the state to cross-border and regional financial networks.

The starkest example of tension between technological and geopolitical structures comes from cryptocurrencies. As noted above, a distributed technology such as permissionless blockchain does not lend itself to coercive control by a power centre. Understandably, then, there is a tension between the world of centralized power such as central banks and the world of cryptocurrencies insofar as these are based on truly distributed ledgers (Mumford, Sampson, and Shires 2024). Where digital dependencies are in consistent tension with physical structures, this can be a catalyst for reshaping the international system, including its multilateral elements, just as earlier strategic energy requirements reshaped the international system around the oil powers and developed new multilateral mechanisms (OPEC) (Romero 2020).

The most extreme example of the relationship between digital technologies and the international system is when digital technologies introduce a new structure of governance that is then adopted in the international system more broadly. The main example here is the concept of “multistakeholderism”, already discussed above as central to the EU’s understanding of multilateralism itself. However, multistakeholderism developed as a mode of governance for digital technologies - specifically the internet - and its principles and procedures are largely drawn from that space (Raymond and DeNardis

³ We do not say “causes” - this relationship is two-way and far more complex, as the later diagram demonstrates.



2015). Some scholars, such as Jan Aart Scholte and his co-authors, have sought to apply this model more widely, connecting digital multistakeholder governance with longstanding questions of legitimacy and institutional characteristics (Jongen and Scholte 2024), as well as identifying multistakeholderism as just one instance of a broader “polycentric” mode of global governance (Gadinger and Scholte 2023). Here, the relationship between digital technologies and the international system goes beyond correspondence towards a much closer structural integration.

Overall, treating digital technologies as structures with conceptual similarities and analogies to the international system is a necessary starting point for considering their two-way relationship - including relations of correspondence and tension. Without this structural comparison, analyses of the role of digital technologies would be limited to the additional power or strategic value they provide to specific actors (states or others) and would be unable to account for more fundamental changes across both structures.

2. Introducing the framework

This section builds on the structural approach to digital technologies and the international system above to develop a framework for examining specific digital technologies. To do so, it first introduces a key concept used across IR and science and technology studies - social constructivism - and explains how it is deployed in this framework. The following subsection details the framework itself, and the final subsection shows how the Advocacy Coalition Framework (ACF) can be used as part of this analysis.

2.1 Social constructivism as an analytical tool

The most straightforward approach to analysis of structures - social or technological or both - is to treat their properties as fixed, even though the distribution of those properties shifts. For example, in this approach, the existence and nature of power in the international system is a given, even though it changes hands regularly. For the financial transaction system or blockchain, their centralized or distributed nature is fixed - they are designed that way - even if their effects vary.

However, this approach is rarely satisfactory. Often, to understand the impact of structural properties, we want to understand how they came about: how did the financial system develop to be so centralized, and blockchain so decentralized? What makes geographic facts about certain states into levers of power in international politics? This approach, usually called “social constructivism”, selects properties that are



naturalized or taken for granted, and investigates how they came to be (Hacking 1999). The aim of constructivism is to rethink and challenge existing assumptions. This analytic lens directs the focus of investigation to the means “by which reality is both revealed and concealed, created and destroyed” (Pearce 1995, p.89). The logic is that if we knew more about the development of something and why it took the course it did, we would approach its current role and impact differently - including opening possibilities for change.

Social constructivism is a common approach to the structures considered here, both in IR (for the international system) and through the “social construction of technology” (SCoT) perspective (Bijker, Hughes, and Pinch 1987) in technology studies (for digital technologies) (Van Baalen, Van Fenema, and Loebbecke 2016). The sheer size and complexity of these two structures means that some level of constructivist analysis - i.e., how did this structure overall or these structural properties come to exist in this form? - is likely to be useful across all research designs. Indeed, a major theoretical paradigm in IR - known as “constructivism” (Onuf 1989; Wendt 1999) - is premised on the utility of social constructivist analysis. While many researchers in IR see natural scientific facts, facts of geography, and tenets of religion as “external” inputs to international political structures, constructivist IR scholars treat all these things as prime candidates for an analysis of their social construction.

Although constructivism is a useful analytical tool, it cannot be universally deployed. Nearly all constructivist analyses treat some things as fixed, while at the same time unpacking and interrogating others. Importantly, these things - we might call them “intrinsic” qualities - are only fixed relative to the research at hand. For example, one could examine the social construction of quantum computing, exploring the corporate and governmental factors that have kept quantum computing high on global agendas despite its lack of immediate tangible output. In such a research design the scientific facts of quantum computing - superposition, entanglement, and so on - would be treated as fixed. In contrast, a different research design could instead examine the scientific consensus around such facts, showing how they are in fact constructed by certain knowledgeable communities. This alternative research design would turn the first on its head: treating scientific facts as socially constructed and “fixing” the environment around them, rather than the other way round.

Given the extensive literature devoted to social constructivism in IR, in the remainder of this report we focus only on the international political implications of the social construction of digital technologies. As Daniel McCarthy notes, “the politics of technology are all too often treated as exogenous to the concerns of IR theorists – an environmental condition or set of instrumental possibilities rather than the product of political contestation in which the International itself is central” (McCarthy 2017). Here, McCarthy argues not only for the utility of social construction as an analytical tool (opposed to treating



technologies as fixed or “exogenous”), but also emphasizes a relative lack of attention to the social construction of technologies in IR. By responding to his call to focus on this area, we do not mean to downplay the importance of social construction in non-digital or non-technological aspects of IR - such as geography or religion - but recognize that this is beyond the scope of this report.

The structural properties of digital technologies are likely to be fruitfully approached as a mix of both intrinsic and socially constructed elements, along a spectrum. This approach borrows from the contrasting perspectives for understanding sociotechnical change highlighted by Bijker. At its extreme ends, this spectrum distinguishes two ideal-type understandings of the evolution of technology, which Bijker identifies as “internalist” or “contextualist” in nature (Bijker 1995). While internalists base the understanding of technology in the minute study of its constituent components (fixed or intrinsic), contextualists argue for the need to consider economic, social, political, and scientific conditions that surround and can influence technology design (socially constructed).

The examples of blockchain and SWIFT, introduced in the previous section, demonstrate that structural properties of digital technologies are likely to be fruitfully approached as a mix of both intrinsic and socially constructed elements, along a spectrum. Some analysts may treat a structural property as being almost entirely derived from fixed technological characteristics, such as the decentralization of permissionless blockchain. Others may treat a structural property as having a fixed or intrinsic foundation but with much social construction layered on top, such as the centralization of the SWIFT financial architecture, which depends as much on political decisions as technological capabilities. Overall, because social constructivism is a research choice about the use of an analytical tool, it is vital for researchers to be clear about what they treat as socially constructed, and what they treat as fixed, and why.

Researchers should also regularly revisit this distinction; sometimes based on new empirical evidence, and sometimes because their own analysis suggests the boundary should be drawn in a different place. For example, one reason the DeepSeek large language model (LLM) chatbot, developed in China, received so much attention in early 2025 is because it undermines a prevalent assumption about a structural property of LLMs: namely, that the computational requirements for training a frontier-level LLM are massive, necessitating extensive capital investment in chips, data centres, and so on, and privileging a few large companies with sufficient resources and scale to achieve this (Mills and Whittle 2025). Whatever the details of DeepSeek’s development (leaning on existing LLMs or trained independently), its launch suggests that what was thought to be an intrinsic or fixed property of LLMs was in fact socially constructed, in a way especially attractive to those in government and industry for whom capital investment aligned with their commercial incentives.



Figure 3 below provides a schematic illustration of this shift. The relevant technological field is frontier LLMs, and the relevant structural property is centralization. Elements contributing to this structural property are arranged along a spectrum from intrinsic to socially constructed, with the four mentioned above placed along this spectrum (this is not an exhaustive list, and others could be included). It should also be noted that these elements do not simply increase or decrease centralization, but summarize far more complex dynamics: for example, within “commercial strategies”, OpenAI/Microsoft cooperation contributes to centralization, while Meta’s open-source release of its Llama model introduces decentralizing tendencies (Bommasani et al. 2023; Widder, Whittaker, and West 2024). As the arrows in red illustrate, DeepSeek caused the field to recalibrate its assumptions of how fixed elements like compute and training data were, making them a more appropriate site for a social constructivist analysis.

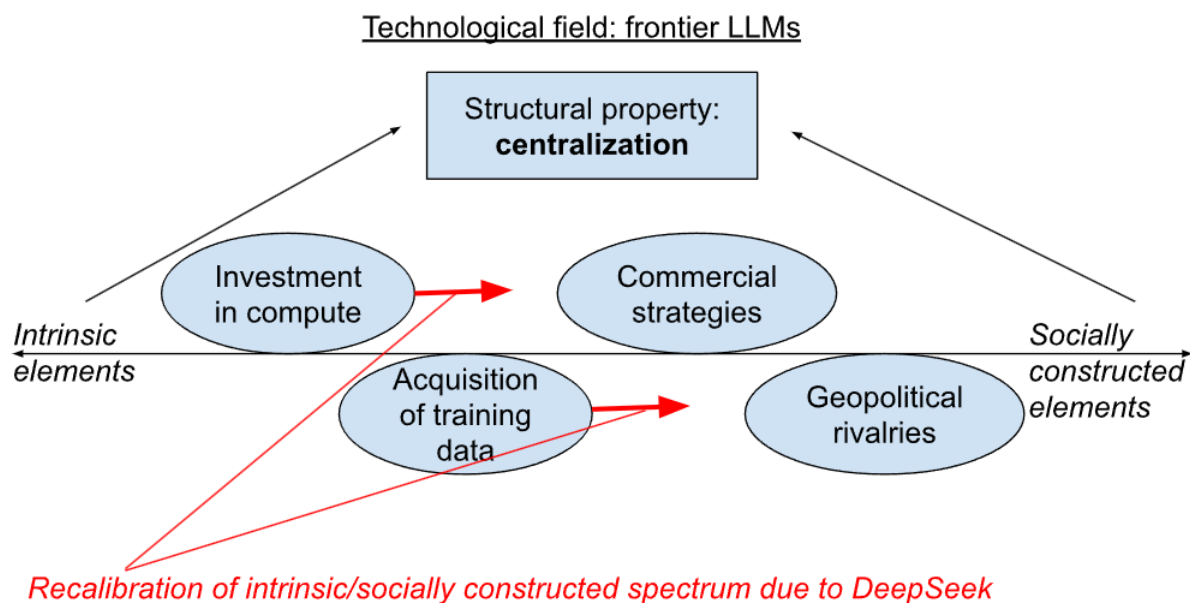


Figure 3: Schematic representation of DeepSeek’s influence on centralization of frontier LLMs

We have examined a single structural property (centralization) for both examples used in this and the previous section, on LLMs and financial architectures. However, similar analysis of many other structural properties is possible, across a variety of technological fields. It may be helpful to indicate a few examples of the potential for investigating structural properties in relation to specific digital technologies in the following table (Table 1 below). The technologies selected are those used in this report (either above or in the examples below) or included in the list of strategic “technology clusters” in D5.1. The properties selected are those investigated in the examples in this report. The two greyed-



out rows - for cloud computing and the Internet of Things (IoT) - indicate only that these technologies are discussed in D5.1 but not in this report.

Three further points may help interpret this table. First, each structural property denotes a spectrum; so, the “X” for blockchain technologies in “centralization” does not mean that blockchain technologies are centralized, but that the examples above consider how far blockchain technologies exhibit structural properties related to centralization (whether decentralized, centralized, or anywhere between). Second, our use of a particular structural property in relation to a technology in an example does not mean other structural properties are not relevant to that field. Almost all technologies could be analysed in terms of their level of centralization and interoperability. Security, resilience and privacy, as more complex concepts, mean different things for different technologies, but are also applicable across multiple technologies. Third, in each case, the structural property arises due to a wide range of elements, on a spectrum from intrinsic to socially constructed; in other words, for each cell in the table, one could create a figure like Figure 3 above.

<i>Technology/ structural property</i>	<i>Centralization</i>	<i>Resilience</i>	<i>Security</i>	<i>Privacy</i>	<i>Interoperability</i>
Blockchain architectures	X				
Quantum technologies			X		
5G/6G networks					X
Internet protocols		X			
LLMs (within AI)	X				
Surveillance technologies (within cybersecurity)				X	
Cloud computing	(not included in this report)				
Internet of Things (IoT)					

Table 1: example application of structural properties to selected digital technologies in this report

Finally, revisiting assumptions about the division between intrinsic and socially constructed elements of a digital technology is useful for policymakers, as well as researchers. While researchers can refocus their research accordingly, policymakers can use such challenges as moments to expand the scope for



action: if something is socially constructed rather than intrinsic, like the need for capital investment in frontier LLMs, then a whole scope of political possibilities suddenly opens. We will return to this in the concluding remarks of this report, as it suggests fruitful avenues for developing scenario testing exercises.

2.2. Analysing the relationship between digital technologies and multilateralism

We can now put forward an initial framework for analysing the relationship between digital technologies and the international system, including its multilateral elements. This framework builds on the three key insights discussed in this report so far. The first is to treat both digital technologies and the international system as **structures**, incorporating power distributions, adherence to certain values, and other structural properties. The second insight is to look for **correspondences** and/or conflicts and tensions between the structural properties of these two systems. The third insight is to treat digital technologies as having both **intrinsic** and **socially constructed elements**, along a spectrum that is constantly subject to review and revision. The following figure (Figure 4 below) captures this framework, identifying three main relationships a), b), and c) between digital technologies and the international system.

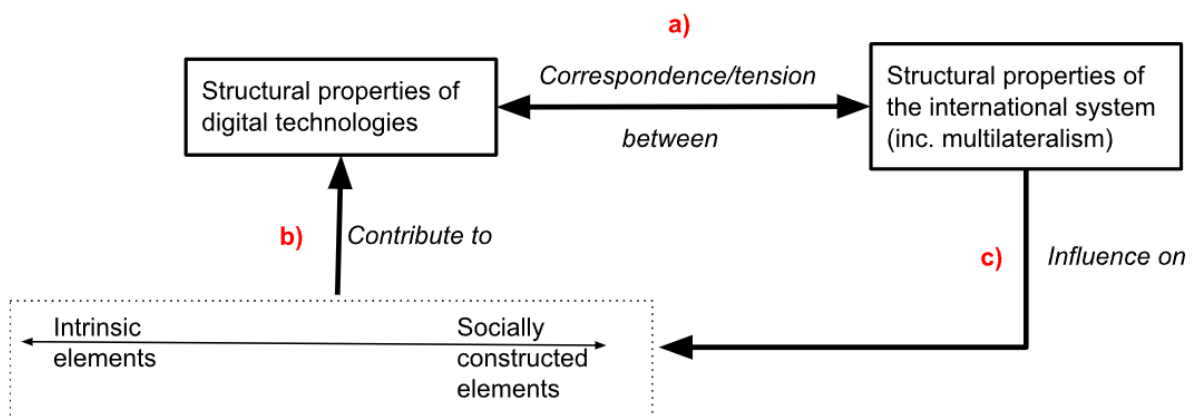


Figure 4: framework for analysing the relationship between digital technologies and multilateralism

Figure 4 centrally depicts structural properties of both digital technologies and the international system (in the two main boxes). The overall relation between structural properties of the two systems is captured by line “a)”. As discussed above, where the structural property can be described using similar concepts (such as centralization or resilience), the relationship is most likely to be one of degrees of



correspondence or tension: does the structural property of the digital technology correspond to, or conflict with, that of the international system? Relationships of correspondence or tension can also be identified where structural properties are analogous (such as modularity), even if they cannot be described using the same concept.

The intrinsic and socially constructed elements that contribute to structural properties of digital technologies are depicted in line “b)”, which is a simplified version of Figure 3 above. As outlined in the previous section, there are many such elements whose place along the intrinsic-socially constructed spectrum is due to research or policy choices, as well as challenges from further research or other empirical evidence.

The influence of the international system on the development of digital technologies is captured in line “c)”. One of the main limitations of structural analysis is its static nature: identifying correspondences or tensions between two structures does not tell us how those correspondences change over time, or indeed how feedback between the structures changes each other - the two-way relationship we seek to explicate in this report overall. While we acknowledge this limitation, we seek to include such feedback relationships through line “c)”. Importantly, the influence of the international system can be on the socially constructed elements (for example, by changing a commercial calculus around technology investment due to trade restrictions); or, as in the case of DeepSeek above, by forcing actors to rethink the division between intrinsic and socially constructed elements itself. This framework can therefore go beyond a static analysis, analysing mutual influences between digital technologies and the international system.

This feedback relationship between digital technologies and the international system does not have to be limited to only one technology. Researchers could choose to trace line c) not from the international system back to the technology already analysed, but instead towards a different, perhaps related, technology. An example we discuss in more detail below is that of telecom networks: structural properties of 5G networks influenced the international system towards greater concerns around hostile state surveillance and “decoupling”, but in turn influenced the development of the successor 6G technology. In such cases, the relationships depicted by a), b) and c) form not a circle but a spiral, tracing structural influences as they progress over time.

Finally, the nature of the three relationships in the diagram deserves further explanation. Line a) is a comparative relationship (correspondence or tension), while lines b) and c) indicate a causal relationship: the intrinsic and socially constructed elements of a digital technology *contribute to* its structural properties, while the international system is in turn an *influence on* those elements. These causal relationships are not deterministic, meaning that a particular set of elements do not necessarily



lead to a particular structural property, nor does the structure of the international system necessarily shape digital technologies in a certain direction. This is partly because causal relationships between such large complex structures are very difficult to disentangle, and structural changes are nearly always multi-causal. The broad causality put forward here is also because both digital technologies and the international system are complex structures in the sense that they have emergent properties, not completely predictable from their constituent parts. A structural property - of a digital technology or the international system - might be emergent in this sense, and we leave open this possibility while not including it explicitly in the diagram.

2.3 Integration with the Advocacy Coalition Framework (ACF)

This structural framework appears to have a major limitation, connected to the classic agent-structure problem in the social sciences. Despite our acknowledgement throughout the discussion so far that a variety of actors are involved in the construction of both international political and digital technological structures, the diagram (Figure 4) seems to omit the role of actors, instead focusing on correspondence between structures and the way these structures develop and interact.

This impression would be mistaken. Agents exert influence on structures in all the ways detailed earlier, from “hard” action to agenda-setting and normative persuasion, and our structural perspective therefore includes a whole ecosystem of actors and their interactions to define, design, develop and deliver digital technologies. For example, free/libre/open source (FLOSS) technologies have particular structural properties: they are highly modifiable, transparent, and accessible. These structural properties stem from a socially constructed process of software development, driven by particular actors with certain values and priorities (the “open-source community”) (Dunbar-Hester 2019). The values and beliefs of the actors involved are central to the open-source ecosystem, and contribute to its structural properties.

The key question is, therefore, not whether actors play a role in creating the structural relationships depicted in Figure 4 - they clearly do, and throughout each part of the diagram. Instead, we should ask to what extent structures (digital or political) impose constraints, identities or interests on actors. Furthermore, one could then ask whether an actor’s influence on structures stems from the structural position occupied by that agent, or that agent’s individual qualities. For example, how far are individuals in the open-source community themselves shaped by that community’s history, values, and track record?



The relevance of these questions can be illustrated by another example: the relationship between social media technologies and multilateral commitments to the integrity of electoral processes. Clearly there are structural properties at play: for social media technologies, their massive scale and surveillance capitalist incentives for targeted advertising and greater engagement from users (Zuboff 2019); and for electoral processes, the relative weight accorded to certain elections (like that for the US President) compared to others. Research in this area could examine the correspondence or tension between structures of online content moderation and political elections (line a); it could also examine how intrinsic and socially constructed elements, such as AI detection or fact-checker training, contribute to the structural characteristics of content moderation (line b); it could even examine how elections influence content moderation policies, as in the 2024 US election (line c).

However, all these research questions may underplay the key influence of actors, both individual and corporate. Such actors include companies, such as X, Meta or Telegram; states, such as the US or Russia; or individuals, such as Elon Musk, Mark Zuckerberg, or Donald Trump. Clearly, these actors have an extraordinary ability to change structures and so must feature in any analysis. However, focusing on structures pushes us to ask a deeper question: is the influence of these agents due solely to their structural position or their own characteristics? For example, are Zuckerberg's decisions simply those of anyone in his position, as head of a large company seeking favourable regulation from its headquartered state, or do they stem from his beliefs, ideology, and priorities? If agents' abilities to change structures depend on their position within those structures, then we can learn much about their actions from understanding the structures in which they operate.

Here, we can benefit from theories such as the Advocacy Coalition Framework (ACF) as a lens or a perspective to zoom in on actors, policy subsystems (including those around digital technologies), and policy change (see for example Jenkins-Smith et al. 2018; Haar and Pierce 2021; Pierce et al. 2022; and Henry et al. 2022). ACF enriches our structural analysis as it draws attention to dynamics (i.e., policy change itself). In short, ACF argues that policy change happens because multiple actors (state and non-state) with shared policy beliefs form coalitions, and those coalitions exert sufficient weight to change policy.

ACF can account for the emergence of certain structural properties of the international system via the advocacy work of actors and coalitions of actors. ACF can also be used to explain the influence of the international system on socially constructed elements of digital technologies (line c); for example, particular groups of actors might form geopolitically aligned coalitions that set new standards for the development of 6G telecoms networks. In the DeepSeek example discussed above, we might analyse AI policy as stemming from interaction between different advocacy coalitions: a predominantly US



government and corporate “big investment” coalition; a diffuse “open-source models” coalition, drawing on the broader open-source community; and a new “China-centric” coalition, attracted to the progress made by Chinese researchers and companies. The formation of and competition between these coalitions results policy decisions that then shape the structural properties of LLMs as a technology overall.

ACF is also very flexible, with the concept of advocacy coalitions being equally applicable to rational, consensus-oriented processes, as well as a world - such as the international order in 2025 - which appears to be far more individual-oriented, with decreasing rationality and quality of political discourse, and many corrupt or otherwise non-transparent levers of power. Advocacy is a neutral term that can apply just as much to “fringe” movements like Project 2025 in the US as it does to more traditional electoral coalitions, allowing analyst to address policy change as the result of individual - even authoritarian - decisions, rather than a legislative process with extensive checks and balances (Haar and Sinkkonen 2025).

However, while coalitions clearly play a role in developing digital technologies, these are not - or not only - *advocacy* coalitions, even at the more socially constructed end of the spectrum. For example, technical internet governance organizations such as the Internet Engineering Task Force (IETF) develop internet protocols through a highly specific social process; this is a process that includes advocacy and policy change, but also advocacy towards technology change, and even in some cases technological change without advocacy (ten Oever 2021). Similarly, while DeepSeek catalysed significant policy change, it was ultimately the building of an app to *demonstrate* capability, rather than advocating for that policy change, which had the greatest impact. By focusing on actor perspectives rather than structural properties, the lens of the ACF assigns less importance to explaining the range of ways in which such non-advocacy actions have an impact on digital technologies, and through those technologies on the international system.

Furthermore, canonical accounts of ACF treat technological changes like the development of DeepSeek as “external events” which can precipitate policy change, but not in a deterministic manner - for example, by opening a window for new coalitions, or for existing coalitions to press their case more successfully or even update their theories of policy impact (policy learning) (Cairney 2011). However, such externalization of technology follows a longer tradition in social theorizing of treating technologies as external or exogenous impacts on policy, rather than as an integral aspect of policy actors and systems themselves. Advocacy coalitions themselves rely on new technologies, such as social media or LLMs to form, split, and otherwise discuss and achieve their goals, and are influenced by these technologies’ structural properties in a much more fundamental way than an external shock causing them to rethink



policy. The framework outlined here is intended to counteract this inclination to externalize technology, treating digital technologies as a core aspect of the international system, with structural properties that shape that system directly, rather than only as an input to a social policy process.

Overall, ACF can enrich our structural analysis of both the international system and digital technologies. However, ACF has some limitations - its treatment of technological change as an “external event”, outside the policymaking process, and its related focus on advocacy to the exclusion of technological or other forms of direct action - that mean integrating it with the structural framework presented here may require further work.

3. Applying the framework

This section applies the framework set out above in four technology areas: 5G/6G telecoms networks, quantum technologies, cybersecurity surveillance technologies, and the internet’s Domain Name System (DNS). As illustrated in Table 1, these examples have been selected because they involve four of the eight technology clusters identified in D5.1 and focus on different structural properties for both the digital technology involved and the international system, illustrating the potential breadth of the framework. The examples presented in this section are thus intended as guides for the more detailed case studies in WP5, rather than conducting the case study research itself.

These examples are deliberately short illustrations of how the framework *might* be applied, rather than extended applications. Because it is a research design choice where to focus on the spectrum of intrinsic and socially constructed elements discussed above, these examples demonstrate different ways in which these decisions could be made and illustrate how researchers can make transparent decisions about these choices. These examples also highlight where the ACF can be used to understand how actors, through advocacy coalitions, influence the interrelated structural properties of technologies and the international system.



3.1 5G telecommunications infrastructure

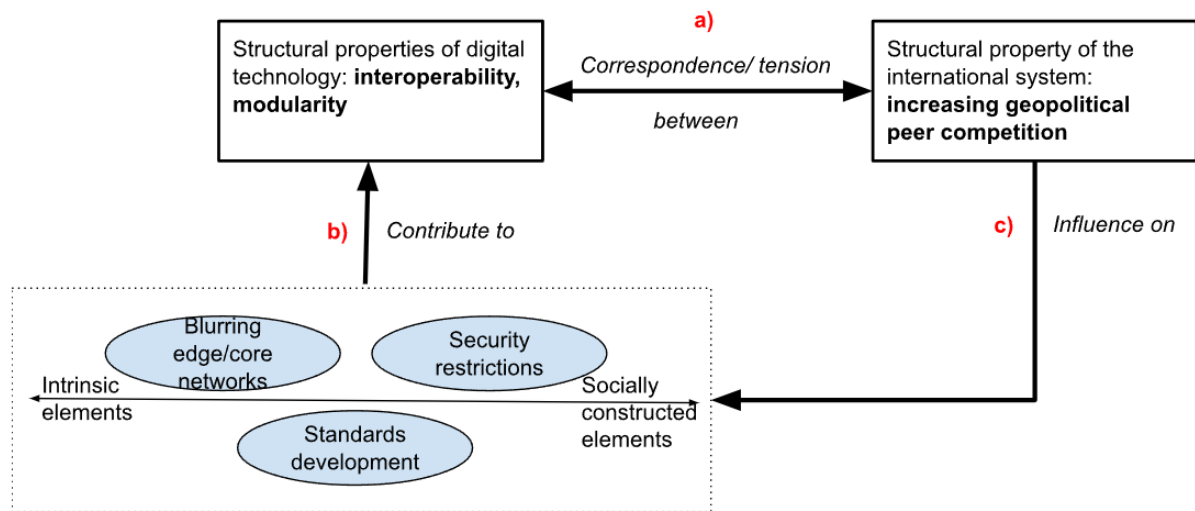


Figure 5: the structural framework applied to telecommunications infrastructure

With 5G, managing risks related to untrusted vendors has become a central consideration in the rollout of a new generation of mobile network infrastructure. The integration of such security considerations into the 5G build-up is a good example of how lessons from one generation of digital technologies are incorporated into the structure of the international system - specifically, increasing peer competition between the US and China - thereby changing the structural properties of subsequent generations of that technology.

On leaving his post in early 2025, Nathaniel Fick, the first US ambassador at large for cyberspace and digital policy, recognized the momentum US outreach had developed around vetting 5G suppliers as one of the strategic shifts during his tenure (Geller 2025). This campaign was based not only on international coalition-building, but also a push to rethink technology implementation. These interrelated efforts span from developing principles about supplier diversity through the Prague 5G Security Conference starting in 2019 ('Prague Proposals' 2019) to setting up a regional platform in Costa Rica to support the adoption of vendor-neutral network architectures in 2024 (US Department of State 2024b).

Underlying security concerns about leading Chinese technology companies that precipitated these shifts were not new. The US government, since 2000, has regularly expressed concerns about ties between Huawei's leadership and the Chinese government and military (Mulligan and Linebaugh 2021) against a backdrop of large-scale Chinese cyber-enabled economic espionage (National Bureau of Asian Research



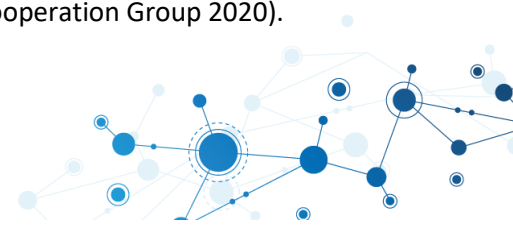
2017). Interventions by the US and UK governments blocked Huawei investments in technology firms over reservations about access to sensitive intellectual property. From 2017, the US government then gradually restricted the use of equipment from Huawei and other Chinese manufacturers. First addressing systems of the Department of Defense in 2017, prohibitions extended to all federal agencies as well as the use of federal grants and subsidies supporting underserved communities in 2018 (Gallagher 2022).

During preparations of the commercial rollout of 5G, warnings about access to technological innovations broadened into questions about governing potential risks related to the participation of foreign suppliers. These risks are rooted in the central role of equipment manufacturers for the integrity of 5G network architectures, which extends to the confidentiality of the data transmitted on them and the availability of the connectivity they provide - a structural feature that undermines the security of the networks as a whole.

Such concerns were reinforced as Chinese suppliers consolidated their market position as end-to-end providers for national telecoms in launching 5G, influencing multiple elements of the technology ecosystem. Active contributions to 5G standard setting and patent development, as well as Chinese government subsidies supporting R&D spending and competitive pricing, afforded Huawei and ZTE a strong first mover advantage. In the first half of 2021, the two Chinese equipment makers held a combined market share of 40% globally, followed by the two European vendors Nokia and Ericsson, which controlled around 15% each (Pongratz 2022).

In response, the US introduced both political and technical measures to undermine the emerging China-dominated structure of 5G networks (Haar 2025). Politically, then-US Secretary of State Mike Pompeo on several occasions in 2019 intimated that Huawei participation in 5G networks could obstruct US intelligence sharing with partners (Brunnstrom 2019), including Five Eyes countries (Castle 2019). Technologically, the US Department of Commerce introduced restrictions on the transfer of key technology components to Huawei (Gallagher 2022).

Citing the impact of expanding US export sanctions on Huawei product security, the UK National Cyber Security Centre in July 2020 assessed that the previous security mitigation strategy for Huawei's participation in the 5G build-out as high-risk vendor was no longer viable (UK National Cyber Security Centre 2020). Following this conclusion, the UK government reversed its decision to allow for Huawei's managed involvement in the UK's 5G infrastructure, mandating the removal of all Huawei equipment by 2027 (Kelion 2020). Earlier in 2020, the EU member states jointly developed a toolbox of risk mitigation measures to harmonize approaches to 5G security across the bloc (NIS Cooperation Group 2020).



Most significantly from a structural perspective, the US, Japan, and EU sought to introduce new structural properties of modularity and interoperability, by opening the closed architecture of radio access networks (RAN) that connect mobile users to core networks. From 2016 onwards, Open RAN aimed to make network equipment from different suppliers interoperable. As a modular approach to telecom infrastructure, Open RAN is designed to foster competition in the 5G market, reducing concerns about vendor lock-in and allowing for the replacement of individual components with equipment from other suppliers.

The EU and the US have set up specific dialogues with host states of 5G equipment manufacturers and financial assistance programs for countries to transition to Open RAN (European Commission 2024). In 2022, a US Patent and Trademark Office study concluded that no one country or company had a leading edge in 5G patents, pointing to a gradual opening of the 5G landscape (US Patent and Trademark Office 2022). Reflecting the possibility of technology integration across vendors, the study showed six companies from China, the EU, South Korea, and the United States competing.

Market assessments of Open RAN suggest it is succeeding. The initial lack of alternatives to end-to-end solutions that allowed Chinese suppliers to secure 5G contracts through subsidized bids is diminishing. At the same time, expectations of a reversal of vendor control through Open RAN are abating, as market shares are converging. The telecommunications analysis company Dell'Oro Group assesses that while suppliers across the board are adding Open RAN solutions, the North America region clearly is leading the rollout (Dell'Oro Group 2024). Following a slower adoption rate, Europe is expected to represent between 15% and 20% of the Open RAN market in 2028. The Open RAN market segment overall is projected to account for 25% of mobile network implementations by 2028.

This introduction of new structural properties was intended not only to impact 5G but also develop similar foundations for the next generation of mobile technology. In 2024, the State Department Bureau of Cyberspace and Digital Policy funded a project to support an “international standards development process grounded in transparency” and “diverse stakeholder engagement” (US Department of State 2024a). Notably, the project frames these objectives around an effort to “enhance like-minded nations' representation and an expanded number of countries that are aligned with [this US government] vision, thus creating greater influence and leadership in international standards governance by the United States.”

Also in 2024, the US and the EU together with other partner countries adopted principles to guide the research and development of 6G (White House 2024). In a notable reflection of the learnings from managing the participation of high-risk vendors for 5G, this guidance approaches 6G from the premise



of security, openness, and resilience by design. Underscoring the need for a systemic shift in both policy and technology, the US government, in its International Cyberspace and Digital Policy Strategy released in May 2024, committed to funding for policy and regulatory frameworks to secure ICT ecosystems that “level the playing field for secure and trustworthy vendors” (US Department of State 2024c).

Overall, this example demonstrates the interaction between structural properties of 5G networks and the international system. As the international system grew increasingly multipolar and competitive, key states rejected the insecure and vendor-dependent telecoms architecture, introducing a more interoperable and modular version (OpenRAN) in response to the changing structure of the international system, via political alliances, standards setting, and commercial arguments. That modular design is now being incorporated into subsequent generations of telecoms technology, potentially in turn shaping future lines of geopolitical competition.

3.2 Cryptographically relevant quantum computers

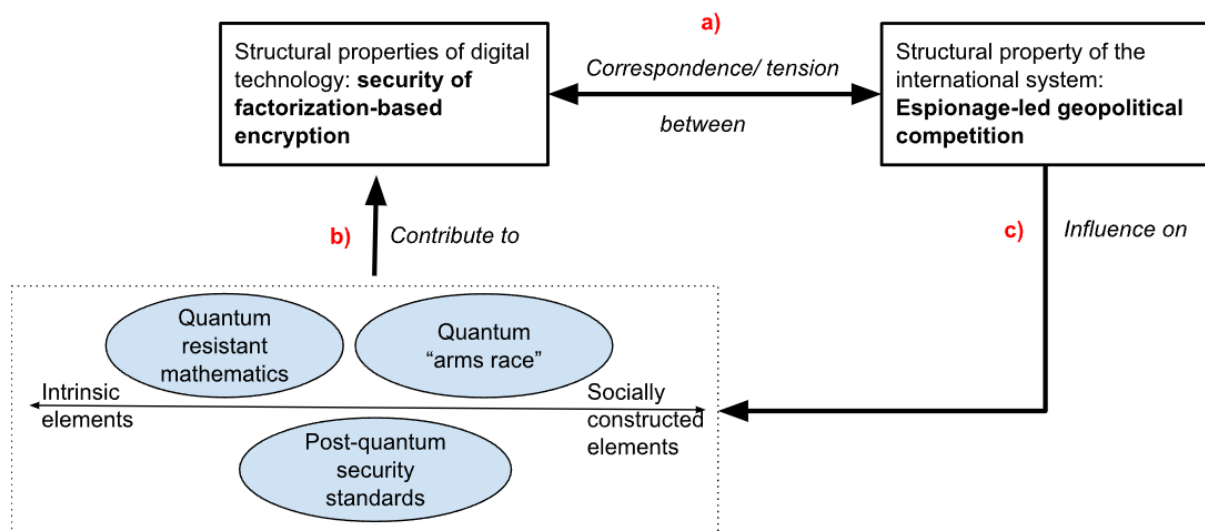


Figure 6: the structural framework applied to quantum computing

One aspect of the development of quantum technologies is the potential for “cryptographically relevant quantum computers”: computers that use qubits - bits with quantum properties of superposition and entanglement - to perform computation that is far slower or impossible with classical (digital) bits. One such computation is the factorization of very large numbers, which is the basis for asymmetric encryption protocols. Consequently, such computers have the potential to radically disrupt current



digital technological structures, with everything from financial transactions to identity verification and secure communications relying on factorization-based encryption.

Such reliance - a structural property of our modern digital landscape - is in tension with a key structural property of the international system: the prevalence of geopolitical competition manifesting in widespread espionage operations to obtain vast quantities of commercially and politically sensitive data. On the one hand, this intelligence contest drives states to “collect it all” through human, cyber, and hybrid intelligence gathering. On the other hand, states also seek to protect their communications and those of their markets and societies through asymmetric encryption (see, for example, the recommendations issued by the FBI in December 2024 to use end-to-end encrypted messaging in the wake of the reported breach of nine US telecommunication companies by the China nexus espionage group Salt Typhoon (Collier 2024)).

Recognizing that the competitive imperatives for data-driven espionage are a structural feature of the current geopolitical situation, and that these imperatives will be greatly enhanced by cryptographically relevant quantum computers, states have sought to reduce reliance on solely factorization-based encryption through both intrinsic and socially constructed means. Towards the former end of the spectrum, states have launched competitions to develop the mathematics for quantum resistant encryption, and to incorporate these algorithms into “post-quantum” security standards. Moving to the latter end of the spectrum, the movement to post-quantum cryptography centrally involves companies and research institutions at the forefront of quantum technology development, who influence the marketing of quantum technologies and make commercial decisions about the prioritization of specific applications, such as quantum cryptography and communication, quantum sensing, and quantum computing.

Simultaneously, states have invested heavily in developing quantum computing to obtain first mover advantage, learning from espionage asymmetries from Enigma to Snowden - not only in decrypting adversaries’ data, but also in developing quantum key distribution (QKD), which promises unconditional security. The pressure to develop cryptographically relevant quantum computers, resulting from socially constructed pressure to achieve breakthroughs ahead of adversaries, has led to what some observers call a quantum “arms race”, where each micro development in quantum computing is heralded as bringing about the end of encryption (Messmer, Shires, and van Rij 2023). States engaged in this rivalry seek to balance national security concerns, market incentives, and international collaborations within multilateral initiatives like EU Quantum Flagship or EuroQCI. Here, states face resistance from civil organizations, think tanks, and advocacy groups advocating for multilateral agreements to prevent a fragmented, unregulated race for quantum technological dominance.



Overall, the introduction and development of quantum science in a competitive international system influences the future direction of basic encryption protocols that underpin almost all digital activities. These encryption protocols and their vulnerability to quantum decryption and replacement by QKD, in turn, affect investment and national security decisions - including those taken at a multilateral level - in the international system. Case studies as part of Task 5.3 may choose to study either of these phenomena, or, building on the ACF at an international level, the efforts by such civil society coalitions to create common ground in the largely state- and industry-driven competition to achieve technological breakthroughs.

3.3 Export controls and digital surveillance technologies

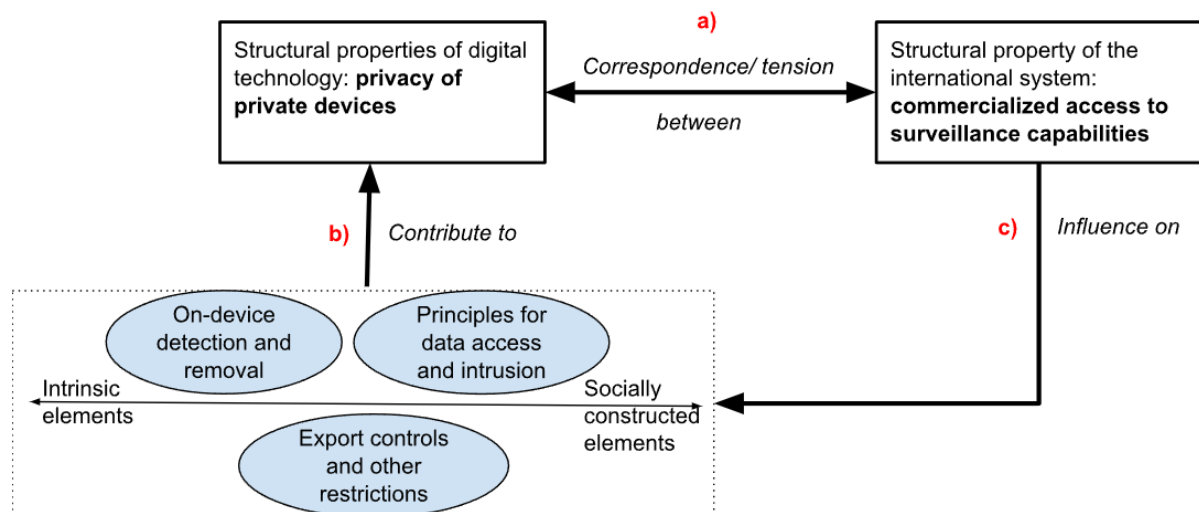


Figure 7: the structural framework applied to digital surveillance technologies

Surveillance scandals involving private companies hacking into people's devices are commonplace and have received attention at multilateral levels, including an extensive report by the EU Parliament (the PEGA committee) (European Parliament 2022). Such cases point to a structural feature of the international system: commercialized access to surveillance capabilities, meaning they are accessible not only to well-resourced states, but many other states and non-state actors (individuals, law firms, private investigators, and so on) (Shires 2024). This privatized surveillance ecosystem represents a diffusion of power away from hegemons and near-peer competitors.



This structural property is in tension with a structural property of personal digital devices, namely, an increasing focus on device (not data) privacy, preventing third parties from malicious access. From walled gardens for applications to strict kernel access protections, personal devices are becoming more and more difficult to penetrate. These improvements in device privacy are often taken by US-based multinational technology companies and are based more on commercial decisions about branding and reputation than concerns for individual privacy.

The advocacy coalitions behind such decisions are complex and would benefit from a careful application of the ACF. An ACF-based analysis would include not only multifaceted national and transnational coalitions around privacy, encryption, and cybersecurity, but also the impact of external events such as the San Bernardino shootings, where Apple was initially requested to provide a “back-door” to an iPhone connected with the event. Such an analysis could also examine the relative power of multinational companies and states other than the US: for example, through the extensive negotiations over the UK’s Online Safety Bill and Investigatory Powers Act, their subsequent use to request encrypted data from Apple, and Apple’s decision to withdraw its end-to-end encrypted cloud storage services from the UK market in response (Kleinman 2025).

Ultimately, this increased focus on device privacy means that there is a cat-and-mouse dynamic between surveillance capabilities and device protections: each development in device cybersecurity is followed by an improved surveillance capability, leading to the introduction of “zero-click” infection capabilities that can gain access to a target device without any user interaction at all, via vulnerabilities in major social media platforms like Facebook and WhatsApp (Richard and Rigaud 2023). But this cat-and-mouse dynamic occurs at the socially constructed level, as well as the level of increased technological sophistication. The more digital devices are secured, the more widespread demand for and access to commercialized surveillance capabilities becomes.

Rather than focus only on improving privacy, various actors - including civil society organizations like Citizen Lab, cybersecurity companies, and certain states targeted by such technologies - have acted to curb the ability of surveillance companies to access devices (Marczak et al. 2018). These range from social measures, such as principles for legitimate intrusion and lawsuits against companies that violate terms of service, through to harder measures like export control, visa restrictions, and sanctions. Also, and illustrating the potential for structural changes through action, rather than advocacy, some companies have recently developed on-device scanners that enable anyone to detect commercial surveillance capabilities on their devices (Newman 2024).

For export controls in particular, the role of existing structures in the international system offers another excellent research opportunity for a case study at both the level of structural properties and advocacy



coalitions. The main instrument for controlling the export of targeted surveillance capabilities is the Wassenaar Arrangement, a post-Cold War arms control agreement that was amended in 2013 to include such capabilities. While this amendment and its subsequent incorporation into participating states' national laws was fiercely contested by opposing advocacy coalitions, at a structural level this export control measure replicates both the strengths and weaknesses of the Arrangement overall: a skew towards the global North; a focus on the “dual-use” aspect of such capabilities; and a focus on the use of such capabilities with human right violations, rather than national security risks. An investigation of this aspect of structural relationships between the international system and digital technologies (line c in Figure 7 above) could be complemented by the EU's more recent adoption of a Dual-Use Regulation (and associated guidance) on the export of cyber-surveillance technologies (Bromley 2023; European Commission 2023).

3.4 The internet Domain Name System (DNS)

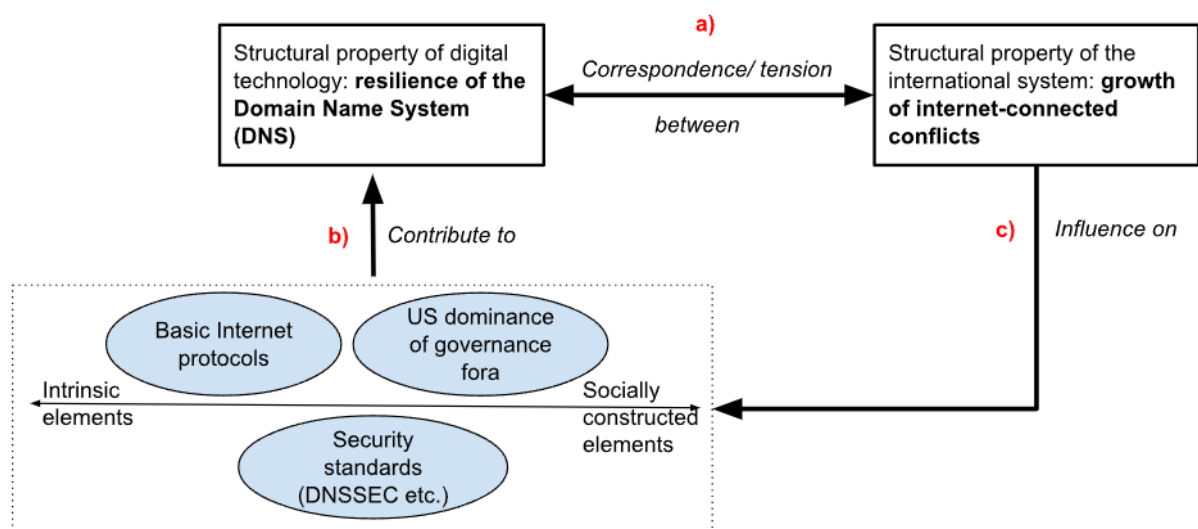


Figure 8: the structural framework applied to the internet DNS

The importance of the DNS grows as existing and emerging technologies continue to rely on this foundational structure as part of the public core of the internet. While the transfer of governance to ICANN, a global technocratic non-profit organisation, has mitigated some of the concern by states outside of the Western camp about US control over, the DNS has remained on the radar of state actors due to a growing structural property of the international system: the frequency of internet-connected



conflicts, where internet connectivity plays a key part both in battlefield dynamics and broader conflict struggles for narrative, economic, and moral high ground (Shires and Wilkinson 2024).

In theory, the multistakeholder model implemented through ICANN is designed to shield a depoliticised and independent approach to DNS governance. However, attempts to weaponize the internet architecture in such conflicts is in direct contradiction with a key structural property of the DNS; its open and resilient architecture, seeking “universal access” (anyone can securely and accurately resolve domain names, from anywhere, in any language). This tension between the structural aspects of the international system on the one hand and the technology underwriting DNS on the other hand is exemplified by the attempt to remove DNS services from Russia to sanction Moscow for its illegal invasion of Ukraine in 2022. Ukraine - backed by Western countries - appealed to ICANN and RIPE NCC to suspend the rights of Russia’s ccTLDs, showing that countries see the DNS as a powerful political tool to disrupt opponents. The request was promptly denied, as it goes directly against the values of an open and unified internet. Demonstrating that the multistakeholder model can resist governmental pressure, the case also highlights the friction resulting from competing structural logics that DNS governance needs to navigate.

Such flashpoints come after a far longer history of doubts over both ICANN’s independence as well as its accountability towards national actors: for example, states, led by China and Russia, have questioned the multistakeholder model of ICANN and US influence over the organisation. For instance, the IANA transition from US oversight to a global multistakeholder model in 2016 was widely interpreted as a reaction to US control over ICANN. Independent of this handover in DNS control, US based companies continue to hold market power for the technical solutions that support nearly every layer of the hierarchical structure of the DNS. Some states have called for further accountability by turning ICANN into a subsidiary of the ITU, ensuring governmental influence.

Of course, the resilience of the DNS is a combination of intrinsic technological and socially constructed elements. At its core, the DNS is designed for interoperability, scalability and resilience with a distributed nature. These intrinsic elements may in turn influence or be influenced by socially constructed elements such as standardisation (IP, DNSSEC, TCP/IP), centralisation (ICANN) and the dominance of the US in DNS. Key actors here that case studies deploying an ACF-based approach could focus on in the next phase to test the framework developed in this deliverable include ICANN and the IETF, as well as the United States and companies such as Google, Amazon and VeriSign.



Conclusion

This report has put forward a **framework for the structural analysis of digital technologies and multilateralism**, focused primarily on relationships of correspondence or tension between these structures. The framework then investigates the dynamic relationship between these structures, analysing **how the structure of the international system influences the constituent elements of digital technological structures** via both socially constructed and intrinsic elements.

The report has also sketched how this framework might be **applied in a range of examples**, using different digital technologies, different structural properties, and different aspects of the multilateral system. It therefore provides a **guide for the case studies undertaken in Task 5.3**, although those case studies will be undertaken in much greater depth and potentially on different technological topics.

Finally, this report suggests **avenues for developing Scenario Testing Workshops (STW)**, especially around questions relevant for policymakers: for example, their assumptions around whether certain elements of a digital technology are an intrinsic feature or could be revised. These moments of doubt, assumption, and challenge are the ideal starting point for a scenario exercise, which could evaluate different hypothetical paths starting from a single assumption. Such scenarios could be based around guiding questions, drawn from the framework developed here and the case studies in Task 5.3. Examples of such questions include:

1. In which way is the competition in AI between open-source and closed-source helpful or not for international cooperation?
2. Given aspiring cooperative multilateralism on quantum technologies (cf. UN Year of Quantum), which applications of quantum technologies (computing, cryptography and communication, sensing, navigation, or others) do we then include or exclude?
3. If the US and the EU bilaterally collaborate on secure 6G but wish to set 6G global standards, how should they structure 6G?
4. What kind of future multilateralist governance fits with blockchain in domain name management (i.e., what is the future of ICANN)?

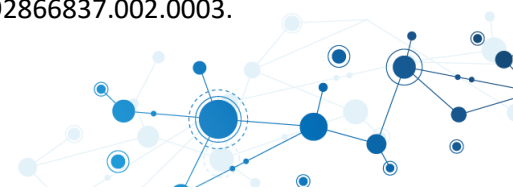


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