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THE DOCTRINE OF FORCE MAJEURE IN THE AGE OF SMART CONTRACTS: A COMPARATIVE ANALYSIS OF JUDICIAL INTERPRETATION AND ALGORITHMIC EXECUTION

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I. ABSTRACT

The rise of blockchain technology and smart contracts has created a structural dissonance at the heart of commercial law, as the deterministic inflexibility of code meets the flexible equity of centuries of contract law. Perhaps nowhere is this dissonance more pronounced than in the application of force majeure, a concept whose very definition relies on human interpretation, foreseeability, and judicial intervention. This paper undertakes a comparative legal analysis of the role of force majeure in traditional contract law and its potential, or lack thereof, in the algorithmic framework of smart contracts. By applying the landmark decision in the Indian Supreme Court case of Energy Watchdog v CERC (2017), as well as the English and American common law tradition, and emerging regulatory frameworks in the United Kingdom, the European Union, and India, it is submitted that the automation gap, or the inherent inability of code to respond to unforeseen circumstances without external data input, fundamentally challenges the contractual balance which force majeure has traditionally been intended to address. Furthermore, it is submitted that the concept of harmonious construction, traditionally applied in contractual interpretation, has the potential to provide a framework by which flexibility can be integrated in algorithmically enforced contractual obligations. The paper concludes by proposing a Legal-by-Design framework, recommending the inclusion of a requirement in smart contract law that dispute resolution, code governance, and legislative frameworks address code as a form of contractual expression, as opposed to its totality.

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II. KEYWORDS

Force Majeure; Smart Contracts; Contract Interpretation; Blockchain Governance; Comparative Contract Law.

III. INTRODUCTION

There is something almost paradoxical about the way Nick Szabo described smart contracts when he first theorised them in 1996. He imagined agreements embedded in code that could self-execute, self-enforce, and resist tampering a vision rooted less in legal formalism than in the cold elegance of cryptographic certainty. For Szabo, the trust problem that plagues human relationships the uncertainty that the other party will perform could simply be engineered away. Yet the history of contract law tells a different story. It tells us that certainty, pursued too zealously, becomes injustice. The doctrine of force majeure exists precisely to interrupt the mechanical march of contractual obligations when events conspire to make performance not merely difficult, but fundamentally contrary to what any reasonable party could have intended.

The advent of Ethereum in 2015 gave Szabo's vision a technological substrate it had never previously possessed. In theory, the contract would be capable of execution without human intervention, as a matter of technology rather than metaphor. The code running on the distributed ledger would be capable of execution without human intervention upon the satisfaction of certain predetermined criteria. The impact of this change is significant and still only imperfectly understood.

The conventional contract, for all the rituals that surround it, is ultimately a human construct. It is written in natural language, interpreted by human decision-makers, and subject to enforcement by human institutions that apply discretion. Where a pandemic disrupts global supply chains or a geopolitical crisis renders performance of the contract unlawful, the law responds with concepts of frustration and force

majeure to align the written contract with the radically changed circumstances that were unforeseen at the outset of the agreement. The smart contract performs regardless of circumstances. It performs because the code has been satisfied; it cannot be stopped, varied, or varied at the request of any of the parties to the contract at least, not without technical intervention that is likely to be subject to legal challenge in turn.

The argument of this paper is that the challenge is not to dismiss smart contracts as legally intractable, but to precisely determine what kind of legal instrument they represent and what supplementary architecture they necessitate. Part II discusses the theoretical split between literalism and objectivism in contract interpretation. This section aims to show how this theoretical debate reflects the tension between coded rigidity and flexible equity. Part III discusses the evolution of the doctrine of force majeure. This section focuses on the nuanced reevaluation by the Supreme Court of India in Energy Watchdog v. CERC (2017), which is significant in determining how force majeure and frustration interact in Indian contract law.

Part IV discusses the technical architecture of smart contracts. This section also introduces the concept of the automation gap the inherent inability of code to account for events outside the parameterized logic. Part V discusses how the doctrine of harmonious construction, as applied by English and Indian courts, offers a potential solution to bridge the gap between coded determinations and the intentions of the parties. This paper concludes with a set of recommendations on how to develop a Legal-by-Design framework in governing smart contracts.

A. Research Objectives

This study aims to:

1. Examine the doctrinal foundations and commercial function of force majeure in traditional contract law;
2. Analyse the limitations of smart contracts in addressing supervening events

and unforeseen contingencies;

3. Compare judicial and regulatory approaches in India, England, and the United States concerning the enforceability and interpretation of smart contracts; and
4. Propose a Legal-by-Design framework to integrate equitable contractual principles into algorithmic execution systems.

B. Research Questions

1. How is the doctrine of force majeure interpreted and applied in Indian, English, and American contract law?
2. To what extent can smart contracts accommodate force majeure events and related equitable doctrines?
3. What legal and technical limitations create the automation gap in algorithmic contracting?
4. How can contractual interpretation principles and regulatory mechanisms reconcile coded execution with legal flexibility?

C. Research Methodology

This paper adopts a doctrinal-comparative research methodology. It analyses primary legal sources, including judicial decisions, statutes, and regulatory materials from Indian, English, and American jurisdictions. The study is supplemented by institutional documents, law commission reports, white papers, and scholarly legal literature relating to force majeure, contract interpretation, blockchain governance, and smart contracts. The comparative approach is employed to evaluate how different legal systems address the tension between algorithmic execution and equitable contractual principles.

IV. PRINCIPLES OF INTERPRETATION: LITERALISM, OBJECTIVISM,

AND THE MODERN CONTRACT

The question of how courts should read a contract has generated more legal scholarship than perhaps any other single issue in private law. At one pole stands the literalist tradition, which insists that the words chosen by the parties are the primary, and often sufficient, guide to the contract's meaning. On the other stands the objectivist or contextual approach, which holds that words derive meaning from the circumstances in which they were used and the purpose the agreement was intended to serve.

In England, the objectivist turn reached its high-water mark in Lord Hoffmann's celebrated statement of principle in Investors Compensation Scheme Ltd v West Bromwich Building Society, where he held that contractual interpretation involves ascertaining the meaning which the document would convey to a reasonable person having all the background knowledge which would reasonably have been available to the parties in the situation in which they were at the time of the contract.

This formulation which deliberately excluded the pre-contractual negotiations and subjective intentions of the parties as interpretive aids represented a significant departure from the purely literal approach that had characterised earlier English case law. Yet even the objectivist approach has its limits, and subsequent case law has revealed a tension between purposive construction and the primacy of text. In Arnold v Britton, Lord Neuberger cautioned against allowing commercial common sense to override clear contractual language, insisting that the more natural the meaning of the words the less appropriate it is for the court to depart from their natural meaning.

This retreat towards the text, even within the broadly objectivist tradition, reflects a residual anxiety about judicial creativity a fear that courts, in seeking to give effect to what they imagine the parties intended, may in fact substitute their own judgment for that of the contracting parties. The Supreme Court's decision in Rainy Sky SA v Kookmin Bank attempted to synthesise these competing tendencies, holding that

where two possible constructions are available, the court should prefer that which is more consistent with business common sense. Crucially, the court recognised that commercial context is not merely a residual aid to resolve ambiguity, but a substantive guide to meaning that operates throughout the interpretive exercise.

This theoretical landscape is directly relevant to the problem of smart contracts because code is, in a sense, the ultimate literalist instrument. It does exactly what it says. It has no room for business common sense, for contextual inference, or for the benevolent flexibility that courts exercise when they read a commercial contract against the background of the parties evident purposes. The code executes; it does not interpret. And that, as will become clear, is precisely the source of its doctrinal inadequacy when circumstances change in ways the parties never anticipated.

V. THE FORCE MAJEURE FRAMEWORK

A. Definition and Commercial Function

The term 'force majeure' from the French, meaning superior force entered commercial drafting as a way of allocating the risk of events that neither party could have foreseen or controlled at the time of contracting. In its modern boilerplate form, a force majeure clause typically lists specific triggering events wars, natural disasters, epidemics, acts of God, governmental action and provides that the affected party's obligations shall be suspended or extinguished for the duration of the supervening event. The clause thus performs an essential risk-allocation function, and its careful drafting is among the most commercially significant aspects of any complex agreement.

Force majeure is distinct from, though closely related to, the common law doctrine of frustration. Where frustration operates by operation of law when a supervening event renders contractual performance fundamentally different from what was originally undertaken, force majeure is a creature of express contract. The distinction matters because, as Lord Radcliffe observed in *Davis Contractors Ltd v Fareham Urban District*

Council, "frustration occurs whenever the law recognises that without default of either party a contractual obligation has become incapable of being performed because the circumstances in which performance is called for would render it a thing radically different from that which was undertaken by the contract."

In India, the force majeure framework is further complicated by the interaction between express contractual provisions and the statutory scheme of section 56 of the Indian Contract Act 1872, which renders an agreement to perform an impossible act void.[7] Section 56 has been interpreted expansively by Indian courts to encompass not only physical impossibility but also what might be called practical impossibility situations where performance remains technically possible but has been rendered wholly unreasonable by supervening events. This expansive reading, established as early as Satyabrata Ghose v Mugneeram Bangur & Co, created an important flexibility in Indian contract doctrine that courts have deployed in a range of commercial contexts.

B. Energy Watchdog v. CERC (2017): A Judicial Recalibration

The Supreme Court of India's decision in Energy Watchdog v Central Electricity Regulatory Commission represents perhaps the most significant recent pronouncement on the interaction of force majeure, frustration, and the allocation of commercial risk in long-term energy contracts.[9]The dispute arose from the long-term power purchase agreements between power-generating entities and distribution companies that were entered into in the aftermath of India's competitive bidding process for the supply of electricity. The generating companies had bid for the contract based on the continued availability of Indonesian coal, their main source of fuel at the time of bidding at relatively fixed prices. The Indonesian government had enacted regulations that had a significant impact on the price of coal. The generators argued that their obligation to provide electricity at agreed-upon prices had been satisfied due to force majeure/frustration.

The Supreme Court's rejection of this argument is instructive on several levels. The Court first examined the force majeure clauses contained in the power purchase agreements and held, applying a strictly textual analysis, that the events in question price increases resulting from regulatory changes in a third country did not fall within the categories of supervening events explicitly enumerated in the contractual provision.

The Court was plainly influenced by the commercial context of the transaction: these were sophisticated parties who had deliberately accepted the risk of commodity price fluctuations in submitting their bids. To allow them to escape contractual liability on the basis of market movements, however dramatic would be to fundamentally undermine the risk allocation embedded in the competitive bidding process.

More significant, however, is the Court's treatment of section 56. Affirming and developing the framework established in Satyabrata Ghose, the Supreme Court held that section 56 applies where the object of the contract has been defeated where the supervening event has made it not merely more onerous, but impossible in any practical sense to achieve the purpose for which the contract was entered into.

A mere increase in the cost of performance, even a dramatic one, does not amount to impossibility within the meaning of the section. The significance of this ruling, for our purposes of analysis, lies in the fact that it reaffirms the role of interpretation by the Courts as a mediator between textual contractual obligations and equitable principles. This decision does not represent an uncritical application of the textual terms of the force majeure clause. Rather, it involves an examination of the terms of that clause within the context of the commercial transaction, an evaluation of the reasonable expectations of the parties at the time of the transaction, and an evaluation of whether the supervening circumstances have frustrated the purpose of the contract or merely made it more expensive to fulfill.

That form of contextual interpretive reasoning is precisely what smart contracts, in

their current form, cannot perform.

VI. SMART CONTRACTS AND IMMUTABILITY

A. The Architecture of Self Execution

In their technical form, smart contracts are programs deployed on a blockchain network typically, though not exclusively, the Ethereum platform that executes automatically when specified conditions are satisfied. The conditions are encoded in the contract's logic, expressed in a programming language such as Solidity, and their satisfaction is determined by reference to data available on the blockchain itself or supplied through external data feeds known as oracles. Once deployed, the code is, in principle, immutable: it cannot be modified by any party, and its execution cannot be blocked by any single actor on the network.

The immutability of smart contracts is both their principal selling point and their most significant legal vulnerability. Proponents argue that immutability eliminates the need for trust between counterparties, since neither party can modify the terms of the agreement after execution. Critics among them Lawrence Lessig, whose observation that 'code is law' anticipated many of the tensions now emerging in blockchain governance note that immutability is not the same as correctness: the code may faithfully execute a bargain that has become, by reason of supervening events, radically different from the one the parties actually struck.

The legal characterisation of smart contracts has evolved significantly in recent years. The UK Jurisdiction Taskforce's Legal Statement on Crypto assets and Smart Contracts, published in November 2019, confirmed that smart contracts are capable of satisfying the requirements for binding legal contracts under English law offer, acceptance, consideration, and certainty of terms provided the code accurately reflects the mutual intentions of the parties.

The Law Commission's 2021 advice on smart legal contracts similarly concluded that

existing English law is sufficiently flexible to accommodate smart contracts without legislative reform, while acknowledging that certain doctrines particularly those requiring the exercise of discretion or judgment may present challenges in an automated environment.

B. The Automation Gap

The automation gap describes the structural incapacity of smart contract code to respond to events that fall outside the parameters of its pre-specified logic. In the context of force majeure, the problem is acute. A force majeure provision in a traditional contract is deliberately expressed in general or open-textured language 'acts of God,' 'circumstances beyond the reasonable control of the parties,' 'events of a nature unforeseeable at the time of contracting' precisely because the drafters cannot anticipate every supervening event with sufficient particularity to enumerate it. The generality of the language is not a failure of drafting; it is the mechanism by which the provision achieves its intended function.

Translating such language into executable code confronts an immediate technical obstacle: code must be precise. A smart contract cannot contain a condition that triggers when 'circumstances beyond the reasonable control of the parties' have occurred, because the occurrence of such circumstances is not a verifiable on-chain fact. It depends on a contextual assessment that requires judgment, not computation.

The practical workarounds enumerated trigger events, oracle feeds supplying verified external data, governance mechanisms empowering a designated arbitrator to modify contract parameters all involve reintroducing the human element that smart contracts were supposed to eliminate. Oracle mechanisms represent the most technically sophisticated attempt to bridge the automation gap.

An oracle is a data feed that supplies external information to a smart contract, enabling the contract to condition its execution on events occurring in the off-chain world. Chainlink, the dominant oracle protocol, aggregates data from multiple sources and

supplies it to smart contracts in a tamper-resistant format. In principle, oracle mechanisms could be designed to trigger force majeure provisions: a smart contract might be coded to suspend performance automatically if a verified oracle feed reports that a specified index, the price of a commodity, the status of a government regulation, the operational status of a transportation network has crossed a pre-specified threshold.

The difficulty is that oracle design replicates the drafting problems of traditional force majeure provisions in a technical register. The drafter must specify, in advance, what events constitute force majeure and how they will be verified by the oracle. This specification exercise requires the same foresight that traditional force majeure drafting has always demanded and is equally vulnerable to the fundamental uncertainty about what the future holds.

Moreover, oracle mechanisms introduce new vectors of legal and technical risk: oracles can be manipulated, sources can be compromised, and the mapping between off-chain events and on-chain data representations inevitably involves interpretive choices that the code cannot make on its own.

VII. COMPARATIVE ANALYSIS: HARMONIOUS CONSTRUCTION AND ALGORITHMIC OUTCOMES

A. The Doctrine of Harmonious Construction

Harmonious construction is a principle of statutory and contractual interpretation holding that where two provisions of a document appear to conflict, they should be read together in a manner that gives effect to both, rather than allowing one to wholly override the other. Originating in the interpretation of constitutions and statutes, the principle has been adopted in commercial contract law as a tool for reconciling conflicting clauses and for resolving ambiguities in favor of interpretations that best serve the manifest purpose of the agreement as a whole.

In the context of smart contracts, harmonious construction offers a framework for treating the coded execution layer and the underlying legal agreement as complementary rather than competing expressions of the parties' intentions. Rather than asking whether the code or the written contract governs a question that assumes an unnecessary conflict court applying harmonious construction would ask: what interpretation of both instruments, read together, best reflects the reasonable expectations of the parties at the time of contracting?

The UK Jurisdiction Taskforce's Legal Statement pointed in this direction, suggesting that where a smart contract is expressed partly in natural language and partly in code, both layers should be treated as part of the contractual agreement, and apparent inconsistencies should be resolved by reference to the parties' intentions.

The Law Commission also advised that in cases where the smart contract forms a constituent part of a larger legal agreement, the interpretation of the elements included in the code should not be done in isolation. There exist supplementary resources in the Indian legal tradition. The Supreme Court's approach in Energy Watchdog, which declined to read the force majeure clause in isolation and instead examined it against the commercial purpose of the power purchase agreements as a whole, exemplifies the kind of purposive, contextual interpretation that harmonious construction demands.

Applied to smart contracts, this would suggest that courts should not treat the automated execution of code as conclusive evidence of what the contract required but should examine the coded provisions against the background of the parties' evident commercial purposes and the reasonable expectations that those purposes generate.

B. Comparative Regulatory Responses

The legal systems that have most actively engaged with the challenge of smart contract governance have adopted broadly similar approaches, recognizing that the existing law of contract is substantially adequate to govern smart contracts but that specific

provisions particularly those addressing the allocation of risk in circumstances of radical uncertainty may require supplementary regulatory attention.

In the United States, the Uniform Electronic Transactions Act and the Electronic Signatures in Global and National Commerce Act set forth the underlying principle that electronic records and signatures carry the same weight in law as paper-based records and signatures. Several states, including Arizona, Tennessee, and Wyoming, have enacted specific legislation recognising the enforceability of smart contracts and, in some cases, providing that force majeure provisions may be encoded in smart contracts subject to specified technical standards. The practical effect of these provisions is limited by their failure to address the oracle problem: recognising that code can constitute a contract does not resolve the question of how the contract's automated execution should be treated when supervening events render that execution contrary to the parties' reasonable expectations.

In the European Union, the ongoing development of the Markets in Crypto-Assets Regulation and the Data Governance Act has created a regulatory framework attentive to the particular risks of algorithmic contracting, though neither instrument directly addresses force majeure in the context of smart contracts.

The European Parliament's 2018 Report on Distributed Ledger Technologies recommended the development of sector-specific guidance on smart contract governance, including provisions addressing the legal consequences of automated execution in circumstances of supervening impossibility.

In the case of India, the legal regime relating to smart contracts is relatively in a nascent stage. The Information Technology Act, 2000, is a starting point in terms of legislation relating to electronic contracts, while the Reserve Bank of India has increasingly shown awareness with respect to the regulatory issues raised by DLT. The distinction between this basic framework and the issues raised by force majeure in smart contracts is quite marked, which has not been addressed by the Indian legal regime.

C. Towards Reconciliation

The comparative analysis suggests that none of the existing legal systems have successfully developed a satisfactory regime for the application of the force majeure doctrine to smart contracts. The fundamental issue here is that the features that make smart contracts appealing to businesses determinism, immutability, and the capacity for automated enforcement also hinder the analysis of force majeure.

There are several possible solutions to this issue, each of which comes with significant drawbacks. The tiered contract solution, whereby a smart contract manages the regular enforcement of the contract while a natural language contract manages the exceptions, maintains the efficiency of the smart contract while preserving the capacity for human analysis of force majeure.

The International Swaps and Derivatives Association's ("ISDA") distributed ledger technology applications for derivatives markets features an interesting solution. The ISDA's master agreement, complete with force provisions, retains the status of the governing law, while smart contracts handle specific settlement functions within the framework it establishes. Decentralized dispute resolution mechanisms, of which the Kleros protocol is perhaps the most developed, offer another potential bridging mechanism.

Under the Kleros system, jurors selected from a pool of token holders adjudicate disputes arising from smart contract performance, applying the governing legal framework to determine whether a supervening event has excused non-performance. Whether such mechanisms can satisfy the requirements of natural justice and due process under national legal systems remains an open and largely unresolved question.

Perhaps most promisingly, the integration of regulatory oracles authoritative data feeds operated by recognised public institutions, supplying verified information about supervening events recognised by law as potential force majeure triggers could

reduce the gap between algorithmic execution and equitable outcomes.

It is noted that regulatory oracles would not completely eliminate problems related to the automation gap; nonetheless, they would provide a technically and legally reliable method for triggering force majeure clauses in response to events that are determinable through objective verification. Such events may include pandemic declarations, designation as a sanctioned party, government-mandated production shutdowns, and similar events that have well-defined legal meanings and can be corroborated through reference to authoritative official records.

VIII. CONCLUSION AND RECOMMENDATIONS: A LEGAL-BY-DESIGN FRAMEWORK

The analysis provided in this study draws a clear inference with regard to the role and function of the doctrine of force majeure. In essence, the doctrine of force majeure, as interpreted and defined in both common law and civil law systems around the world, is not merely a legal principle but a manifestation of a larger principle of contractual justice the idea that parties to a contract should not be bound by the literal meaning of that contract where unforeseen events have caused a radical divergence in contract performance from what either party would reasonably expect. Smart contracts are not capable, in any configuration, of achieving this principle.

The statement provided in this section should not be construed as an argument against smart contracts. Instead, it is an argument for a more nuanced understanding of what smart contracts are and what they can achieve. Smart contracts are incredibly powerful tools in facilitating routine contract execution and mitigating risks in predictable scenarios. They are not appropriate for addressing unforeseen events that are precisely what the force majeure doctrine was created to address.

The proper approach is not to stop using smart contracts or to argue that code execution always prevails over principles of equity. Nor is it to negate the existence of

code as a contract or to impose a requirement that all smart contracts be accompanied by a parallel contract expressed in a natural language. The right approach is to create a Legal by Design approach that injects legal flexibility into the design of smart contracts at the start, rather than trying to add it afterwards as an afterthought.

The recommendations that emerge from this analysis are as follows:

1. First, regulators should require that escalation mechanisms be included as part of smart contracts that relate to high-value or long-term business relationships. These mechanisms would provide that, upon the occurrence of specified trigger events as verified by regulatory oracles, the code execution would be stayed until resolution of the supervening event through a specified dispute resolution process. These trigger events would be specified by reference to various categories of force majeure using existing jurisprudence such as Energy Watchdog or guidance offered by the Law Commission.
2. Second, the development of standardised oracle governance protocols should be treated as a regulatory priority. Oracle mechanisms are the principal technical means by which external events can be incorporated into smart contract logic, and their reliability is fundamental to the credibility of any automated force majeure mechanism. Regulatory bodies should establish technical standards for oracle design, requiring minimum levels of source diversification, data verification, and audit trail maintenance.
3. Thirdly, it is recommended that legislative bodies in different countries introduce provisions that specify the relationship between smart contract code and the legal contract. In line with the UK Law Commission's recommendations, it is recommended that legislative provisions specifically state that smart contract code represents part but not all of the contractual expression and that courts are empowered to interpret the execution of smart

contracts in line with reasonable intentions and in line with the principles of the general law of contract. The Indian legislative body, which has not specifically addressed these issues in its legislation, should consider amending the Information Technology Act 2000 or introducing legislation specifically to deal with smart contracts.

4. Fourth, the legal profession should develop standardised boilerplate for smart contract force majeure provisions that have been designed with the automation gap explicitly in mind. The ISDA model of maintaining a governing natural-language agreement alongside automated settlement mechanisms provides a template that other sectors could adapt, with appropriate modifications to address the specific force majeure risks that arise in each commercial context.

5. Fifth, courts adjudicating disputes arising from smart contract execution should be encouraged, through judicial guidance and legislative direction, to apply the doctrine of harmonious construction to treat coded execution and the underlying legal agreement as complementary expressions of the parties intentions. Where automated execution has produced outcomes contrary to the reasonable expectations of the parties in circumstances of supervening impossibility, courts should have the authority and the conceptual tools to grant appropriate relief.

This will require, in some jurisdictions, a clarification that the immutability of the blockchain record does not preclude legal remedies operating outside the blockchain rescission, damages, restitution that courts have always been able to award in response to unjust contractual outcomes.

The fundamental insight that this analysis yields is not novel in any deep sense: law and technology have always been in productive tension, and the law has always, eventually, developed the conceptual resources needed to govern new forms of human activity. The challenge of force majeure in smart contracts is, in the end, a version of a challenge the law has faced many times before the challenge of applying principles developed for one technological context to a radically different one. The principles of contextual interpretation, equitable relief, and risk allocation that underlie the force majeure doctrine are robust enough to meet that challenge. What is needed is regulatory imagination and legislative will to give them adequate institutional expression in the age of algorithmic contracting.

The future of contract law is neither the pure automation that Szabo envisioned nor the unmodified application of doctrines developed in an era of paper and ink. It lies, as it has always lain, in the creative synthesis of technical possibility and legal principle in the development of instruments adequate to the complexity of the world as it actually is.

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