
**Blockchain and distributed ledger
technologies — Guidelines for
governance**

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document addresses how key governance characteristics such as decision rights, accountabilities, and incentives operate effectively and efficiently in DLT systems.

Due to the fast-evolving nature of DLT systems and their adoption, this document has been developed at a level of abstraction to provide guidance and instruction in diverse contexts. “Distributed ledger technologies” (DLT) includes blockchain technologies. The specific blockchain technology will be named explicitly only where specific characteristics of blockchain technologies warrant doing so.

DLT systems challenge our existing understanding of governance as these systems are often decentralized in their governance. In the case of permissionless public distributed ledgers, they can comprise an unrestricted number of potentially pseudonymous DLT users and nodes. Even permissioned public blockchains can have hybrid governance structures, comprising elements of centralized as well as decentralized governance. In the absence of a central governing authority for distributed ledger systems, several governance questions regarding ownership, decision rights, responsibilities and accountabilities, and incentive structures emerge that cannot be addressed by applying traditional governance mechanisms.

Thus, for distributed ledger systems, it is important for participants to establish who they are dealing with (identity) and who is responsible and accountable for the directing and control of the DLT system (governance). For organizations and broader industries, it is difficult to engage in the development of DLT systems in the absence of effective DLT-governance mechanisms.

In general, DLT systems aim for decentralizing decision rights and the technical implementation of accountability. The locus of achieving consensus is decentralized, meaning that the records that form the foundation of the DLT systems are not only distributed but also in many instances validated by multiple DLT users. Moreover, disagreements can be resolved in a decentralized way if users initiate ‘forks’ by copying and branching existing codebases and developing them further according to differing goals.

As DLT systems gain importance, incentive alignment becomes increasingly important. While incentives are at the core of all economic activities, in DLT systems aligning incentives adequately is important for effective functioning because in many DLT systems incentives provide the means of achieving consensus. Unless incentives are properly aligned, the nodes of the DLT system will not contribute to consensus. Improper incentive alignment threatens the integrity of the system and can prevent a DLT system’s effective functioning.

Smart contracts can allow for decentralized governance mechanisms, but many present-day DLT systems continue to be characterized by a degree of centralized, often informal, decision-making. In DLT systems, accountability in principle will increasingly be implemented technically rather than institutionally through traditional contracts.

Smart contracts allow for specifying and enforcing accountability using codified rules on-ledger. However, in some cases it is not possible to implement autonomous transaction enforcement completely on-ledger. In these cases, some form of off-ledger institutional involvement can be necessary for effective dispute resolution among DLT users. The establishment of ‘off-ledger’ governance instruments will be beneficial in assuring participants in the integrity of DLT systems.

Standards in these areas will also benefit DLT developers and providers looking to establish new DLT systems that provide confidence to stakeholders. A key accountability issue concerns identity in DLT systems, usually granted through the public addresses that are used to conduct transactions in public DLT systems. Given multiple and pseudonymous identities, this could be a problem. Some users will wish to identify themselves using traditional institutional means (e.g. driver licenses linked to their DLT identities). Other technical approaches can seek to address the problem of ensuring confidence in user identity, for example by linking reputation to public addresses. Overall, the shift toward the enforcement of accountability through technology has only begun and it is likely that institutions will continue to play important roles for ensuring accountability in DLT systems for some time to come.

This document is organized as follows. [Clause 4](#) presents governance principles for DLT systems. [Clause 5](#) discusses the governance framework for DLT systems. [Clause 6](#) discusses the governance of different types of DLT systems. [Clause 7](#) the lifecycle of DLT systems. [Clause 8](#) discusses the roles involved in the governance of DLT systems. [Clause 9](#) discusses governance instruments for DLT systems. [Clause 10](#) examines governance considerations of the interoperability of DLT systems.

The audience includes but is not limited to academics, architects, participants, users, developers, regulators, auditors, and standards development organizations.

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Blockchain and distributed ledger technologies — Guidelines for governance

1 Scope

This document provides guiding principles and a framework for the governance of DLT systems.

The document also provides guidance on the fulfilment of governance, including risk and regulatory contexts, that supports the effective, efficient, and acceptable use of DLT systems.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 22739, *Blockchain and distributed ledger technologies — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 22739 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at <https://www.iso.org/obp>

— IEC Electropedia: available at <https://www.electropedia.org/>

3.1

distributed ledger technology governance

DLT governance

system for directing and controlling DLT systems including the distribution of on-ledger and off-ledger decision rights, incentives, responsibilities, and accountabilities

3.2

governing body

entity that is accountable for the performance and conformance of the distributed ledger technology governance

4 Governance principles for DLT systems

4.1 Overview

This clause sets out nine action-oriented principles for good governance of DLT systems that will be elaborated in more detail throughout the document. The principles are intended to help stakeholders evaluate and improve governance mechanisms, structures and activities, with a view to meet governance objectives, which are: effective, efficient, and acceptable use of DLT systems. This is primarily achieved by providing stakeholders with the right incentives to perform their roles within a governance framework.

The governance of DLT systems should include commitments to address sustainability issues in their establishment, operation, and termination.

NOTE Useful sources of information on sustainability issues are ISO 26000 and UN Sustainable Development Goals (SDGs)^[15].

The governance principles provide the foundation for implementing mechanisms, structures, and activities in DLT systems. The statement of each principle refers to why it is important and what should happen, but does not prescribe how, when or by whom the actions must be implemented, as these aspects are dependent on the nature of the DLT systems.

4.2 Principles

4.2.1 Principle 1: Define identifiers of entities involved

DLT systems can vary in terms of the identifiers of the actors of the systems. Some DLT systems use pseudonyms as on-ledger identifiers while others use off-ledger identifiers to provide confidence. The definition of identifiers appropriate for the DLT system is the foundation for all governance functions.

4.2.2 Principle 2: Enable decentralized decision-making

Decentralization of decision-making is a key characteristic of many DLT systems. Decision-making in DLT systems can either be embedded on-ledger or off-ledger. Decentralized systems foster participation in collective decision-making, thereby enhancing overall trust. DLT systems should enable decentralized, on-ledger decision-making processes. When decisions are made off-ledger, they should be made in an explicit and formal manner.

4.2.3 Principle 3: Ensure explicit accountability

Over the lifecycle of DLT systems, ownership and decision-making rights can change and thus, so does accountability. Due to the decentralized nature of most DLT systems, explicit accountability mechanisms are needed to enforce rules. Accountability mechanisms should be enforced on-ledger where appropriate but can be enforced or complemented by off-ledger mechanisms.

4.2.4 Principle 4: Support transparency and openness

During a DLT system's lifecycle, the actions, decisions, and operation of the system should be transparent to DLT stakeholders to enhance trust. DLT systems should comprise mechanisms that allow stakeholders to observe and audit system dynamics.

4.2.5 Principle 5: Align incentive mechanisms with system objectives

Incentives in DLT systems drive the achievement of consensus among decision makers, the resolution of conflicts and decisions on the ongoing governance, design, and operation of systems. Incentive mechanisms in DLT systems play a key role in driving desirable behaviour across DLT users and other stakeholder groups. Incentive mechanisms should be explicitly designed to support system objectives.

4.2.6 Principle 6: Provide performance and scalability

If performance is not provided, the agility and maintainability of the system is affected. DLT systems should provide mechanisms to meet performance and scalability needs over the lifecycle of the respective DLT system. The use of DLT systems should be effective, efficient, and scalable while achieving system performance.

4.2.7 Principle 7: Make risk-based decisions and address compliance obligations

The lifecycle of a DLT system can pose specific risks, including jurisdictional challenges. Challenges should be assessed and treated appropriately in decision-making processes. DLT systems should seek

to set rules that ultimately induce self-compliance in order to reduce the risk of non-compliance with regulation.

4.2.8 Principle 8: Ensure security and privacy

Security serves the purpose of keeping confidentiality, integrity, and availability of the DLT system. The DLT system should provide appropriate security mechanisms. The safeguarding of privacy in DLT systems should be ensured. Privacy impacts should be considered. Depending on the task or process operated on a DLT system, related requirements should be addressed accordingly.

4.2.9 Principle 9: Consider interoperability requirements

Where DLT systems will need to work together with other systems, interoperability should be considered in the whole lifecycle of the system, especially at the design stage. A DLT system architecture should provide mechanisms to interoperate with other DLT and non-DLT systems with similar or different governance mechanisms in place.

5 Governance framework for DLT systems

5.1 Overview

This clause describes the governance framework for DLT systems. The framework for governance encompasses the decision rights, accountabilities and incentives associated with the governance of DLT systems. The differences between the governance of IT systems in general and the governance of DLT systems are discussed.

5.2 Comparison with other governance frameworks

Traditional approaches to governance of IT, for example as described in ISO/IEC 38500 and ISO/IEC/TR 38502, assume centralized governance. Such governance typically encompasses the effective, efficient and acceptable use of IT within the organization and is responsible for evaluating plans and proposals, directing policies and strategies and monitoring performance and conformance related to IT. An organization is not necessarily a company, enterprise, or government agency, but is assumed to be well-defined and be upheld by a clear source of authority. Boundaries on the scope and authority of a governing body are normally documented, for example, in a constitution, charter, or legislation. The implications of organizationally bound IT governance flow through elements and assumptions of these existing governance frameworks. These are commonly reflected in the role of conventional IT governance frameworks in defining and ensuring the implementation of IT strategy and business plans, the accountabilities of organizational management and boards, and the management of organizational risks including their relevant control treatments.

DLT systems differ from IT systems in general in that they involve distributed computing and are decentralized systems, where different nodes of the system are typically controlled by different organizations or individuals. In the context of governance, only organizations and individuals are considered as accountable entities. DLT systems can span organizational and jurisdictional boundaries. As a result, governance can span multiple organizations or individuals and therefore goes beyond the governance approaches of International Standards such as ISO/IEC 38500 and ISO/IEC/TR 38502. The relationship between the organizations and individuals involved with the DLT system is key and the governance framework for the system needs to address a series of critical questions such as:

- a) What are the different types of DLT systems and how do they affect the establishment and execution of governance rules?
- b) How do changes of the governing body over the lifecycle of DLT systems affect different DLT governance contexts?
- c) Which stakeholder roles exist and how do they affect DLT systems governance?

- d) How can risk, accountability, and compliance considerations be embedded in different types of DLT systems?
- e) How can interoperability between DLT systems as well as between DLT systems and non-DLT systems be achieved and what are the governance implications?

To achieve effective governance of decision rights, accountabilities, and incentives, DLT systems governance should accommodate for multi-stakeholder, distributed governance, reflecting the decentralization typical of DLT systems.

5.3 Specific governance considerations for DLT systems

Governance of IT is defined by ISO/IEC 38500 as ‘a system by which the current and future use of IT is directed and controlled’. ISO/IEC 38500 covers many of the aspects of governance that also apply to DLT systems.

There are certain characteristics and dependencies of DLT systems that require a different approach to governance of IT as described in ISO/IEC 38500. While the governance of IT systems of a centralized organization is a relatively mature field, the governance of decentralized systems such as DLT systems is less well understood. This document addresses the unique aspects of governing DLT systems that warrant the adoption of specific governance functions and characteristics.

Governance of IT as defined in ISO/IEC 38500 addresses responsibilities and accountability. Another definition for governance of IT is given in Reference [17]: ‘IT governance represents the framework for decision rights and accountabilities to encourage desirable behavior in the use of IT’. This definition encompasses three key dimensions of governance of IT: decision rights, accountability, and incentives. These dimensions are useful when considering decentralized systems that span across multiple organizations.

The essence of a decentralized system such as a DLT system is that the system is typically decentralized among a group of organizations or individuals. The governance of such decentralized systems is closely connected to the nature of the group and the means by which the group is bound together.

There are three types of DLT systems with different governance structures and associated processes according to their degree of decentralization. While permissionless public DLT systems are considered to be completely decentralized, DLT systems that are permissioned public or permissioned private share attributes of centralization, see [Table 2](#). For example, the governing body of permissionless public systems can be a decentralized group of pseudonymous stakeholders without any explicitly declared organizational hierarchy. In contrast, the governing body in a permissioned public system can be one or more entities clearly identifiable and verified. Different forms of governance implementations in permissioned public DLT systems are imaginable, such as cooperatives, oligarchies, or associations that can have membership voting mechanisms to elect representatives or appoint decision makers with tenure limited to a fixed period.

The key dimensions of DLT governance are described in more detail in [Table 1](#), based on a definition provided in Reference [18].