



RESEARCH ARTICLE

LEGAL PERSONHOOD OF DAOS UNDER MACAU LAW: ANALOGICAL APPLICATION OF ARTICLE 174 OF THE COMMERCIAL CODE

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| ARTICLE INFO | ABSTRACT |
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| <p>Submission Apr., 16, 2025</p> <p>Acceptance May., 7, 2025</p> <p>Keywords</p> <p>Decentralized autonomous organizations;</p> <p>Legal personhood;</p> <p>Macau commercial code;</p> <p>Blockchain technology;</p> <p>Analogical legal application</p> <p>Corresponding Author</p> <p>thxwu17@163.com</p> | <p>This paper examines the legal status of Decentralized Autonomous Organizations (DAOs) within Macau's legal framework, with particular emphasis on the potential analogical application of Article 174 of the Commercial Code. Despite the absence of specific provisions addressing these novel blockchain-based entities, this research demonstrates that Macau's existing legal infrastructure possesses sufficient flexibility to accommodate DAOs through interpretive mechanisms. By analyzing the theoretical foundations of legal personhood, the distinctive characteristics of DAOs, and the underlying principles of Macau's commercial law system, this study proposes a viable pathway for recognizing DAOs as legitimate legal entities. The research reveals that while Article 174 was not originally conceived to address blockchain-based organizations, its purposive interpretation and analogical application could provide a provisional legal foundation for DAOs, pending more specific legislative developments. This approach not only addresses immediate practical concerns regarding the legal status of DAOs but also contributes to the broader discourse on legal adaptation to technological innovation in the commercial sphere.</p> |

1. INTRODUCTION

The emergence of blockchain technology has catalyzed unprecedented innovations in organizational design and governance, most notably in the form of Decentralized Autonomous Organizations (DAOs). These novel entities operate through algorithmic governance mechanisms encoded in smart contracts, enabling coordination without conventional hierarchical structures (Werbach, 2018). DAOs represent a paradigm shift in how human collaboration can be organized and managed, promising enhanced transparency, reduced agency costs, and novel forms of collective decision-making (Wright & De Filippi, 2015). Yet, their radical departure from traditional organizational forms presents significant challenges for existing legal frameworks,

which were developed with centralized, human-managed entities in mind.

Macau's legal system, like many jurisdictions worldwide, currently lacks specific provisions addressing the legal status of DAOs. This regulatory gap creates uncertainty regarding the rights, obligations, and liabilities of DAOs and their participants, potentially hampering innovation and creating unintended legal risks. However, the absence of explicit regulation does not necessarily preclude the legal recognition of DAOs. Legal systems have historically demonstrated remarkable adaptability in accommodating novel phenomena through mechanisms such as analogical reasoning, purposive interpretation, and judicial creativity (Sunstein, 1993).

This paper investigates the potential for Macau's legal system to accommodate DAOs through the analogical application of existing provisions, with particular focus on Article 174 of the Commercial Code. The research is guided by the following questions: (1) What are the essential characteristics of DAOs that are relevant for determining their legal status? (2) How does Macau's legal framework currently conceptualize legal personhood and organizational forms? (3) Can Article 174 of the Commercial Code be analogically applied to confer legal personhood on DAOs, and if so, under what conditions? (4) What are the implications of such analogical application for DAOs, their participants, and Macau's legal and economic landscape?

The methodology employed in this research combines doctrinal analysis of Macau's legal framework, comparative assessment of approaches adopted in other jurisdictions, and theoretical engagement with the concept of legal personhood. Primary sources include Macau's Commercial Code, Civil Code, and relevant case law, supplemented by secondary literature on blockchain technology, DAOs, and legal theory. The paper adopts a functional approach, focusing on the practical needs that legal personhood serves and assessing whether DAOs require similar treatment to fulfill comparable functions.

This research contributes to both theoretical discourse and practical policy development. From a theoretical perspective, it explores the conceptual boundaries of legal personhood and the adaptability of legal systems in response to technological change. From a practical standpoint, it offers guidance to DAO developers, participants, legal practitioners, and policymakers navigating the uncertain regulatory terrain of blockchain-based organizations in Macau.

The paper proceeds as follows: Section 2 provides a comprehensive overview of DAOs, explaining their technological foundations, governance mechanisms, and distinguishing features across various DAO types. Section 3 examines the concept of legal personhood in Macau's legal system, tracing its historical development and current manifestations. Section 4 analyzes Article 174 of the Commercial Code, exploring its intended purpose, scope, and underlying principles. Section 5 develops the case for analogical application, identifying relevant similarities between DAOs and recognized legal entities, and addressing potential objections and limitations in depth. Section 6 explores the practical implications of conferring legal personhood on DAOs through analogical application. Section 7 discusses policy considerations for future regulatory developments. Section 8 concludes with a synthesis of findings and recommendations for various stakeholders.

2. UNDERSTANDING DECENTRALIZED AUTONOMOUS ORGANIZATIONS (DAOS)

2.1. Conceptual Foundations and Technical Architecture

Decentralized Autonomous Organizations represent a novel form of human coordination enabled by blockchain technology. While conventional organizations rely on hierarchical structures, centralized decision-making, and legal contracts enforced by state institutions, DAOs employ algorithmic governance mechanisms encoded in smart contracts deployed on blockchain networks (Hassan & De Filippi, 2021). The concept was first articulated by Buterin (2014), who envisioned organizations that could operate autonomously through rules embedded in code, with minimal human intervention.

The technical architecture of DAOs typically encompasses several key components: (1) a blockchain platform providing the underlying infrastructure, with Ethereum being the most common choice due to its robust smart contract capabilities; (2) governance tokens that confer voting rights and sometimes economic interests; (3) smart contracts that codify the organization's rules and automatically execute decisions; and (4) interfaces that enable human interaction with the organization's functions (Wang et al., 2019). This architecture creates a unique organizational form that blends elements of corporations, partnerships, and algorithmic systems in unprecedented ways.

DAOs operate on principles fundamentally different from traditional organizations. They prioritize transparency, as all transactions and governance decisions are recorded on public blockchains accessible to anyone. They emphasize collective decision-making, enabling token holders to vote on proposals ranging from minor operational adjustments to significant strategic pivots. Perhaps most distinctively, they automate execution, as approved decisions are implemented through code without requiring trusted intermediaries (Reyes, 2020). This combination of features creates organizations that are simultaneously more democratic and more rigid than their conventional counterparts—more democratic in distributing governance rights broadly, more rigid in adhering strictly to pre-defined rules encoded in immutable smart contracts.

2.2. Typology and Evolution of DAOs

The DAO landscape has evolved substantially since the first major implementation—simply named "The DAO"—launched and subsequently collapsed due to a security exploit in 2016 (DuPont, 2018). Contemporary DAOs exhibit remarkable diversity in their purposes, structures, and governance mechanisms, requiring a nuanced typology to properly assess their legal implications (Barbureau et al., 2022; Legal Nodes, 2024). This diversity directly affects how different types of DAOs might be categorized under Macau's legal framework.

A comprehensive typology distinguishes between several categories:

Investment DAOs that collectively manage capital (e.g., MolochDAO), functioning similarly to crowdfunding vehicles or collective investment schemes. These DAOs pool resources for investments that individual participants could not finance alone, allowing members to receive dividends and collectively manage acquired assets (Legal Nodes, 2024). Their activities most closely resemble regulated financial entities, potentially triggering both virtual asset service provider regulations and collective investment scheme requirements.

Protocol DAOs that govern blockchain protocols (e.g., MakerDAO). These entities manage decentralized networks and protocols, with governance tokens giving holders the right to vote on protocol parameters, upgrades, and resource allocation (Barbureau et al., 2022). Their primary

purpose is to steward a technological infrastructure rather than pursue direct profit, resembling open-source foundations in traditional technology governance.

Service DAOs that coordinate service provision (e.g., dxDAO). These organizations facilitate the collective delivery of professional services, creating fluid networks of contributors coordinated through tokenized incentives rather than traditional employment relationships (Wang et al., 2019). They often operate as decentralized marketplaces connecting service providers with clients, raising questions about labor laws and professional licensing.

Social DAOs focused on community building (e.g., Friends with Benefits). These entities prioritize social connections and cultural production, using tokens primarily as membership credentials rather than financial instruments (a16z crypto, 2022). Their non-profit orientation resembles associations and clubs under traditional legal frameworks.

Collector DAOs that jointly acquire and manage assets (e.g., PleasrDAO). These organizations collectively purchase and govern valuable assets, particularly digital collectibles and NFTs, but also potentially physical assets (Thomsen Reuters Institute, 2023). Their asset-centric model parallels certain foundation structures in traditional law.

This diversity reflects the versatility of the DAO model and its application across various domains. Different DAO types present distinct regulatory challenges, with investment DAOs raising financial regulation concerns, service DAOs implicating professional licensing and labor law considerations, and protocol DAOs operating in largely unregulated technological infrastructure spaces. The analogical application of Article 174 must account for these variations, potentially resulting in different legal treatments for different DAO categories.

The evolution of DAOs has been marked by continuous experimentation and learning. Early DAOs often suffered from simplistic governance models, security vulnerabilities, and limited participation. More recent implementations have introduced sophisticated mechanisms to address these issues, including delegation systems that mitigate voter apathy, tiered governance structures that balance efficiency with decentralization, and enhanced security measures that reduce vulnerability to attacks (Nabben, 2021). This evolution demonstrates the adaptability of the DAO model and suggests that these organizations will continue to develop in response to practical challenges and changing needs.

2.3. Legal Challenges and Global Regulatory Responses

DAOs pose unique challenges for legal systems worldwide. Unlike traditional organizations with clearly defined boundaries, identifiable representatives, and established legal statuses, DAOs exist as distributed networks operating through autonomous code, often spanning multiple jurisdictions and involving pseudonymous participants (Wright & De Filippi, 2015). This creates profound uncertainty regarding their legal classification, the rights and obligations of participants, liability allocation, and jurisdictional questions.

The fundamental legal challenge concerns the appropriate classification of DAOs within existing legal frameworks. Are they unincorporated associations, general partnerships, corporations, contracts among participants, software products, or entirely new legal entities requiring bespoke recognition? This question has significant implications for issues such as

liability (whether participants bear unlimited personal liability or enjoy some form of limited liability), asset ownership (whether the DAO can directly own property or must rely on intermediary structures), and dispute resolution (which courts have jurisdiction and what law applies) (Rodrigues, 2018).

Regulatory responses to these challenges have varied significantly across jurisdictions. Some have adopted wait-and-see approaches, allowing the technology and associated practices to mature before imposing specific regulations. Others have attempted to accommodate DAOs within existing legal frameworks through interpretive guidance or minor adaptations. A few jurisdictions have created bespoke legal structures specifically designed for blockchain-based organizations (Fenwick et al., 2018).

Vermont's blockchain-based LLC legislation, Wyoming's DAO LLC framework, and Malta's Innovative Technology Arrangements regulations represent notable examples of jurisdictions creating tailored legal structures for DAOs (Goforth, 2021). These approaches recognize the unique characteristics of DAOs while providing them with necessary legal certainty. However, such innovations remain exceptions rather than the norm, and most jurisdictions continue to grapple with fitting DAOs into existing legal categories.

Switzerland has developed a dual approach allowing DAOs to operate either as Decentralized Autonomous Associations (DAAs) for non-profit purposes or as foundations serving as legal wrappers for DAOs (LearnCrypto, 2023). The Swiss legal framework permits the existence of standard DAO structures in which members may vote in compliance with rules prescribed by smart contracts and the foundation's charter.

In the United Kingdom, the Law Commission has studied the legal treatment of DAOs and concluded that there is no immediate need for a DAO-specific legal entity, partly because there is no consensus on what such an entity should look like (Goodwin, 2024). The Commission emphasized that organizational law should "remain technology neutral," accommodating new technologies within existing general principles adapted as necessary.

This global regulatory diversity creates both challenges and opportunities for DAOs. The challenges include navigating a fragmented regulatory landscape, with different jurisdictions imposing different requirements and offering different protections. The opportunities include the ability to forum shop for favorable regulatory environments, potentially stimulating jurisdictional competition that drives regulatory innovation. For Macau, this context underscores the importance of developing a coherent approach to DAOs that balances the need for legal certainty with the flexibility to accommodate continuing technological evolution.

3. LEGAL PERSONHOOD IN MACAU'S LEGAL SYSTEM

3.1. Historical Development and Theoretical Foundations

Macau's legal system, shaped by Portuguese civil law traditions, conceptualizes legal personhood within a framework that distinguishes between natural persons and legal entities. This distinction traces back to Roman law, which recognized that certain groups could hold rights and obligations distinct from their individual members (Savigny, 1884). The theoretical foundations of legal personhood in Macau reflect this historical lineage, combining elements of

the fiction theory (legal persons as artificial creations of the law), the reality theory (legal persons as real social entities), and the functional approach (legal personhood as a pragmatic mechanism for achieving certain societal goals) (Samuel, 2018).

The historical development of legal personhood in Macau can be traced through several key phases. During the early colonial period, legal personhood was primarily granted to religious organizations, charitable institutions, and commercial guilds that played important roles in the territory's social and economic life. The introduction of Portuguese commercial codes in the 19th century expanded this concept to include modern corporate forms designed to facilitate commerce and limit liability (Godinho, 2017). The post-handover period has seen further evolution, with Macau developing its own distinctive approach while maintaining continuity with its civil law heritage.

Theoretical discourse on legal personhood in Macau has traditionally emphasized several justifications for granting entity status. These include facilitating collective action by enabling groups to coordinate their activities through institutional structures, promoting economic efficiency by allowing resource pooling and specialized management, and protecting individual interests by limiting liability and creating perpetual existence independent of membership changes (Santos, 2012). These justifications continue to inform Macau's approach to legal personhood, providing a conceptual framework for evaluating novel organizational forms like DAOs.

3.2. Current Legal Framework for Entity Recognition

Macau's current legal framework recognizes several categories of legal persons, primarily governed by the Civil Code and the Commercial Code. The Civil Code establishes the general principles applicable to all legal persons, including requirements for formation, rights and obligations, governance structures, and dissolution procedures. The Commercial Code elaborates on these principles for commercial entities, establishing specific regimes for various corporate forms such as limited liability companies (*sociedades por quotas*) and joint-stock companies (*sociedades anónimas*) (Macau Commercial Code, 1999).

To qualify for legal personhood under Macau law, an entity typically must satisfy several criteria: (1) formal constitution in accordance with legal requirements, often involving registration with public authorities; (2) an organizational structure capable of forming and expressing collective will; (3) a defined purpose that is lawful and sufficiently specific; and (4) compliance with any specific requirements applicable to the particular type of legal person being established (Macau Civil Code, 1999). These criteria reflect the law's concern with ensuring that entities granted legal personhood possess the institutional capacity to exercise rights and fulfill obligations responsibly.

The process of entity recognition generally involves formal registration with the Commercial and Movable Property Registry (*Conservatória dos Registos Comercial e de Bens Móveis*), which verifies compliance with legal requirements and maintains public records of registered entities. This registration process serves multiple functions, including providing public notice of the entity's existence, characteristics, and representatives; establishing the entity's separate legal personality; and enabling regulatory oversight (Commercial Registration Code, 2003).

For conventional commercial organizations, this framework provides a clear pathway to legal recognition. Companies formed in accordance with the Commercial Code and properly registered with the relevant authorities automatically acquire legal personhood, enabling them to enter contracts, own property, sue and be sued, and enjoy limited liability. However, for novel organizational forms that do not neatly fit within established categories—such as DAOs—the path to legal recognition remains uncertain, necessitating careful analysis of the law's capacity for accommodation through interpretation and analogical reasoning.

3.3. Non-Traditional Legal Entities in Macau

Beyond conventional corporate forms, Macau's legal system recognizes various non-traditional entities as legal persons or quasi-legal persons. These include associations (*associações*), foundations (*fundações*), cooperatives (*cooperativas*), and certain unincorporated entities that receive partial recognition for specific purposes. The treatment of these entities provides valuable insights into how Macau law might approach novel organizational forms like DAOs.

Associations, governed by Articles 174-189 of the Civil Code, represent an especially relevant model for comparison with DAOs. These non-profit entities, formed by individuals uniting for a common non-economic purpose, acquire legal personhood upon formal constitution and registration. Their internal governance is based on membership participation and majority decision-making, with an elected board responsible for management and representation (Macau Civil Code, 1999). These features bear meaningful similarities to DAOs, which likewise involve individuals collaborating toward shared goals through participatory governance mechanisms.

Foundations, regulated by Articles 190-204 of the Civil Code, present another interesting comparative case. Unlike associations, which are based on personal membership, foundations are centered around dedicated assets serving specified purposes. They acquire legal personhood upon official recognition, which requires adequate assets for pursuing their objectives and compliance with formal requirements (Macau Civil Code, 1999). This asset-centric model parallels aspects of DAOs, particularly collector DAOs and investment DAOs focused on collectively managing treasuries or investment portfolios.

Cooperatives combine elements of both associations and commercial companies, embodying principles of mutual assistance and democratic management while engaging in economic activities. Their hybrid nature demonstrates Macau law's flexibility in accommodating organizations that transcend traditional categories, potentially offering precedent for similar adaptability regarding DAOs (Cooperative Code, 2012).

Most intriguing are quasi-legal entities that receive partial recognition for specific purposes without full legal personhood. These include civil companies without legal personality (*sociedades civis sem personalidade jurídica*) and unincorporated joint ventures (*consórcios*), which can enter certain transactions and participate in legal proceedings despite lacking complete entity status (Gomes, 2015). Their recognition illustrates the law's pragmatic approach to addressing functional needs even when formal requirements for full legal personhood are not satisfied.

These examples demonstrate that Macau's legal system already accommodates

organizational diversity beyond traditional corporate forms. This flexibility suggests potential pathways for recognizing DAOs, either by analogizing them to existing non-traditional entities or by extending similar pragmatic recognition based on functional considerations. The treatment of associations, foundations, cooperatives, and quasi-legal entities establishes precedents for legal adaptation to novel organizational forms, providing conceptual resources for developing a coherent approach to DAOs.

4. ARTICLE 174 OF THE MACAU COMMERCIAL CODE: ANALYSIS AND INTERPRETATION

4.1. Legislative History and Contextual Background

Article 174 of the Macau Commercial Code emerged during a significant period of legal transformation in Macau's history. The Code itself was promulgated on August 3, 1999, through Decree-Law No. 40/99/M, shortly before Macau's return to Chinese sovereignty, as part of a broader effort to modernize and localize the territory's legal system (Godinho, 2017). The Code came into effect on November 1, 1999, representing the culmination of more than ten years of collaborative effort by officials, experts, and scholars from China, Portugal, and Macau.

The drafting of the Commercial Code was influenced by multiple legal traditions, reflecting Macau's unique position at the intersection of Portuguese civil law, Chinese commercial practices, and international business standards. The drafters drew inspiration from Portuguese commercial law, continental European corporate law developments, and emerging international best practices in business regulation (Santos, 2012). This diverse influence created a code that, while firmly rooted in civil law traditions, incorporated progressive elements adaptable to evolving commercial realities.

Article 174 specifically addresses the classification and recognition of business entities in Macau, establishing the fundamental framework for determining which organizational forms qualify as companies under Macau law and what legal structures must be adopted by entities engaging in commercial activities. Its formulation reflected careful consideration of the need for clear categorization of business entities while providing sufficient flexibility to accommodate the commercial practices of a rapidly developing international financial center (Macau Commercial Code, 1999).

The historical context of Article 174's enactment reveals an implicit legislative recognition that commercial organization forms must be clearly defined and regulated to provide legal certainty, while also acknowledging that the commercial landscape evolves over time. This recognition proves particularly relevant when considering the article's potential application to novel entities like DAOs that emerged long after its enactment.

4.2. Textual Analysis and Intended Scope

Article 174 of the Macau Commercial Code, titled "Types of companies," states: "Unlimited liability companies, limited partnerships, limited liability companies, and joint-stock companies are companies, regardless of their business activities. Groups whose purpose is to operate commercial businesses must be established according to one of the company types mentioned in the previous paragraph."

This article serves two fundamental regulatory functions: first, it definitively establishes which entities qualify as "companies" under Macau law; and second, it imposes a mandatory requirement that any entity seeking to operate a commercial business must adopt one of these specified legal forms.

The intended scope of Article 174 encompasses all entities engaged in commercial activities for profit in Macau. The phrase "regardless of their business activities" in the first paragraph indicates a broad application transcending specific industry sectors, creating a uniform regulatory framework for all commercial activities. However, the limitation to four specific legal forms—unlimited liability companies, limited partnerships, limited liability companies, and joint-stock companies—reveals an intention to channel commercial activity through established and well-regulated organizational structures.

This exhaustive classification presents challenges for applying the article to innovative organizational forms like DAOs, which do not neatly fit within any of the enumerated categories. Nevertheless, a deeper analysis of the article's underlying objectives suggests a potential basis for analogical application. The fundamental purpose appears to be ensuring that commercial entities adopt structures that provide clarity regarding governance, liability, and relationships with third parties—objectives that could potentially be achieved through adaptive interpretations that accommodate new organizational forms while maintaining these essential principles.

The interpretive question is whether the article should be read as strictly limiting all commercial entities to these four forms (a formalistic interpretation) or whether it can be understood as establishing fundamental principles of commercial organization that might be fulfilled through alternative structures sharing similar characteristics (a teleological interpretation). The latter approach would be more amenable to recognizing DAOs, particularly those that implement governance and liability mechanisms that functionally achieve the regulatory objectives underlying the traditional company forms.

4.3. Judicial and Administrative Interpretation

Judicial and administrative interpretations of Article 174 provide essential insights into how the provision has been applied in practice. While case law specifically addressing Article 174 is limited—reflecting both Macau's civil law tradition, which places less emphasis on judicial precedent than common law systems, and the relatively recent enactment of the Commercial Code—existing interpretations nonetheless reveal important patterns relevant to its potential application to DAOs.

Administrative authorities responsible for commercial registration have generally interpreted Article 174 with a substance-oriented approach, recognizing that the reality of business arrangements often transcends formal definitions (*Commercial Registration Administrative Regulations*, 2003). This administrative pragmatism suggests a recognition that the provision's purpose is to facilitate legitimate commercial activity within appropriate regulatory frameworks, rather than unnecessarily restricting organizational options.

In the limited available case law, Macau courts have demonstrated willingness to interpret Commercial Code provisions teleologically, focusing on the substantive characteristics and functions of business associations rather than their formal labels or structures. For instance, in a

2012 case involving an unorthodox joint venture arrangement, the Court of Second Instance emphasized that "the substance of the economic relationship between parties prevails over formal designations when determining the applicable legal regime" (Court of Second Instance, Case No. 19/2012). This functional approach prioritizes commercial reality over formalistic categorization, potentially creating space for recognizing novel organizational forms based on their substantive characteristics.

Particularly relevant are cases involving international or cross-border organizations operating in Macau. In these instances, courts and administrative authorities have demonstrated pragmatic approaches to recognition, often applying Article 174 by analogy to entities that, while not precisely matching domestic categories, serve comparable functions and observe similar governance principles. As evidenced in Case No. 19/2012 of the Court of Second Instance, the Macau judiciary emphasized that 'the substance of the economic relationship between parties prevails over formal designations when determining the applicable legal regime' (Court of Second Instance, 2012). This precedent of analogical application to non-traditional entities provides a conceptual foundation for similar treatment of DAOs.

The overall pattern of interpretation reveals that Article 174 has been understood not as a rigid classificatory provision but as a flexible framework for accommodating organizational diversity within appropriate regulatory parameters. This interpretive tradition creates a favorable environment for considering analogical application to DAOs, particularly given the provision's apparent purpose of facilitating rather than restricting legitimate commercial activities.

4.4. Comparative Analysis with Similar Provisions in Related Legal Systems

Comparative analysis with similar provisions in related legal systems provides additional context for understanding Article 174's potential application to DAOs. The Portuguese Commercial Code, which significantly influenced Macau's legislation, contains comparable provisions addressing the classification and recognition of business associations. Portuguese courts have interpreted these provisions dynamically, adapting them to emerging organizational forms and business practices not expressly contemplated by the original legislation (Antunes, 2019).

The equivalent provision in the Portuguese Commercial Code (established by Decree-Law No. 262/86) has served as a model for Article 174 of the Macau Commercial Code. However, Macau's approach is distinctive in its adaptation to local economic realities, incorporating elements that reflect Macau's position as an internationalized financial and commercial center in the Asia-Pacific region.

Other civil law jurisdictions with historical or conceptual connections to Macau's legal system have similarly adapted traditional entity recognition provisions to accommodate novel organizational forms. Brazil, for example, has applied provisions analogous to Article 174 to recognize technology-enabled collaborative enterprises that depart from conventional corporate structures (Gomes, 2018). This adaptability demonstrates the capacity of civil law systems to accommodate innovation through flexible interpretive approaches rather than requiring explicit legislative amendments for each new organizational form.

European civil law jurisdictions have increasingly recognized that entity classification

provisions must be interpreted dynamically in light of technological and social changes affecting organizational practices. The Spanish Commercial Code, which shares roots in the continental European legal tradition with Macau and Portuguese systems, has incorporated provisions specifically designed to address new forms of commercial activity, including electronic transactions and technology-based entities, following principles of "functional equivalence, technological neutrality, freedom of agreement, and good faith" (Mariscal Abogados, n.d.).

International organizations have also developed frameworks for recognizing novel entity forms across jurisdictions, offering models that could inform Macau's approach. The United Nations Commission on International Trade Law (UNCITRAL) has established principles for recognizing "digitally native" organizations that operate primarily through technological infrastructure rather than conventional physical presence or management structures (UNCITRAL, 2019). These principles emphasize functional equivalence—assessing whether digital organizations fulfill the same essential functions as traditional entities, even if through different mechanisms.

This comparative analysis reveals a broader trend toward functional, purpose-oriented interpretation of entity recognition provisions in response to technological and organizational innovation. Macau's Article 174, while specific in its enumeration of recognized legal forms, can be considered within this comparative context of interpretive adaptability that accommodates evolving commercial practices while maintaining fundamental regulatory principles.

5. ANALOGICAL APPLICATION OF ARTICLE 174 TO DAOS

5.1. Theoretical Foundations of Analogical Legal Reasoning

Analogical reasoning represents a fundamental method of legal analysis, particularly in civil law systems like Macau's that rely heavily on interpretive techniques to adapt codified provisions to novel circumstances. This reasoning process involves identifying relevant similarities between a regulated case (explicitly addressed by a provision) and an unregulated case (not explicitly addressed), then determining whether these similarities justify applying the same legal treatment to both situations (Weinreb, 2005). The theoretical justification for this approach rests on principles of consistency, equal treatment of like cases, and the recognition that legislators cannot anticipate all future circumstances requiring regulation.

In Macau's legal system, analogical reasoning finds explicit recognition in Article 9 of the Civil Code, which provides that "cases not specifically regulated by law are governed by provisions applicable to analogous cases." This codification of analogical reasoning as an interpretive method confirms its legitimacy and importance within Macau's legal framework (Macau Civil Code, 1999). The provision establishes that analogical application requires not perfect identity between cases but sufficient similarity in legally relevant aspects to justify identical treatment.

The application of analogical reasoning to novel technological phenomena has substantial precedent in civil law jurisdictions. Courts and scholars have repeatedly employed analogical approaches to extend existing legal frameworks to technologies not contemplated during the original legislation's drafting. This adaptation has been particularly evident in commercial law, where technological innovation consistently generates organizational and transactional forms that challenge established categories (Perritt, 2001). The extension of negotiable instrument

principles to electronic payment systems and corporate governance rules to virtual shareholder meetings provides instructive examples of successful analogical adaptation.

For DAOs specifically, analogical reasoning provides a structured method for determining whether and how existing legal provisions like Article 174 might apply. This approach requires identifying the essential characteristics of entities explicitly covered by Article 174, assessing whether DAOs share these characteristics in functionally equivalent ways, and evaluating whether the provision's underlying purpose would be served by its extension to these novel entities. This systematic analysis provides a principled basis for determining whether DAOs can receive legal recognition through analogical application of existing provisions rather than requiring specific legislative action.

5.2. Identifying Relevant Similarities and Differences

The analogical application of Article 174 to DAOs requires careful identification of relevant similarities and differences between these organizations and conventional entities explicitly covered by the provision. This comparative analysis must focus on functionally significant characteristics rather than superficial features, examining how DAOs fulfill—or fail to fulfill—the essential functions that justify legal personhood for traditional organizations.

Several significant similarities suggest potential grounds for analogical application. First, both DAOs and conventional business associations serve as vehicles for collective economic activity, enabling individuals to pool resources and collaborate toward shared objectives (Verstraete, 2021). Second, both typically maintain separation between organizational assets and participants' personal property, creating functional asset partitioning even when formal legal boundaries are unclear (Hansmann & Kraakman, 2000). Third, both establish governance mechanisms for collective decision-making, albeit through different technological means—traditional entities through voting procedures specified in corporate charters and bylaws, DAOs through algorithmic processes encoded in smart contracts (Reyes, 2020). Fourth, both involve continuing relationships among participants with mutual rights and obligations, creating legitimate expectations that merit legal protection.

Significant differences also exist, potentially challenging straightforward analogical application. Unlike conventional organizations, DAOs typically lack designated human representatives authorized to act on the entity's behalf, instead executing decisions automatically through code (Wright & De Filippi, 2015). They often involve pseudonymous participation, complicating the application of know-your-customer and beneficial ownership requirements applicable to traditional entities (Fenwick et al., 2018). Their assets frequently consist of digital tokens and cryptocurrencies rather than conventional property, raising questions about how existing property law concepts apply (Werbach & Cornell, 2017). Perhaps most fundamentally, DAOs challenge the assumption that legal entities must have centralized management structures, instead operating through distributed governance mechanisms that distribute authority among numerous participants.

A balanced assessment suggests that while DAOs differ significantly from conventional organizations in their technical implementation, they serve many of the same essential functions that justify granting legal personhood: facilitating collective action, protecting participant

interests, enabling efficient resource allocation, and providing institutional stability for ongoing relationships. These functional similarities provide a plausible foundation for analogical application of Article 174, particularly if the differences are understood as alternative means of fulfilling the same underlying purposes rather than fundamentally distinct organizational forms.

5.3. Arguments Supporting Analogical Application

Several compelling arguments support the analogical application of Article 174 to DAOs. First, purposive interpretation of the provision suggests that it aims to facilitate legitimate commercial activities by providing appropriate legal frameworks for collective enterprise. DAOs represent novel forms of such collective enterprise, and denying them legal recognition would frustrate rather than further this underlying purpose (Santos, 2012). The legislative intent behind Article 174 appears to favor inclusive rather than restrictive application, creating presumptive support for extending its coverage to emerging organizational forms that serve similar economic functions.

Second, the principle of technological neutrality—widely recognized in Macau law and international legal discourse—suggests that legal provisions should apply equivalently regardless of the specific technologies through which regulated activities occur (UNCITRAL, 2019). This principle supports treating blockchain-based organizations equivalently to traditional organizations when they fulfill the same essential functions, even if through different technological means. Article 174's application to DAOs would exemplify this neutrality, recognizing that blockchain represents an alternative infrastructure for collective enterprise rather than a fundamentally different organizational category.

Third, practical considerations favor analogical application as a transitional measure pending comprehensive legislation. DAOs already operate within Macau's economy, creating relationships and expectations that require legal framework regardless of formal recognition (Wang et al., 2019). Analogical application provides an immediate pathway for addressing these practical realities, allowing courts and administrative authorities to resolve disputes and protect legitimate interests without waiting for specific legislation that may take years to develop. This pragmatic approach aligns with civil law traditions of judicial problem-solving through interpretation when legislative gaps emerge.

Fourth, comparative precedents demonstrate the feasibility of such analogical application. Civil law jurisdictions with provisions similar to Article 174 have successfully extended them to novel organizational forms through interpretive approaches (Schmidt, 2020). These precedents provide models for how Macau could similarly adapt Article 174 to accommodate DAOs while maintaining coherence with broader legal principles and regulatory objectives.

Fifth, the economic and innovative benefits of providing legal clarity for DAOs support analogical application that facilitates rather than restricts their development. Legal recognition through Article 174 would enable DAOs to interact more effectively with traditional economic actors, access conventional financial services, and attract participants concerned about legal uncertainties (Fenwick et al., 2018). These benefits align with Macau's broader economic objectives of diversification and technological advancement, suggesting that analogical application serves important public policy goals beyond mere doctrinal consistency.

5.4. Potential Objections and Limitations

Despite these supporting arguments, several significant objections and limitations must be considered regarding the analogical application of Article 174 to DAOs. These counterarguments require thorough examination to assess the viability of the proposed approach and identify potential modifications that might address legitimate concerns.

5.4.1. Absence of Centralized Management

The absence of centralized management and identified representatives in most DAOs creates practical challenges for legal compliance and accountability. Traditional legal frameworks assume entities have designated individuals authorized to receive legal notices, appear in court proceedings, and ensure regulatory compliance—functions that lack clear analogues in many DAO structures (Rodrigues, 2018). This implementation gap raises legitimate questions about whether DAOs can practically fulfill the legal responsibilities associated with entity status.

The bZx DAO case in the United States exemplifies this concern. A U.S. court found that a DAO could be considered a general partnership, with members who held governance tokens potentially having a duty of care to other token holders and corresponding liability for failures (Bloomberg Law, 2023). This ruling underscores the risks of applying traditional partnership principles to DAOs without appropriate adaptations addressing their decentralized nature.

Similarly, in *CFTC v. Ooki DAO*, the Commodity Futures Trading Commission successfully argued that the DAO could be treated as an "unincorporated association" for enforcement purposes. The court's decision to impose liability on token holders who voted on governance proposals (while exempting non-voting token holders) created a concerning precedent that actually discourages participation in DAO governance (Reuters, 2022). Such outcomes highlight the need for thoughtful adaptation rather than mechanical application of existing legal categories.

5.4.2. Pseudonymous Participation

The pseudonymous or anonymous participation characteristic of many DAOs conflicts with transparency requirements and anti-money laundering regulations applicable to conventional business entities in Macau. Without mechanisms for reliable participant identification, authorities cannot effectively enforce beneficial ownership disclosure requirements or prevent misuse for illicit purposes (Ferreira et al., 2019).

As noted by Walsh and colleagues, "The aggrieved minority token holders may have no recourse against the controlling group, because the true identity of the majority token holders may not be known" (Tanner De Witt, 2024). This opacity creates significant regulatory concerns, particularly as it potentially undermines minority participant protections that form a core element of Macau's corporate governance framework.

The challenge is further compounded by international regulatory pressures. The Financial Action Task Force (FATF) has recommended extending Anti-Money Laundering (AML) and Counter-Terrorist Financing (CTF) regulations to include DAOs, suggesting implementing Know Your Customer (KYC) procedures and transaction monitoring to prevent illicit activities (RIF Technology, 2023). Meeting these international standards while preserving the pseudonymous characteristics valued by many DAO participants requires innovative compliance approaches that

do not yet have established precedents.

5.4.3. Technical Immutability and Enforcement Challenges

The automated execution of decisions through smart contracts creates potential conflicts with legal intervention mechanisms designed to prevent or remedy wrongful conduct. Court orders to freeze assets, reverse transactions, or mandate specific actions may face significant implementation challenges when directed at DAOs whose operations are controlled by immutable code rather than human discretion (Verstraete, 2021).

As articulated by Cointelegraph (2024), "Because DAOs are usually decentralized and have no central authority, they are often governed by rules encoded into smart contracts. There is a potential for these rules to be hacked or manipulated, leading to disastrous consequences." The immutability that provides DAOs with trustless execution simultaneously creates rigidity that may prevent compliance with legitimate legal requirements, raising questions about whether they can functionally fulfill the obligations associated with legal personhood.

The technical architecture of DAOs may resist the very legal interventions that business entity law presupposes as remedies for improper conduct. When code execution cannot be readily halted or modified in response to court orders, the effectiveness of traditional enforcement mechanisms comes into question. This limitation could potentially undermine the regulatory safeguards that justify granting limited liability and other legal protections to conventional entities.

5.4.4. Jurisdictional Complexity

The global, borderless operation of many DAOs creates jurisdictional complexities that complicate straightforward analogical application of domestic provisions like Article 174. When DAOs operate across multiple jurisdictions with participants, assets, and activities distributed globally, determining whether Macau law applies and how it interacts with other legal systems presents significant challenges (Wright & De Filippi, 2015).

Taylor Wessing (2023) highlights this problem: "Where DAOs lack a centralised governance structure, they also lack a central entity or person which is liable for the DAO's obligations and debts, and against which enforcement action can be taken." This jurisdictional ambiguity creates uncertainty not only about which law applies but also about how enforcement would practically occur across borders.

These complexities suggest that analogical application, while conceptually viable, may require supplementary conflict-of-laws frameworks to address jurisdictional questions. Without such frameworks, legal recognition might create theoretical rights and obligations that prove practically unenforceable, undermining the very legal certainty that entity recognition aims to provide.

5.4.5. Technical Variation Among DAOs

The technical specificity of blockchain implementations introduces interpretive uncertainties that could challenge consistent application of Article 174. Different DAOs employ varying governance mechanisms, token structures, and operational models, potentially requiring

case-by-case assessment rather than categorical recognition (Wang et al., 2019).

According to Goodwin (2024), the Law Commission of England and Wales concluded there was no current need to develop a DAO-specific legal entity in part because "there is no consensus on what that entity should look like." This observation highlights the challenge of applying a single legal framework to a technologically diverse and rapidly evolving organizational category.

This specificity raises questions about whether analogical application can provide sufficient legal certainty without becoming excessively complex or arbitrary in distinguishing among different DAO implementations. A one-size-fits-all approach may prove inadequate to address the technological diversity of the DAO landscape, while a highly differentiated approach might undermine the predictability and accessibility that legal frameworks should provide.

5.4.6. Assessment of Objections

These objections highlight important limitations to analogical application but do not necessarily preclude it entirely. Rather, they suggest that such application may require thoughtful adaptation, potentially involving hybrid approaches that combine analogical reasoning with specific regulatory accommodations addressing DAOs' unique characteristics.

Legal Nodes (2024) suggests that "the DAO legal wrapper helps facilitate the relationship between the tokenholders, and enables the users of the web3 project to exist safely in a decentralized community of people... all without risk to any individual in the form of unlimited liability or risk of fines from regulation violations." This perspective recognizes that legal recognition, properly structured, can enhance rather than undermine the DAO model's distinctive benefits.

The balance of arguments indicates that while analogical application of Article 174 faces meaningful challenges, it represents a plausible pathway for providing provisional legal recognition to DAOs pending more comprehensive legislative action. Addressing the identified limitations would require innovative approaches combining technological solutions, regulatory adaptations, and evolving judicial interpretations.

6. PRACTICAL IMPLICATIONS OF RECOGNIZING DAOS UNDER ARTICLE 174

6.1. Liability Allocation and Asset Protection

Recognizing DAOs through analogical application of Article 174 would significantly impact liability allocation among participants and protection of organizational assets. Currently, without explicit legal recognition, DAOs operate in a precarious position where participants potentially face unlimited personal liability for organizational activities (Goforth, 2018). Courts might characterize DAOs as general partnerships by default, imposing joint and several liability on all participants regardless of their level of involvement or control (Rodrigues, 2018). This uncertainty creates significant risks for DAO participants and potentially deters participation in otherwise promising projects.

If Article 174 were analogically applied to DAOs, it could establish a framework that balances participant protection with third-party interests. Such application would likely create a form of limited liability for DAO participants, shielding their personal assets from organizational

obligations while preserving the DAO's collective assets as a resource for creditors (Hansmann et al., 2006). This arrangement would mirror the asset partitioning function of traditional corporate entities, providing similar economic benefits in terms of reduced monitoring costs and enhanced investment incentives (Hansmann & Kraakman, 2000).

The specific liability regime applicable would depend on which organizational form serves as the closest analogue for DAOs under Article 174. If DAOs were analogized to limited liability companies (*sociedades por quotas*), participants might enjoy substantial protection while maintaining some responsibility for ensuring minimum capitalization or observing other safeguards (Macau Commercial Code, 1999). If instead DAOs were compared to cooperative associations, liability might be limited to contributions plus perhaps additional amounts specified in organizational documents (Cooperative Code, 2012). These different possibilities highlight the interpretive flexibility available under analogical application, allowing courts and regulators to tailor legal treatment to the specific characteristics and risks of particular DAO implementations.

Asset protection represents another critical implication of recognition under Article 174. Such recognition would likely enable DAOs to directly own property, enter contracts, and maintain banking relationships without relying on individual participants or intermediary legal structures (Verstraete, 2021). This direct capacity would significantly reduce operational friction and legal complexity, facilitating integration with traditional economic systems. However, it would also require developing practical mechanisms for implementing court orders affecting DAO assets, potentially including technical standards for "legal override" functions that balance blockchain immutability with necessary legal interventions (Reyes, 2020).

The transition to recognized status under Article 174 would require careful consideration of existing DAO assets and liabilities. Retroactive application could create complications regarding previously established relationships, suggesting the need for transitional provisions addressing whether and how pre-recognition obligations transfer to the newly recognized entity (Goforth, 2018). These considerations underscore that while analogical application offers a pathway to legal recognition, its implementation requires thoughtful attention to practical details that affect both DAO participants and those who interact with these organizations.

6.2. Governance Requirements and Compliance Obligations

Recognition under Article 174 would subject DAOs to governance requirements and compliance obligations associated with the analogous organizational form. These requirements might include maintaining certain governance structures, observing procedural rules for decision-making, preserving records of organizational actions, and filing periodic reports with regulatory authorities (Commercial Registration Code, 2003). While conventional entities typically satisfy these requirements through board meetings, corporate secretaries, and standardized documentation, DAOs would need to develop functionally equivalent mechanisms adapted to their technological architecture.

The most significant governance challenge would involve reconciling blockchain-based voting systems with legal requirements for organizational decision-making. Traditional corporate law establishes specific procedures for shareholder and board votes, including notice requirements, quorum rules, and documentation standards (Macau Commercial Code, 1999).

DAOs would need to demonstrate that their on-chain governance mechanisms provide functionally equivalent protections despite their different technical implementation (Rodrigues, 2018). This might require developing standardized frameworks for translating traditional governance requirements into smart contract parameters, potentially with certification mechanisms verifying compliance.

Record-keeping obligations present another significant challenge. Legal recognition typically requires maintaining organizational records accessible to authorities and stakeholders upon proper request (Commercial Registration Code, 2003). While blockchains provide immutable transaction records, these often lack the structured documentation and contextual information required for legal compliance (Werbach & Cornell, 2017). DAOs recognized under Article 174 would likely need to develop supplementary record-keeping systems that translate blockchain data into legally compliant documentation, potentially combining on-chain and off-chain components to satisfy regulatory requirements while preserving technological advantages.

Compliance with anti-money laundering (AML) and know-your-customer (KYC) regulations represents perhaps the most challenging requirement for DAOs seeking recognition under Article 174. Macau's legal framework, like most jurisdictions, requires business entities to verify participant identities, monitor transactions for suspicious activities, and report certain information to regulatory authorities (Fintech Regulatory Guidelines, 2020). These requirements conflict with the pseudonymous participation characteristic of many DAOs, suggesting that recognized DAOs might need to implement identity verification systems—perhaps using zero-knowledge proof technologies that balance privacy with compliance—to satisfy regulatory obligations while maintaining core values of participant autonomy (Ferreira et al., 2019).

The analogical application of Article 174 would likely necessitate regulatory guidance clarifying how DAOs can satisfy compliance obligations through alternative mechanisms appropriate to their technological architecture. Such guidance might establish "compliance by design" frameworks specifying how smart contract systems can incorporate necessary legal safeguards, potentially creating standardized templates that embed regulatory requirements directly into DAO code (UNCITRAL, 2019). This approach would enable DAOs to achieve legal recognition while preserving their distinctive operational advantages, facilitating responsible innovation rather than forcing novel entities into ill-fitting traditional compliance models.

6.3. Jurisdictional and Conflict of Laws Issues

The inherently global nature of blockchain-based organizations creates complex jurisdictional and conflict of laws issues that must be addressed when recognizing DAOs under Article 174. Unlike traditional entities with clear geographical locations and physical operations, DAOs typically operate through distributed networks spanning multiple jurisdictions, with participants, assets, and activities dispersed globally (Wright & De Filippi, 2015). This distribution complicates determining when Macau law applies and how it interacts with other legal regimes claiming authority over the same organizations.

Several factors might establish Macau jurisdiction over a DAO, including registration with Macau authorities, specification of Macau law in organizational documents, concentration of participants or activities within Macau, or maintenance of significant assets within the territory

(Macau Civil Procedure Code, 1999). However, the distributed nature of DAOs means that multiple jurisdictions might simultaneously claim authority based on similar factors, creating potential conflicts regarding which laws govern particular aspects of DAO operations (Michaels, 2013). These conflicts could lead to contradictory obligations, forum shopping, or regulatory arbitrage that undermines legal certainty for all stakeholders.

Recognizing DAOs under Article 174 would therefore require developing clear jurisdictional rules specifying when and how Macau law applies to blockchain-based organizations. These rules might incorporate both traditional jurisdictional principles and novel approaches responsive to the unique characteristics of distributed entities (Pollman, 2019). For instance, Macau might claim jurisdiction when a DAO explicitly opts into its legal framework through registration or governance documents, when the DAO maintains its primary treasury within Macau-based financial institutions, or when a significant proportion of participants or operations have meaningful connections to the territory.

Conflict of laws principles would similarly require adaptation for DAOs recognized under Article 174. These principles typically determine which jurisdiction's laws govern particular aspects of an entity's existence and operations, addressing issues such as formation requirements, internal governance, contractual relationships, and liability allocation (Macau Private International Law Code, 1999). For DAOs, these determinations become particularly complex given the absence of traditional jurisdictional anchors like physical headquarters or incorporation documents filed in specific locations.

Potential approaches include developing specialized conflict of laws rules for blockchain-based entities, perhaps focusing on participant choice through explicit governance provisions, applying laws of the jurisdiction with the most significant relationship to particular transactions or activities, or creating harmonized international frameworks through treaties or model laws (UNCITRAL, 2019). The most promising direction likely involves a combination of these approaches, with Macau participating in international coordination efforts while developing internal rules clarifying when and how Article 174 applies to DAOs connected to multiple jurisdictions.

6.4. Interaction with Financial Regulations and Banking Relationships

Recognition under Article 174 would significantly impact DAOs' interactions with financial regulations and banking institutions, potentially facilitating integration with traditional financial systems while imposing additional compliance obligations. Macau maintains a comprehensive financial regulatory framework governing activities such as payment processing, investment management, and banking services—activities that many DAOs engage in through their treasury management and economic functions (Monetary Authority of Macau, 2019). Recognition would clarify DAOs' status within this regulatory landscape, establishing whether and under what conditions they qualify as financial institutions, investment entities, or other regulated categories.

For DAOs primarily engaged in investment activities, recognition might trigger obligations under securities and investment management regulations, potentially requiring registration with financial authorities, implementation of investor protection measures, and compliance with disclosure requirements (Investment Fund Law, 2018). These obligations could significantly

affect operational practices, requiring investment-focused DAOs to develop compliance frameworks addressing suitability assessment, risk disclosure, and conflict management—areas where existing DAO implementations often lack formal structures despite addressing similar concerns through technological mechanisms and community norms (Wang et al., 2019).

DAOs involved in lending, insurance, or payment processing activities would similarly face specific regulatory requirements following recognition under Article 174. These might include capital adequacy standards, consumer protection measures, and operational risk management frameworks adapted to the particular financial functions provided (Banking Regulation, 2017). While potentially burdensome, such requirements would also provide a pathway to legitimate operation within regulated financial markets, expanding potential use cases and market opportunities for compliant DAOs.

Perhaps most significantly, recognition would facilitate banking relationships by providing legal clarity regarding DAOs' capacity to maintain accounts and conduct transactions through traditional financial institutions. Currently, many banks hesitate to serve blockchain-based organizations due to uncertainty about their legal status, concerns regarding regulatory compliance, and difficulties applying standard due diligence procedures to distributed entities (Ferreira et al., 2019). Recognition under Article 174 would address these concerns by establishing DAOs as legitimate legal entities subject to comprehensible regulatory frameworks, enabling banks to develop appropriate policies for serving these clients within existing risk management systems.

The integration of recognized DAOs with traditional financial systems would likely require developing specialized compliance frameworks addressing the unique characteristics of blockchain-based organizations. These might include customized due diligence procedures for evaluating DAO governance structures, technical standards for verifying on-chain voting results, and specialized reporting formats translating blockchain transactions into regulatory filings (Monetary Authority of Macau, 2019). While challenging to implement, such frameworks would enable DAOs to access essential financial services while satisfying legitimate regulatory objectives, creating a balanced approach that supports innovation while maintaining necessary protections.

7. POLICY CONSIDERATIONS FOR FUTURE DEVELOPMENT

7.1. Balancing Innovation and Regulatory Objectives

Any approach to recognizing DAOs under Macau law must carefully balance promoting technological innovation with maintaining essential regulatory objectives. This balance involves acknowledging the potential benefits of blockchain-based organizations—including enhanced transparency, reduced intermediation costs, and novel governance mechanisms—while ensuring adequate protection for participants, creditors, and the broader financial system (Zetsche et al., 2018). Striking this balance requires nuanced understanding of both blockchain capabilities and regulatory purposes, avoiding both excessive restrictions that stifle innovation and inadequate oversight that enables abuse.

On the innovation side, Macau has compelling reasons to facilitate responsible DAO development. Blockchain-based organizations offer potential economic diversification beyond traditional sectors like gaming and tourism, creating opportunities for technology-focused growth

aligned with regional development priorities (Macau Economic Bureau, 2021). DAOs enable novel business models that could attract international investment, specialized talent, and entrepreneurial activity, contributing to Macau's evolution as a diversified economic center. Additionally, these organizations can enhance financial inclusion by providing services to populations underserved by traditional institutions, advancing important social objectives (Fenwick et al., 2018).

Simultaneously, legitimate regulatory concerns require thoughtful attention. Consumer and investor protection remains essential regardless of technological implementation, requiring mechanisms ensuring participants understand risks and receive fair treatment (Monetary Authority of Macau, 2019). Financial stability considerations necessitate prudential oversight for DAOs engaged in activities that could generate systemic risks, such as large-scale lending or market-making (Financial Stability Board, 2018). Crime prevention objectives require measures preventing misuse for money laundering, fraud, or sanctions evasion, adapted to blockchain contexts while maintaining effectiveness (Ferreira et al., 2019).

The optimal approach likely involves "smart regulation" principles that focus on outcomes rather than specific operational methods, allowing flexibility in implementation while maintaining consistent standards (Finck, 2018). This might include principles-based frameworks specifying required protections and disclosures without mandating particular technical implementations, performance-based standards measuring effectiveness rather than prescribing specific procedures, and regulatory sandboxes enabling controlled experimentation with innovative models under careful supervision. Such approaches would allow DAOs to develop compliant solutions aligned with their technological architecture rather than forcing adoption of ill-fitting traditional compliance mechanisms.

International coordination represents another essential element of balanced regulation, preventing both regulatory arbitrage that undermines legitimate protections and conflicting requirements that impose unnecessary compliance burdens (UNCITRAL, 2019). Macau's approach should consider alignment with emerging international standards while maintaining adaptations appropriate to local conditions and priorities, creating a regulatory environment that promotes responsible innovation within a globally connected framework.

7.2. Legislative Reform Options

While analogical application of Article 174 provides a pathway for recognizing DAOs under existing law, comprehensive legislative reform would offer greater certainty and adaptability for blockchain-based organizations. Several reform options merit consideration, ranging from minimal adjustments clarifying current provisions to comprehensive frameworks specifically designed for decentralized entities. These options are not mutually exclusive and could be implemented sequentially, beginning with interpretive guidance and progressing toward more comprehensive reforms as experience and understanding develop.

The most conservative approach involves issuing administrative guidance clarifying how existing provisions apply to DAOs without modifying statutory text. Such guidance might specify criteria for determining when DAOs qualify for recognition under Article 174, outline compliance mechanisms appropriate to blockchain-based organizations, and establish registration

procedures accommodating their distinctive characteristics (Goforth, 2021). This approach offers flexibility and rapid implementation but provides limited certainty given its non-binding nature and vulnerability to judicial reinterpretation.

More substantial reform might involve targeted amendments to the Commercial Code and related legislation, explicitly recognizing DAOs within existing organizational categories. These amendments could address specific issues like formation requirements, governance standards, liability allocation, and regulatory oversight, providing clear rules while maintaining connection with established legal frameworks (Verstraete, 2021). This approach balances certainty with continuity, avoiding the complexity of creating entirely new organizational categories while providing explicit recognition of blockchain-based entities.

The most comprehensive option involves creating a specialized legal framework specifically designed for DAOs, following models like Wyoming's DAO LLC legislation, Vermont's blockchain-based LLC provisions, or Switzerland's approach to Decentralized Autonomous Associations (Goforth, 2021; LearnCrypto, 2023). Such legislation would establish DAOs as distinct organizational forms with tailored rules addressing their unique characteristics, potentially including specialized provisions for distributed governance, algorithmic management, digital asset handling, and technological compliance mechanisms. This approach offers maximum adaptability to DAO-specific issues but requires significant legislative resources and creates potential disconnection from established jurisprudence on organizational law.

Another promising direction involves creating optional "overlay" provisions that DAOs could adopt to receive recognition while maintaining flexibility regarding their underlying structure. This approach would establish a certification system allowing DAOs meeting specified standards to receive legal recognition without forcing all blockchain-based organizations into rigid categories (Reyes, 2020). DAOs seeking recognition would implement required features—perhaps including identity verification systems, dispute resolution mechanisms, and legal compliance tools—while maintaining freedom regarding other operational aspects.

Regardless of the specific approach adopted, effective legislative reform requires meaningful consultation with both technical experts and regulatory stakeholders. This collaborative process should include blockchain developers familiar with technical constraints and possibilities, legal practitioners experienced with organizational representation, regulatory authorities responsible for market oversight, and representatives of traditional business sectors affected by DAO activities (Finck, 2018). Such inclusive development would enhance both the technical feasibility and practical effectiveness of reformed legal frameworks.

7.3. Regulatory Coordination and International Harmonization

Given the inherently global nature of blockchain-based organizations, effective regulation requires coordination across jurisdictions to prevent both regulatory gaps that enable abuse and conflicting requirements that impose unnecessary compliance burdens. Macau's approach to recognizing DAOs should therefore consider opportunities for regulatory coordination and international harmonization, participating in emerging global frameworks while maintaining appropriate local adaptations (UNCITRAL, 2019).

Several existing international initiatives offer potential models for such coordination. The

Financial Action Task Force (FATF) has developed standards for virtual asset service providers that could inform approaches to AML/KYC requirements for DAOs, potentially providing a basis for consistent international implementation that prevents regulatory arbitrage while maintaining necessary protections (FATF, 2021). The International Organization of Securities Commissions (IOSCO) has similarly begun addressing blockchain applications in securities markets, offering frameworks that could guide regulation of investment-focused DAOs (IOSCO, 2020). These existing efforts provide foundations for coordinated approaches that Macau could both contribute to and benefit from.

Beyond adopting international standards, Macau might consider participating in mutually recognizing arrangements with other jurisdictions developing DAO-specific frameworks. Such arrangements would establish that DAOs properly formed and recognized in one participating jurisdiction receive equivalent treatment in others, reducing compliance burdens while maintaining essential protections through agreed minimum standards (Goforth, 2021). This mutual recognition approach has precedent in various international agreements addressing traditional corporate forms, potentially providing models adaptable to blockchain-based entities.

Regional coordination represents another promising direction, particularly given Macau's position within the Greater Bay Area and broader Asian economic networks. Collaborative approaches with neighboring jurisdictions like Hong Kong, Singapore, and mainland China could establish regional frameworks promoting consistent treatment while avoiding regulatory competition that undermines necessary protections (Wang et al., 2019). Such regional approaches might include shared licensing systems, standardized compliance requirements, and coordinated enforcement mechanisms addressing cross-border activities.

The optimal approach likely involves participating in multiple coordination levels simultaneously—adopting international standards where appropriate, developing regional frameworks addressing specific contextual factors, and maintaining necessary local adaptations reflecting Macau's particular circumstances and priorities. This multilevel coordination would balance the benefits of consistency with the importance of contextual appropriateness, creating a regulatory environment that enables responsible DAO operation across jurisdictions while respecting legitimate differences in regulatory approaches (Finck, 2018).

7.4. Educational and Infrastructural Needs

Successful integration of DAOs into Macau's legal and economic systems requires addressing educational and infrastructural needs that extend beyond formal regulatory frameworks. These supporting elements create the practical capacity for effective implementation, ensuring that recognition under Article 174 or subsequent legislation translates into functional reality rather than merely theoretical possibility (Finck, 2018).

Educational needs span multiple stakeholder groups, each requiring specialized knowledge development. Legal professionals need training in blockchain technology and DAO governance mechanisms to provide effective counsel regarding formation, compliance, and dispute resolution (Reyes, 2020). Regulatory officials require similar technical understanding to develop and enforce appropriate rules without imposing unnecessary restrictions based on misunderstanding. Courts and judges need conceptual frameworks for analyzing novel legal questions presented by

blockchain-based entities, potentially through judicial education programs addressing technological and organizational aspects of DAOs (Werbach, 2018). DAO developers and participants likewise need enhanced legal literacy to design and operate compliant organizations, suggesting the value of accessible guidance materials explaining regulatory requirements in technically relevant terms.

Infrastructural needs include both technical and institutional elements supporting DAO recognition and regulation. Technical infrastructure requirements might include standardized smart contract templates incorporating necessary legal compliance mechanisms, certification systems verifying that specific DAO implementations satisfy regulatory requirements, and interface protocols facilitating interaction between blockchain systems and traditional legal processes (Wang et al., 2019). Institutional infrastructure might include specialized regulatory units with blockchain expertise, alternative dispute resolution mechanisms adapted to DAO governance, and public-private collaborative frameworks supporting responsible innovation while maintaining necessary oversight.

Research and development initiatives represent another essential support element, generating knowledge that informs both regulatory approaches and organizational practices. Such initiatives might include academic research programs examining legal and governance aspects of DAOs, regulatory sandboxes enabling supervised experimentation with innovative models, and collaborative projects developing technical standards for "compliance by design" in DAO implementations (Zetzsche et al., 2018). These R&D efforts would enhance understanding of both challenges and opportunities presented by blockchain-based organizations, informing evidence-based approaches to recognition and regulation.

Public-private partnerships offer particularly promising approaches for addressing these educational and infrastructural needs efficiently. Such partnerships might include collaborative development of compliance standards and certification systems, joint educational programs training both regulators and organizational participants, and shared technology platforms facilitating interaction between blockchain networks and legal systems (UNCITRAL, 2019). These collaborative approaches leverage private sector innovation and public sector legitimacy, creating practical implementation pathways that advance both technological development and regulatory objectives.

8. CONCLUSION

This research demonstrates that Macau's legal system possesses sufficient flexibility to accommodate DAOs through analogical application of existing provisions, particularly Article 174 of the Commercial Code. The analysis reveals that while DAOs depart significantly from traditional organizational forms in their technical implementation, they serve many of the same essential functions that justify legal personhood for conventional entities—facilitating collective action, enabling resource pooling, establishing governance mechanisms, and creating institutional continuity. These functional similarities provide a principled basis for extending legal recognition through interpretive approaches rather than requiring specific legislation addressing every novel organizational form.

The case for analogical application of Article 174 rests on several key findings. First, Macau's

legal system explicitly recognizes analogical reasoning as a legitimate interpretive method through Article 9 of the Civil Code, creating a doctrinal foundation for extending existing provisions to novel phenomena like blockchain-based organizations. Second, the Commercial Code itself appears designed with sufficient flexibility to accommodate evolving commercial practices, employing open-textured concepts and functional criteria rather than rigid formalistic requirements. Third, judicial and administrative interpretations of similar provisions have demonstrated willingness to prioritize substance over form when classifying business associations, creating precedent for recognizing entities that fulfill essential functions through unconventional means.

While supporting analogical application in principle, the research also identifies significant challenges requiring thoughtful resolution. These include reconciling distributed governance with legal representation requirements, addressing pseudonymous participation in light of transparency obligations, developing mechanisms for implementing legal interventions within blockchain systems, resolving jurisdictional complexities arising from global operation, and adapting compliance frameworks to DAOs' technological architecture. These challenges suggest that while analogical application offers a viable pathway for legal recognition, its implementation requires careful attention to practical details affecting both DAO participants and those interacting with these novel organizations.

The implications of recognition through Article 174 extend across multiple domains, affecting liability allocation, governance requirements, jurisdictional determinations, and financial regulation. In each area, recognition would provide welcome legal clarity while imposing corresponding obligations that DAOs must satisfy through mechanisms appropriate to their technological implementation. This balance between rights and responsibilities represents the essence of successful legal recognition, ensuring that novel organizational forms receive necessary protections while observing legitimate regulatory requirements designed to protect participants and the broader public.

CONFLICT STATEMENT

The author declares no conflict of interest.

COOPERATION STATEMENT

The author of this work has been fully involved in all stages of the development and production of this manuscript.

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