



# Blockchain for the Next Generation Internet

## D6.2 LEGAL / REGULATORY/ ETHICAL FRAMEWORK REPORT 2

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ABSTRACT	ONTOCHAIN with a €6 M fund marries the Semantic Web with Blockchain to deliver a new software ecosystem for trusted, traceable and transparent ontological knowledge management.
KEYWORDS	Decentralization, trustworthy content, data traceability, trustworthy knowledge exchange, privacy protection, user empowerment, service interoperability

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## EXECUTIVE SUMMARY

This report is the deliverable “D6.2 – Legal, regulatory and ethical framework report 2” of the European project “ONTOCHAIN – Trusted, traceable and transparent ontological knowledge on blockchain”.

Today, more than ever, our digital life is an extension of our physical world. Thanks to the Internet, it is now possible for citizens from all over the world to participate in the generation and use of knowledge like never before. However, from the current Internet standpoint, the way knowledge is generated, curated, shared and stored raises critical concerns about security, privacy, fair and equal distribution of benefits, potential for abuse and adverse impact on individual rights. Citizens everywhere are at risk of being presented with partial or biased information reflecting the viewpoint of their provider. From now on, it is time to handle our digital world with the same critical, moral and ethical thinking that we use in our physical one. The internet of the future should follow a human rights approach, be more resilient, trustworthy and sustainable. An appropriate legal, regulatory and ethical framework should be built around it, especially in what concerns data/knowledge governance, access and sharing.

In the digital landscape, EU has recognized in 2018, with the setup of the European Blockchain Partnership (EBP), the potential of the blockchain technology to help reshape our digital world in a more human centric way, to promote user trust and the protection of personal data, to help create new business opportunities and to establish new areas of leadership, benefiting citizens, companies and public services. In 2019, the OECD acknowledged that the policy and regulatory framework around this disruptive technology was under-developed<sup>1</sup>. Since then, the EU and various countries have continued to work on shaping blockchain regulations and frameworks to create a harmonized and supportive environment for this technology while ensuring legal compliance and safeguarding the interests of its citizens and businesses leading to i.e. EBSI (European Blockchain Services Infrastructure), the eIDAS 2 framework and reference architecture, the Digital Services Act (DSA) and the Digital Markets Act (DMA) while emphasizing on data protection, privacy, interoperability, user trust, digital sovereignty and security. EU commitment to blockchain regulation highlights the complex interaction between technology and law in today's digital landscape, particularly in the context of blockchain. The interplay between law and technology is indeed crucial and this is thus also the responsibility of developers to ensure that the technologies they create align with legal and ethical standards.

ONTOCHAIN, by conceptualising a software ecosystem based on blockchains, has taken this responsibility seriously. If the objective of D6.1 Legal, regulatory and ethical framework report was to identify in Year 1 the legal, ethical and societal implications and impact of ONTOCHAIN early enough in its development and implementation to

enable corrective actions to be taken at this level if and when necessary as well as to contribute to the definition of a clear policy environment for blockchain innovation and adoption., D6.2 constitutes a picture of the last advancements regarding blockchain regulation in year 3 and an update of the impacts of ONTOCHAIN with respect to legal, ethical and societal aspects as well as on the EU policy after 36 months of implementation. All project partners were engaged in identifying the impact of the ONTOCHAIN technology and have contribute to this deliverable in month 36.

Hence in this document:

- **Section 1** builds upon the foundation laid in D6.1 concerning human rights-related considerations and recalls the stance of ONTOCHAIN in that context.
- **Section 2** elaborates on human rights ethical, societal challenges and tracks any legal and regulatory developments in the EU that have occurred since D6.1 was authored with regards to the regulatory framework surrounding blockchain technology considering EBSI, eIDAS 2, DSA, and DMA and the interplay with ONTOCHAIN development and implementation. It identifies specific aspects that have needed a specific consideration of ONTOCHAIN for its development.
- **Section 3** re-examines the potential impacts of ONTOCHAIN in terms of legal, ethical and societal aspects as well as on EU strategic policy after 36 months of implementation and the achievement of the ONTOCHAIN ecosystem. This includes how ONTOCHAIN contribute to the EU regulatory framework that reflects the fundamental values of diversity, plurality, democracy, equality, privacy and participation, and more broadly of human-rights. The ones foreseen and expected at the beginning, concerning more credible content, Trustworthy transactions, less centralized Internet, More inclusive Internet, Higher accountability, but no harm to anonymity has been addressed through the ONTOCHAIN OC innovative solutions.

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## ABBREVIATIONS

OHCHR	United Nations High Commissioner for Human Rights
DLTs	Distributed Ledger Technologies
IPR	Intellectual Property Rights
IoT	Internet of Things
EBSI	European Blockchain Services Infrastructure
DAO	Distributed Autonomous Organization
DApps	Decentralised Applications
OECD	Organisation for Economic Cooperation and Development
ICOs	Initial Coin Offerings
BEPS	Base Erosion and Profit Shifting
VAT	Value Added Tax
p2p	Peer to peer
APIs	Application Programming Interfaces

## 1. ONTOCHAIN POSITIONING TOWARD AN OPEN AND TRUSTED INTERNET

Over the past three years, ONTOCHAIN has stand as a forward-looking initiative with a clear commitment to shaping the digital landscape into an open and trusted internet. At its core, the project has embodied a dedication to innovation, seeking to integrate cutting-edge technologies that go beyond conventional paradigms. Through the seamless integration of innovative elements such as Semantic Web, Blockchain, Smart Contracts, and Decentralized Oracles, ONTOCHAIN has led a technologically advanced and resilient foundation of the internet of the future.

Crucially, ONTOCHAIN has distinguished itself by placing a strong emphasis on ethical considerations and human-rights principles. The project since the very beginning has acknowledged the pivotal role that technology plays in shaping societal values and, therefore, has taken deliberate steps to embed human rights and ethical standards not only at the selected solutions level but across the broader ecosystem and network. This holistic approach has ensured that the digital environment fostered by ONTOCHAIN was reflecting its commitment to respecting fundamental human rights, safeguarding user privacy, and promoting ethical decision-making.

User trust was a cornerstone of ONTOCHAIN's philosophy and a foundational element for the success of its ecosystem. By taking proactive measures to build and maintain this trust through its technological innovations, by formulating stringent technological requirements in its three Open Calls, the project has prioritized the creation of a user-centric internet involving considerations for user empowerment, data privacy, and transparent and trustworthy processes. Co-creation of a digital environment that aligns with shared values were integral aspects of ONTOCHAIN's strategy mobilising various stakeholders, including developers and users. An inclusive approach to decision-making in terms of ONTOCHAIN development across the three Open Calls has also ensured that diverse perspectives whether from the ONTOCHAIN core consortium, advisory board members or OC innovators could contribute to the optimal evolution of the project.

**ONTOCHAIN has stand as a project committed to an open and trusted internet, leveraging the blockchain technology and semantic web to push the boundaries of innovation while staying grounded in ethical principles, prioritizing user trust, and fostering collaboration. Through its endeavours, it has contributed to the realization of a digital realm that is not only technologically advanced but also aligned with the values of ethics, human rights, and user-centricity. Following, section 2 recalls on human rights, ethical, societal and legal aspects that influence ONTOCHAIN**

development while section 3 demonstrates ONTOCHAIN contribution and impact at societal and legal level.

## 2. HUMAN-RIGHTS, ETHICAL, SOCIETAL AND LEGAL CONSIDERATIONS

### 2.1 HUMAN RIGHTS AND ETHICAL CONSIDERATIONS

Today like never before, the internet facilitates global connectivity, allowing individuals to interact, share knowledge, and exchange ideas. However, as the digital revolution progresses, concerns arise over the misuse of technology for illegitimate purposes. Issues such as security, privacy, fair distribution of benefits, disinformation, abuse, and potential infringement on individual rights become prominent. Citizens express anxiety regarding the utilization of their data, citing concerns about a perceived lack of control and apprehension regarding profiling and discrimination. Additionally, fears of becoming victims of data breaches, identity theft, and various forms of cybercrime contribute to their unease in the digital environment. Internet users are particularly troubled by the adverse impact of pervasive surveillance on their privacy and other fundamental rights.

In that context and over the past three years, the ONTOCHAIN project has been focused on integrating moral and ethical principles developed over thousands of years of European and global history into the fundamental structure of the Internet and this to support the aims of humanity i.e., human rights, sustainability, plurality, diversity, and democracy.

**ONTOCHAIN role was to be pivotal in shaping an open and trusted Internet, reaping the social, sustainability, and economic benefits it offers. It has contributed to a more human centred Internet that fosters innovation, provides opportunities for all, and facilitates the graceful evolution of humanity based on:**

- **ground-breaking work of the EU in terms of policy and regulation**, for instance:
  - the General Data Protection Regulation (GDPR, 2016)<sup>2</sup>** regime that upholds data privacy, the code of conduct with social media platforms to combat hate speech online (2016)<sup>3</sup>,
  - All the current work on electronic identification and trust services for electronic transactions supported by the eIDAS Regulation and its revised version eIDAS 2 (2014 & 2021)<sup>4</sup>,**

- the **legislation on human-centric Artificial Intelligence** (2019)<sup>5</sup> as well as more recently,
  - the **Digital Service and Market Acts** (2020)<sup>6</sup> to create a safer digital space in which the fundamental rights of all users of digital services are protected and to establish a level playing field to foster innovation, growth, and competitiveness, both in the European Single Market
  - the **European Blockchain Services Infrastructure** (EBSI, 2021)<sup>7</sup> evolution,
  - the **European Declaration on Digital Rights and Principles** (2022)<sup>8</sup> that presents the EU's commitment for a secure, safe and sustainable digital transformation that puts people at the centre, in line with EU core values and fundamental rights.
- The **human-rights based approach for our digital life set up in 2018 by the United Nations High Commissioner for Human Rights (OHCHR)** that proposed preliminary principles, recommendation and good practices for the use of data among other participation, self-identification, transparency, privacy and accountability<sup>9</sup>:

ONTOCHAIN has been dedicated to the integration of human rights and ethical mechanisms within innovative open technologies, forming an interoperable blockchain ecosystem as outlined in the initial ONTOCHAIN blueprint architecture to ensure trustworthy exchange of data/services and reliable content handling in the digital environment. By strategically combining Semantic Web with Blockchain technologies, encompassing Smart Contracts, Decentralized Oracles, and others, ONTOCHAIN has enabled a technological foundation for trustworthy decision-making on the internet, aligning with the principles of humanity as previously discussed in D6.1. This went together with the consideration of blockchain technologies challenges both at societal and legal level. Those are briefly recall in the next sections since already identified and discussed in D6.1.

## 2.2 SOCIETAL CHALLENGES

These last years, blockchain technology has emerged as a beacon of promise, offering a potential remedy for various shortcomings within the current Internet infrastructure. Its capacity to redefine business development, enrich the quality of democratic processes, and seemingly address a myriad of societal issues has attracted considerable attention. However, blockchain networks, are not without challenges encompassing issues that are hereafter briefly resumed:

- The actual decentralization of power in blockchain networks often falls short of the intended design, with a significant **concentration of mining power controlled by a few major players**. The essence of public blockchain networks relies on decentralized trust through agreements among diverse nodes, making

the continuous pursuit of decentralization crucial for their sustainable development and to uphold the foundational principles of trustworthiness.

- The envisioned **geographical diversity of blockchain nodes** is frequently compromised, as nodes tend to cluster within the same country, raising concerns about potential government/organisations influence over blockchain networks. This concentration within a single location can introduce vulnerability, undermining the decentralized goals of blockchain. It emphasizes the crucial need for genuine geographical diversity among nodes to ensure network independence, integrity, and resistance to censorship.
- **Entry barriers for newcomers in public blockchain networks** are substantial, requiring significant investments in computational resources or staking power due to high mining difficulty. These barriers hinder the openness of the networks, particularly affecting non-tech-savvy individuals, emphasizing the importance of ensuring accessibility for all to avoid exclusion.
- Blockchain, particularly ones using the Proof-of-Work consensus protocol, poses a **significant environmental concern** with a massive carbon footprint, as its mining operations consume electricity surpassing that of many countries and contribute to environmental impact through extensive silicon and semiconductor infrastructure.
- **Ethical challenge** in blockchain arises from the substantial energy consumption in mining, prompting a call for the technology to address global energy poverty through initiatives like peer-to-peer energy exchange and donations to those lacking access to energy resources.
- The **lack of trustworthiness** in entities and **the lack of credibility of information** persists in blockchain networks, where transactions are immutable among unknown entities, and the quality of exchanged goods or services, as well as the credibility of the information stored in distributed ledgers, remains uncertain.
- The **business landscape surrounding blockchain** technology holds significant promise, but it remains largely unexplored and entails high investment risks.

## 2.3 BLOCKCHAIN, SMART CONTRACTS AND ORACLE LEGAL CHALLENGES

The convergence of blockchain technology, smart contracts, and oracles represents a **paradigm shift with immense potential for widespread socio-economic impact**. These innovative technologies offer new avenues for efficiency, transparency, and trust in various sectors. **However, this transformative potential is still not without its share of legal and regulatory challenges** as already largely discussed in D6.1.

In summary, **Blockchain**, as a decentralized and tamper-resistant ledger, introduces **complexities in terms of jurisdiction and legal frameworks**. The borderless nature of blockchain transactions raises questions about which laws and regulations apply when disputes arise. Additionally, the pseudonymous nature of participants on the blockchain poses **challenges for identity verification and legal accountability**. In the realm of crypto assets, **regulatory uncertainty and security concerns** demand careful consideration. Ethical concerns surrounding wealth concentration also highlight the need for balancing innovation with equitable access. Addressing **data privacy protection challenges** involves **navigating pseudonymity issues, cross-border data flows, and ensuring informed consent**. Ethical frameworks must reconcile **blockchain's immutability** with the right to erasure. In **governance**, legal challenges arise with decentralized autonomous organizations (DAOs) and the delicate balance between **regulatory compliance and decentralized decision-making**. Ethical considerations call for inclusive governance structures and transparency in decision-making processes.

When it turns to **smart contracts**, self-executing agreements powered by blockchain, they face challenges related to their **enforceability within existing legal frames**. Traditional legal systems may not seamlessly accommodate the unique features of smart contracts, such as **automatic execution and decentralized governance**. Ensuring that smart contracts align with legal standards and are recognized as valid agreements still presents a regulatory hurdle.

**Oracles**, which serve as bridges between blockchain smart contracts and real-world data, introduce concerns related to **data accuracy and reliability**. The legal implications of relying on external data sources in blockchain-based applications become crucial, as **inaccuracies or manipulation of data** could lead to legal disputes.

In fact, many of the aforementioned challenges **are deeply rooted in the prevailing norm of centralized governance and control that characterizes our world**. The existing legal and regulatory frameworks across most countries are crafted with the assumption of centralized structures, where businesses or entities operate under a singular seat of control and responsibility. The convergence of blockchain, smart contracts, and oracles disrupts this traditional paradigm, presenting a unique set of challenges from both legal and regulatory standpoints and giving rise to enforcement issues. Indeed, departing from the established norm of centralized control introduces complexities that legal systems are not inherently equipped to handle. **Existing laws often lack the flexibility to accommodate the decentralized nature of blockchain networks and the automated execution of smart contracts**. As a result, the transformative potential of these technologies is hindered by regulatory uncertainties and enforcement challenges. The concept of decentralized governance, enabled by blockchain technologies, challenges the traditional understanding of authority and accountability. Legal frameworks struggle to adapt to decentralized autonomous organizations (DAOs) and distributed decision-making structures. This departure from

centralized control models necessitates a re-evaluation of enforcement mechanisms and raises questions about how compliance and accountability can be ensured in a decentralized landscape.

The following sections dwells on tracking any legal and regulatory developments in the EU that have occurred since D6.1 was authored and provides updates on the evolution of the regulatory framework surrounding blockchain technology in particular considering EBSI, eIDAS, DSA, and DMA as well as the interplay with ONTOCHAIN development and implementation.

## 2.4 THE EU POLICY, LEGAL AND REGULATORY FRAMEWORK AROUND BLOCKCHAIN AND DIGITAL ENVIRONMENT: CHALLENGES & EVOLUTIONS

The EU objectives is to create a Digital Single Market and position Europe as a leader in the digital era. In that context, EU's stance underscores a strategic and holistic approach to digital transformation, emphasizing the need for a unified regulatory framework to reap the benefits of emerging technologies while safeguarding the interests of citizens, consumers, and investors. With regards to distributed ledger technology (DLT), blockchain and smart contracts, the EU has taken a proactive approach toward the development of a legal and regulatory to foster innovation while ensuring robust protections for citizens, industries, and organizations.

So, the EU has been at the forefront of shaping and implementing ground-breaking policies to address the challenges and opportunities presented by the digital age starting with the **General Data Protection Regulation (GDPR, 2016)** that stands as a landmark regulation that sets a global standard for data protection and privacy. It empowers individuals with greater control over their personal data and imposes strict obligations on organizations handling such data, promoting transparency and accountability. However, **the intersection of GDPR and blockchain technology presents some challenges due to the inherent characteristics of blockchain, such as immutability, decentralization, and transparency.** Indeed, once data is added to the blockchain, it is challenging to alter or delete it, but the GDPR grants individuals the **"right to be forgotten"**, allowing them to request the erasure of their personal data. This presents a conflict as blockchain's **immutability** may make it difficult to comply with such requests. Blockchain operates on a **decentralized network of nodes, and there may not be a clear data controller or processor, as defined/requested by GDPR,** making it challenging to determine who is responsible for ensuring compliance with GDPR requirements. Also, since it operates across borders and involves multiple nodes globally, **ensuring compliance with the GDPR restrictions on the transfer of personal**



**data outside the EU becomes complex.** Finally, when coming to transparency that is a key advantage of blockchain, it may also **conflict with GDPR requirements, particularly regarding the principle of data minimization.** Indeed, GDPR emphasizes that organizations should only collect and process the data necessary for the intended purpose, whereas blockchain often involves the storage of all transactional data across the network.

Since 2019, EU's approach involves a combination of collaboration, research, and a nuanced understanding of the blockchain ecosystem with the EUBOF as well as with INATBA (International Association for Trusted Blockchain Application) to set an appropriate framework. Indeed, technology, policy and regulation need to progress hand in hand, and innovators and policy makers should consult each other to develop the most appropriate regulatory framework. So **the European Union Blockchain Observatory and Forum (EUBOF) has played a pivotal role in advancing this agenda by preparing a comprehensive report<sup>10</sup> on the Legal and Regulatory Framework around Blockchains and Smart Contracts.** Within this influential document, the EU acknowledges several critical aspects that underscore the complexities and challenges inherent in regulating blockchain and smart contract technologies. These key acknowledgments include:

- **Identification of Central Points for Regulation:**

The report recognizes the importance of pinpointing central points within the blockchain ecosystem that can serve as focal points for regulatory measures. This encompasses various stakeholders such as miners, core software developers, end-users, and even governmental or regulatory entities, all of whom play pivotal roles in the blockchain landscape.

- **Liability Issues for Core Software Developers:**

Acknowledging the intricacies of identifying liability, especially concerning core software developers, is a significant aspect of the EU's approach. Given the collaborative and decentralized nature of blockchain development, determining responsibility is a nuanced challenge that requires careful consideration. The EU has been working on regulatory approaches to address these challenges it has **proposed the Digital Services Act (DSA) and the Digital Markets Act (DMA) (2020)** to regulate digital services and platforms. While these acts primarily target online platforms and digital services, they reflect the EU's broader efforts to create a legal framework that ensures accountability and addresses liability concerns in the digital space. The DSA, in particular, aims to update the liability regime for online intermediaries, holding them accountable for content on their platforms. While this may not directly address liability for core software developers in a blockchain context, it indicates a broader EU focus on assigning responsibilities within the digital ecosystem.

- **Challenges of Immutability and Lack of Updatability in Smart Contracts:**

The report recognizes the challenges posed by the immutability and lack of updatability inherent in smart contracts. While these attributes ensure the integrity of transactions, they also introduce complexities related to adaptability and addressing errors after deployment. The immutability of smart contracts ensures the integrity of transactions and the security of the network but can pose challenges in terms of adaptability and correcting errors once the smart contract is deployed. To address these challenges, privacy mechanisms like **zero-knowledge proofs and ring signatures** are being explored and implemented in some blockchain solutions. These privacy-focused techniques aim to provide a level of confidentiality for transactions while still adhering to the principles outlined in regulations such as the General Data Protection Regulation (GDPR).

- **Need for Quality Assurance and Technology Audit Processes:**

The EU underscores the critical need for quality assurance and technology audit processes. This acknowledgment reflects an awareness of the importance of ensuring the reliability, security, and overall quality of blockchain implementations, contributing to a trustworthy and resilient digital environment. Regarding these aspects, EU has taken a significant step towards fostering innovation and reducing legal uncertainty in the blockchain space by launching the **European Regulatory Sandbox for Blockchain**<sup>11</sup> (2023). This sandbox provides a controlled environment for companies to test blockchain products and services while engaging with regulators. It is designed to offer legal certainty, encourage experimentation, and facilitate collaboration between innovators and regulatory authorities. It is being operated to facilitate the dialogue between regulators and innovators for private and public sector use cases and fosters a regulatory environment conducive to the responsible development of blockchain technology within the European Union. Moreover, to support the digitalisation of finance services, the **EU's Digital Finance Strategy**<sup>12</sup> has includes a regulatory framework for crypto-assets, known as the Markets in Crypto-Assets (MiCA) regulation (2023)<sup>13</sup>. MiCA aims to establish clear rules for the issuance and provision of crypto-assets, and it may include provisions related to technology audit processes to ensure the security and reliability of blockchain-based financial services.

**On democratisation of the digital environment as well as trustworthy data sharing in this environment**, the EU's approach is to balance innovation with the need for regulatory safeguards. Its focus is on promoting transparency, security, and efficiency while ensuring compliance with existing legal frameworks. It boosts the development of trustworthy data-sharing systems and align with principles of empowering individuals, promoting data altruism, enhancing public sector data reuse, ensuring neutrality, and fostering innovation in data governance. With that respect it recognises

the value of Blockchain technology with the implementation in 2018, of **EBSI** (European Blockchain Service Infrastructure)<sup>14</sup> that consists of a peer-to-peer network of interconnected nodes running a blockchain-based services infrastructure and allow public organisations to develop applications that connect to and make use of the EBSI infrastructure for specific use cases in relation with identity, diploma, document traceability and in a near future with social security, trust data sharing, SME financing, Asylum process management. In fact, EBSI places a strong emphasis on security and trust in blockchain technology, offering a tamper-resistant environment for digital transactions and data sharing. It supports cross-border digital services, leveraging blockchain's transparency and immutability in domains such as identity verification, supply chain management, and notarization of documents. EBSI also prioritizes data privacy compliance with EU regulations, streamlining processes, reducing administrative burdens, and lowering costs associated with cross-border transactions and services through blockchain technology. Furthermore, EBSI fosters collaboration between public and private sector entities and research institutions to develop and deploy blockchain solutions that cater to diverse stakeholder needs. Its potential applications span healthcare, supply chain management, public administration, and more, aligning with the European Commission's vision to harness blockchain's potential for enhancing digital services, improving efficiency, and driving innovation while relying on EU regulation in particular GDPR and **eIDAS**. eIDAS (and its updated version eIDAS 2) is a pivotal regulation within the EU which objective is to establish a legal framework for electronic identification and trust services, fostering secure and seamless digital interactions across EU member states. At its core, eIDAS focuses on electronic identification methods, trust services such as electronic signatures and time stamps, interoperability among member states, legal recognition of digital signatures, and robust security standards. It has played a pivotal role in enhancing the digital single market within the EU by promoting secure cross-border transactions, encouraging electronic solutions adoption, and facilitating e-commerce and public services. eIDAS, with its robust framework for electronic identification and trust services, and EBSI, offering a standardized and secure blockchain infrastructure, possess complementary strengths that are instrumental in shaping the internet of the future.

Taking a broader view, the **OECD from its side, has reinforced in 2022<sup>15</sup> via some recommendations the necessity for a globally harmonised approach to blockchain regulation, fostering innovation, and ensuring responsible and sustainable adoption across diverse sectors** emphasising essentially on:

- Compliance and coherence of policies and standardized approaches across sectors and countries to ensure that regulatory measures are consistent, transparent, and aligned with global best practices.

- Governance, transparency, and accountability with clear governance models that foster trust, transparency in transactions, and mechanisms to hold stakeholders accountable for their actions.
- Interoperability with specific standards to facilitate seamless interaction and data exchange between different blockchain systems.
- Digital security and privacy with prioritisation on robust digital security measures and respect for privacy in blockchain implementations.
- Education and skills Development with initiatives that should enhance the understanding of blockchain technology among various stakeholders, ensuring that citizens and organisations at large are equipped with the necessary skills for effective blockchain utilization.
- Environmental Impact by considering sustainable practices and explore ways to mitigate the environmental footprint associated with blockchain operations.

To conclude, today, the successful implementation of the blockchain technology requires a comprehensive understanding of the legal landscape and frameworks as well as its meticulous consideration from the outset by innovators. This is essential to ensure compliance, mitigate risks, and promote scalability and adoption. This proactive approach not only enhances transparency and trust but also positions blockchain researchers and developers to navigate regulatory changes and contribute to the long-term sustainability of their innovations. This has been the roadmap for ONTOCHAIN during these three years, not only, monitoring and implementing the evolving legal framework but in some cases impacting it as addressed in the following sections.

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## 3. ONTOCHAIN SOCIETAL, LEGAL AND REGULATORY IMPACT

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### 3.1 ONTOCHAIN SOCIETAL, LEGAL AND REGULATORY IMPACT

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Over the course of its three-year implementation, ONTOCHAIN has been steadfast in its commitment to conducting comprehensive investigations into the regulatory, legal, ethical, and societal implications of its technology. With a holistic approach, the project was committed to make meaningful contributions to essential aspects crucial to humanity, including diversity, pluralism, democracy, human rights, sustainability, and environmental care. Positioned as a technological cornerstone, ONTOCHAIN has not only addressed these pivotal concerns but also has seek to serve as a catalyst for continuous evolution, striving for the improvement of both humankind and the environment.

Practically, throughout the ecosystem development stages, ONTOCHAIN has explicitly identified challenges to tackle and meticulously formulated technological requirements for each Open Calls (OC), ensuring the realization of a user-centric internet, the implementation of ethics and human-rights principles as well as considering the last evolution of the legal and regulatory frame around blockchain. Notably, these requirements were transcending individual solutions, placing a strong emphasis on integrating ethics, human-rights principles, legal and regulatory aspects at the broader ecosystem and network levels thanks to ONTOCHAIN blueprint architecture with a view to ensure:

- More credible content
- Trustworthy transactions
- Less centralized Internet
- More inclusive Internet
- Higher accountability, but no harm to anonymity

Here are some examples of the consideration of the Legal/regulatory/ethical framework as well as systematic integration of specific human-rights related considerations towards an open and trusted Internet in the design of the topics & requirements of ONTOCHAIN OCs:

- OC2 Topic 2 - Market mechanisms for ONTOCHAIN with specific requirement of Monetizing data in compliance with regulation e.g. GDPR, ...
- OC2 Topic 6 - Data provenance in ONTOCHAIN with specific requirement of supporting automated checking of data-related transactions against GDPR ...
- OC3 Topic B8- "... Dealing with data identification, data ownership, data provenance, data handling in compliance to GDPR, privacy-aware data processing, data valuation, data value sharing ..."

Through its endeavours ONTOCHAIN has tackled several legal and societal challenges and achieved the expected impact even more in some cases as reflected in the following table.

**TABLE 1: ONTOCHAIN CONTRIBUTION TO TACKLE SOCIETAL CHALLENGES AND TO CONSIDER THE LEGAL AND REGULATORY FRAME**

	OC1	OC2	OC3
<b>Legal compliance of smart contracts</b>	KNOWLEDGE X	CARECHAIN Bowler PS-SDA	BABELFISH ECOS
<b>Legal accountability</b>		CARECHAIN Bowler PS-SDA	ECOS INGRESS
<b>Ethics</b>		PRINGO	ECOS INGRESS TRUSSIHEALTH Convex Global DLT ReCheck Green Box My3Sec
<b>Right for privacy and privacy protection</b>	ONTOSSIVault HIBI COPYRIGHTLY KNOWLEDGE X REPUTABLE	PXC MFSSIA DKG PS-SDA	DEFev DLMD CREATE DAOstar INGRESS Low-code app builder TRUSSIHEALTH
<b>Data ownership and control</b>	ONTOSSIVault HIBI COPYRIGHTLY KNOWLEDGE X REPUTABLE	CARECHAIN GEONTOLOGY PS-SDA	Convex Global DLT My3Sec DEFev OTCnLNG DLMD CREATE DAOstar INGRESS CAPS-CO TRUSSIHEALTH
<b>Data protection and Security</b>	ONTOSSIVault HIBI COPYRIGHTLY KNOWLEDGE X GRAPHCHAIN REPUTABLE	ADOS CARECHAIN PXC MFSSIA ONTOSPACE GEONTOLOGY DKG PS-SDA	Convex Global DLT ReCheck Green Box My3Sec DLMD CREATE INGRESS CAPS-CO TRUSSIHEALTH
<b>Transparency</b>	COPYRIGHTLY KNOWLEDGE X REPUTABLE	ADOS PXC MFSSIA PS-SDA	My3Sec ECOS OTCnLNG CREATE INGRESS CAPS-CO TRUSSIHEALTH
<b>Data accuracy and reliability</b>	ONTOSSIVault	DESMO-LD	BABELFISH

	HIBI COPYRIGHTLY KNOWLEDGE X REPUTABLE POC4COMMERCE	ADOS CARECHAIN GEONTOLOGY NFTWATCH NFTSWAP	ReCheck Green Box My3Sec ECOS DEFev OTCnLNG DLMD CAPS-CO INGRESS CREATE TRUSSIHEALTH
<b>Trustworthiness and credibility of knowledge/content/services</b>	ONTOSSIVault HIBI COPYRIGHTLY KNOWLEDGE X REPUTABLE POC4COMMERCE	CARECHAIN DESMO-LD ADOS PXC MFSSIA GEONTOLOGY DKG Bowler PS-SDA NFTWATCH NFTSWAP	Convex Global DLT ReCheck Green Box My3Sec ECOS DEFev OTCnLNG DLMD CREATE INGRESS CAPS-CO Low-code app builder TRUSSIHEALTH BABELFISH
<b>Trustworthy, fair and just transactions</b>	COPYRIGHTLY KNOWLEDGE X REPUTABLE POC4COMMERCE	PRINGO PXC MFSSIA GEONTOLOGY DKG Bowler NFTWATCH NFTSWAP	ReCheck Green Box My3Sec ECOS DEFev OTCnLNG DLMD CREATE INGRESS CAPS-CO TRUSSIHEALTH
<b>Freedom of expression and anti-censorship</b>	COPYRIGHTLY		CREATE
<b>Decentralise decision making, inclusive governance, accessibility for all</b>	KNOWLEDGE X REPUTABLE	PRINGO PS-SDA	Convex Global DLT ECOS DLMD DAOstar INGRESS Low-code app builder
<b>Interoperability, universal access and exchange of information</b>	ONTOSSIVault HIBI COPYRIGHTLY KNOWLEDGE X REPUTABLE GRAPHCHAIN POC4COMMERCE	DESMO-LD ADOS CARECHAIN PXC MFSSIA ONTOSPACE GEONTOLOGY DKG	BABELFISH Convex Global DLT ReCheck Green Box OTCnLNG DAOstar INGRESS CAPS-CO Low-code app builder

<b>Distributed system, Decentralisation, geographical diversity of blockchain nodes</b>	GRAPHCHAIN COPYRIGHTLY KNOWLEDGE X	PS-SDA	TRUSSIHEALTH
		DESMO-LD	
		ADOS	BABELFISH
		PRINGO	Convex Global DLT
		CARECHAIN	ReCheck Green Box
		PXC	DEFev
		ONTOSPACE	OTCnLNG
		GEONTOLOGY	CREATE
		DKG	Low-code app builder
		Bowler	
		PS-SDA	
		NFTWATCH	
		<b>Environmental sustainability/greenness</b>	

By empowering innovators through its 3 Open Calls ONTOCHAIN has also widely contribute to the European Policy Objectives to the EU's digital strategy as reflected in the following table.

**TABLE 2: ONTOCHAIN CONTRIBUTION TO THE EUROPEAN POLICY OBJECTIVES**

	OC1	OC2	OC3
<b>Digital Services Act (Ensuring a safe and accountable online environment)</b>	REPUTABLE	CARECHAIN, MFSSIA	
<b>Digital Market Act (Ensuring fair and open digital markets)</b>	POC4Commerce	PRINGO, NFTSWAP, PXC	
<b>European Digital Identity strategy</b>	ONTOSSIVault, HIBI		TRUSSIHEALTH
<b>European Data strategy</b>		PS-SDA	

Based on its outcomes, by participating in different events of the EU (e.g EC cycle of roundtables blockchain, standardization and verticals), of the NGI initiatives (NGI forums) and other, ONTOCHAIN has had the opportunity to convey key messages to policy makers and other stakeholders that takes part in the Web 3.0 development, it:

- o Proposes policy measures to establish a regulatory framework that safeguards user privacy, data security, and trust while promoting innovation and collaboration. These measures are presented in the deliverable D6.5 ONTOCHAIN recommendations.



- o Encourages continued research and innovation in blockchain and distributed ledger technologies, focusing on addressing challenges and realizing the full potential of semantic blockchain (D6.5 ONTOCHAIN recommendations).

### 3.2 ONTOCHAIN IN THE CONTEXT OF EBSI

Over its three years of implementation, ONTOCHAIN has not only aligned with the initial use cases of the European Blockchain Services Infrastructure (EBSI) but has also generated ambitious and innovative solutions. These innovations have the potential to contribute to EBSI use cases in the future, particularly in the context of cross-border digital services aimed at supporting citizens and businesses. The table below showcases specific ONTOCHAIN solutions that are relevant to certain EBSI use cases.

TABLE 3: ONTOCHAIN CONTRIBUTION TO EBSI USE CASES

EBSI Use Cases	OC1	OC2	OC3
<b>Identity</b>	ONTOSSIVault, HIBI		TRUSSiHEALTH BABELFISH ReCheck Green Box My3Sec ECOS
<b>Trust data sharing</b>	COPYRIGHTLY KNOWLEDGE X REPUTABLE POC4COMMERCE	PRINGO PXC MFSSIA GEONTOLOGY DKG Bowler NFTWATCH NFTSWAP	DEFev OTChLNG DLMD CREATE INGRESS CAPS-CO TRUSSiHEALTH

Potential use cases generated by ONTOCHAIN that could be suggested to EBSI to be implemented are the following: copyright management, trustworthy and legally compliant digital transactions.

## 4. CONCLUSIONS

In conclusion, the efforts and achievements of ONTOCHAIN have clearly showcase its commitment over the past three years not only to align but also to actively contribute with the ongoing evolution and expansion of blockchain applications within the European blockchain ecosystem. The project's willingness to adapt and contribute to the dynamic landscape of blockchain technology reflects its dedication to staying at the forefront of advancements.

With its blueprint architecture referenced as a backbone for any development within ONTOCHAIN since the beginning of the project, with the follow-up of the evolution of the regulatory frame around blockchain in EU but also with a more global vision, with the systematic approach implemented within its OCs targeting challenges and requirements to be considered by the innovators, ONTOCHAIN has not only led to the creation of advanced technological blockchain solutions but also to a digital ecosystem that upholds legal and ethical standards as well as human rights.

Striking the right balance between fostering innovation and ensuring compliance with existing laws was essential for the responsible development, scalability, and adoption of the ONTOCHAIN ecosystem of solutions. This approach will be maintained after the completion of the project when it will be the time to sustain ONTOCHAIN achievements in the context of the ONTOCHAIN foundation.

## REFERENCES

- 1 The Policy Environment for Blockchain Innovation and Adoption: 2019 OECD Global Blockchain Policy Forum Summary Report, OECD Blockchain Policy Series.
- 2 [EUR-Lex - 32016R0679 - EN - EUR-Lex \(europa.eu\)](#)
- 3 [The EU Code of conduct on countering illegal hate speech online | European Commission \(europa.eu\)](#)
- 4 <https://digital-strategy.ec.europa.eu/en/policies/eidas-regulation>
- 5 [Communication: Building Trust in Human Centric Artificial Intelligence | Shaping Europe's digital future \(europa.eu\)](#)
- 6 [The Digital Services Act package | Shaping Europe's digital future \(europa.eu\)](#)
- 7 [European Blockchain Services Infrastructure | Shaping Europe's digital future \(europa.eu\)](#)
- 8 [European Declaration on Digital Rights and Principles | Shaping Europe's digital future \(europa.eu\)](#)
- 9 A human rights-based approach to data. Leaving no one behind in the 2030 agenda for sustainable development. © United Nations 2018
- 10 Tom Lyons, Ludovic Courcelas, Ken Timsit. Legal and Regulatory Framework around Blockchains and Smart Contracts European Union Blockchain Observatory & Forum 2019.
- 11 <https://digital-finance-platform.ec.europa.eu/cross-border-services/ebsi>
- 12 [Digital finance package \(europa.eu\)](#)
- 13 [EUR-Lex - 32023R1114 - EN - EUR-Lex \(europa.eu\)](#)
- 14 [European Blockchain Services Infrastructure | Shaping Europe's digital future \(europa.eu\)](#)
- 15 [RECOMMENDATION OF THE COUNCIL ON BLOCKCHAIN AND OTHER DISTRIBUTED LEDGER TECHNOLOGIES \(oecd.org\)](#)