Industry Insights Report on Web3: Building a Skills and Talent Pipeline for the coming Web3 Decade

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Web3 has the potential to change how we work, how we play, and how we interact with vital services, for the betterment of all. This report will go a long way towards identifying the unique aspects of this wave of technological development to allow Ireland to become a centre for Web3 development and a world leader in developing the right skills and talent for a Web3 future.

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- Una Fitzpatrick, Director of Technology Ireland

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Foreword

Foreword by Technology Ireland

Technology Ireland is the representative body for the technology sector in Ireland and is the authoritative voice driving effective change for the sector. Our vision is to make Ireland a global technology powerhouse. Together with Skillnet Ireland, we are delighted to see this study on building a skills and talent pipeline for Web3.

The EU Commission regards Web3 as a new decentralised paradigm for the web, where users can own and control their data. The Commission's European Blockchain Services Infrastructure (EBSI) supports this transformation by creating an architecture for decentralised trust, making information verifiable and so empowering EU citizens.

However, that promise cannot be fulfilled without also laying foundations now for a future of skilled and trained individuals who will build and develop those vital services and infrastructure.

That work of education also extends to the wider public, as the new paradigm means its features of trust and self-sovereignty must be communicated to users and citizens as a whole, ensuring awareness and adoption.

Web3 has the potential to change how we work, how we play, and how we interact with vital services, for the betterment of all. This report will go a long way towards identifying the unique aspects of this wave of technological development to allow Ireland to become a centre for Web3 development and a world leader in developing the right skills and talent for a Web3 future.

Una Fitzpatrick,
Director of Technology Ireland

Foreword by Blockchain Ireland

It is my distinct honour to introduce this vital report on Web3 and its potential to shape the future of Ireland's digital economy.

As we stand at the cusp of a new era, Web3 presents unparalleled opportunities to revolutionise how we interact with technology, commerce, and society at large. However, to fully harness these opportunities, it is essential that we focus on one of the most crucial elements of any technological transformation — developing a robust skills and talent pipeline.

The findings in this report underscore the growing importance of Web3, not only as a technological advancement but as a shift in philosophy, driven by decentralisation and community empowerment. While the landscape is still evolving, with a lack of widespread adoption and regulation challenges, early movers are already exploring hybrid models, leading us into what may be considered a "Web2.5"era.

One of the most critical insights is the need for Ireland to build its Web3 capabilities now, laying the groundwork through targeted education, cross-industry collaboration, and government support. This report identifies the necessity of structured educational programmes, from foundational courses for business leaders to advanced technical training, ensuring that the country is prepared for the coming Web3 decade.

Particularly noteworthy is the emphasis on non-technical roles, such as communication and community management, which are gaining prominence in this decentralised ecosystem.

Moreover, the recommendations around policy and regulation highlight the importance of providing regulatory certainty in areas such as taxation and accounting, which will allow for innovative business models to thrive. Ireland's strong history in technology sectors positions us to be a leader in Web3, but success will depend on collaboration between government, academia, and industry to ensure a supportive framework for sustainable growth.

I strongly urge all stakeholders — industry, government, and education — to consider the report's recommendations and work collectively to ensure Ireland becomes a global centre of excellence for Web3. The potential of Web3 to restore trust in digital services, empower individuals through self-sovereignty, and foster inclusivity through diverse talent is significant.

Together, we can seize this opportunity to build a future that is not only technologically advanced but also equitable and sustainable. With commitment and collaboration, Ireland can play a leading role in shaping the future of the internet.

Lory Kehoe
Chair, Blockchain Ireland

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Lory Kehoe - Chair, Blockchain Ireland

Executive Summary

Building a Skills and Talent Pipeline for Web3

The Web3 Landscape

Web3, a nascent paradigm characterised by decentralisation, empowerment, and community, presents both immense potential and significant challenges. While early adopters are exploring its applications in various sectors, widespread adoption is hindered by factors such as regulatory uncertainty, infrastructure limitations, and a lack of clear success stories.

The current state of the industry in Ireland

Ireland is extraordinarily well placed to prosper in Web3, should there be the collective and collaborative will to do so. This is based on a number of factors which are explored under government, regulation, taxation, industry ecosystem, and education and training.

Government

From a government perspective, there has been long interest in the elements that will underpin Web3 development, namely blockchain and Distributed Ledger Technologies (DTL), crypto/digital assets, digital currencies and smart contracts.

The Department of Finance was part of the originating group that set up the technology advocacy group Blockchain Ireland.

There have been numerous government publications around blockchain and digital assets, going back to 2018.

However, there has not been a national strategy document produced for the blockchain, crypto, and digital asset topic, as there has in other technology areas such as artificial intelligence (AI).

Regulation

Ireland has fared well in regulation, with the Markets in Crypto Assets Regulation (MiCAR) coming into force in 2024, through the Central Bank of Ireland.

The Central Bank of Ireland has been active in engaging with the community here and has made significant improvements and expansions to its Innovation Hub, and sandbox programme.

However, the EU Blockchain Observatory notes that although "the European Union has been at the forefront with landmark legislations such as the Markets in Crypto-Assets (MiCA) regulation and the Digital Operational Resilience Act (DORA)," it also states "the Central Bank of Ireland and the government's approach to crypto have been relatively conservative compared to other jurisdictions.

The government has not issued any legislation outside the EU regulations." The report adds "MiCA has been pivotal in setting a harmonised regulatory standard for crypto-assets, issuers, and service providers, focusing on consumer protection, transparency, and market integrity."

Taxation

The Irish Revenue Commissioners issued guidance in 2020 on the taxation of cryptocurrencies, but it is of limited scope and refers primarily to capital gains tax (CGT) on cryptocurrency transactions. However, additional clarifications were provided to aid the general understanding of the mechanics of crypto-asset taxation, though areas remain to be defined, such as where someone receives crypto-assets as a salary payment.

Ireland's CGT rate at 33% puts it at a significant disadvantage compared to other EU regions where the rate of tax applied to crypto assets is lower or zero.

Ecosystem

There is a strong, vibrant, mixed ecosystem for blockchain, crypto, digital assets and Web3 in Ireland.

The ecosystem covers start-ups that are increasing in double digit growth rates each year, supportive groups such as special interest groups, communities, and foundations; and a range of enterprises and financial institutions. Added to this are a range of digital asset exchanges and platforms, with major data infrastructure providers, all supporting Web3 efforts.

There are also adjacent supports such as blockchain labs or centres of excellence with the large advisories.

There are also strong supports such as the 2023 funding of almost €60 million as part of the Disruptive Technologies Innovation Fund, to encourage businesses to do more in research and development fields here in Ireland.

Key Challenges & Opportunities

Skills Gap

The Web3 ecosystem faces a shortage of skilled professionals, particularly in areas such as blockchain development, smart contract engineering, and community management.

Regulatory Environment

The slowly evolving regulatory landscape creates uncertainty for businesses operating in Web3, impacting investment and growth.

Infrastructure Development

The supporting infrastructure for Web3, such as blockchain networks and decentralised applications, is developing rapidly, but still in its early stages.

Education & Awareness

Traditional education systems are slow to adapt to the rapidly changing needs of the Web3 industry, while public awareness of the technology remains low.

Recommendations

Education & Training

- Develop comprehensive education programmes covering Web3 fundamentals, technical skills, and business acumen.
- Collaborate with industry leaders to create relevant and up-to-date training materials.
- Promote public awareness campaigns to demystify Web3 and encourage wider adoption.

Infrastructure Development

- Support the development of scalable and interoperable blockchain networks and decentralised applications.
- Encourage collaboration between industry players to accelerate infrastructure advancements.

Regulatory Clarity

- Advocate for clear and consistent regulations to foster a conducive business environment.
- Engage with policymakers to address specific concerns related to taxation, accounting, and growth planning.

Talent Development

- Establish mentoring programmes and networking opportunities to connect aspiring professionals with industry experts.
- Provide financial support and resources to Web3 startups and entrepreneurs.
- Foster a diverse and inclusive Web3 ecosystem that attracts talent from various backgrounds.

By implementing these recommendations, Ireland can position itself as a leader in the Web3 space, capitalising on its vibrant tech culture, strong track record, and fostering innovation.

Stakeholder Summaries

Education Stakeholders

Immediate Actions

1. Develop Education Course:
There is an immediate need to create a course or courses covering the fundamentals of Web3 aimed at business leaders and entrepreneurs.

Short- Term Actions

2. Publicise Existing Resources:
Circulate all existing relevant technical and business resources related to Web3 through respective supportive communities, such as developers, marketers, community managers, entrepreneurs, etc.

3. Develop New Resources:
Create new materials addressing business fundamentals as they relate to Web3, such as financial services, taxation, and growth strategies.

Medium-Term Actions

4. Develop Courseware:
Enhance education and skills frameworks with new materials, refined through industry consultation.

5. Collaborate with Technology Vendors:
Engage technology vendors to provide education resources to developers, supervised by skills agencies to ensure professional recognition.

6. Introduce Micro-Credentials:
Implement short, focused courses with micro-credentials that can be integrated with formal learning pathways, recognising and validating prior learning.

Ongoing Actions

7. Establish Skills Forums:
Set up regular skills and education forums involving policy, industry, and education stakeholders to keep resources updated and relevant.

8. Host Public Awareness Campaigns:
Launch campaigns to educate the public about Web3, using successful previous initiatives as models.

9. Highlight Successes:
Develop and communicate use cases to improve public knowledge and understanding of Web3.

These steps aim to build a comprehensive skills and talent pipeline for Web3, ensuring a robust and continuous flow of knowledgeable professionals.

Policy & regulation stakeholders

1. Increase Regulatory Certainty: Develop clearer and more comprehensive regulations to support the innovative business environment required for Web3.

2. Focus on Business Model Innovation: Adapt regulations to accommodate and encourage new and innovative business models within the Web3 space.

3. Improve Taxation, Accounting, and Growth Planning Policies: Review and enhance policies related to taxation, accounting, and growth planning to better support the unique requirements of businesses in the Web3 industry.

4. Collaborate with Education and Skills Forums: Engage in ongoing discussions with education and skills forums to ensure that policy developments are informed by industry and educational needs, providing feedback to policy makers and regulators.

By addressing these key areas, policy and regulation stakeholders can help create a more supportive and dynamic environment for the growth and innovation of the Web3 industry.

Industry stakeholders

1. Provide Industry-Specific Supports: Develop mentoring, funding, financial, taxation, and advisory services tailored to the Web3 industry.

2. Create and Share Case Studies: Develop case studies that showcase successful Web3 applications, services, and business models to improve awareness and understanding.

3. Enhance Industry Ties for Support Agencies: Foster closer ties and dialogue between support agencies and the industry to ensure that support facilities and services evolve with industry needs.

4. Facilitate Community Supports: Provide spaces and funding to support community initiatives within the Web3 sector, promoting its open and accessible nature.

5. Promote Web3's Sustainability Strengths: Capitalise on and publicise the sustainability benefits of Web3, highlighting these as specific opportunities beyond just fundamental Web3 education.

6. Support Underrepresented Groups: Examine and support the aspects of Web3 communities that attract women and other underrepresented groups, recognising and addressing any imbalances to broaden opportunities.

By focusing on these action points, industry stakeholders can effectively contribute to the growth and inclusivity of the Web3 ecosystem.

All stakeholders

1. Cross-Sectoral Collaboration: Ensure careful use of terminology and nomenclature to make resources easily discoverable and interpretable.

2. Learn from Past Development Cycles: Use lessons from previous technology cycles to understand likely time frames for Web3 adoption, which may take up to 10 years.

3. Broad Preparation: Utilise this preparatory period to understand the implications of Web3, focusing on public awareness and user-friendly implementation of personal identity and data ownership.

4. Facilitate Public Engagement: Make it easy and advantageous for users to manage their personal identity and data to ensure the central value proposition of Web3 is realised.

5. Restore Trust and Combat Disinformation: Leverage Web3 technologies to rebuild trust in internet services and providers and use its strengths to tackle disinformation effectively.

6. Monitor Public Initiatives: Learn from initiatives such as the Irish COVID Tracker app and the EU Digital Identity Wallet to gauge public appetite and readiness for self-custodial facilities.

7. Evaluate Value Proposition: Assess whether the envisioned future internet is valuable enough from public service, economic, and societal perspectives to justify a decade of preparation and planning.

These steps will guide the development and adoption of Web3, ensuring it aligns with the needs and expectations of all stakeholders.

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Introduction

The internet has heretofore developed along well documented generations.

The first stages were regarded as Web 1.0, where large service providers had relatively centralised and static resources that offered little interaction. Some of the notable early companies represented on the web were recognisable names from the tech world, such as Apple (earliest site launched in 1993), Amazon (1994), IBM (1994), Microsoft (1994), Yahoo! (1994), and eBay (1995). Other notables were IMDb (1993), Pizza Hut (1994), and BBC (1997). Notably, Google did not arrive until 1997[1].

The second major stage, or Web 2.0, saw the emergence of resources that were much more distributed but also more interactive, where users also produced content. This is sometimes characterised as the 'Social Web', due to the rise of what was later termed social media companies, such as Facebook, MySpace, and Friendster. User created content propelled the likes of YouTube to phenomenal growth, but also saw the advent of Wikipedia[2]. New technologies such as Dynamic HTML[3], allowed web pages to become publishing portals for users, creating bulletin boards and discussion forums.

However, this also meant that there was a great propensity to harvest the information of users for monetisation. Although invented in 1994, the Web 2.0 era was somewhat characterised by the rise of the use of the web cookie that allowed a web server to deposit a small file containing specific details on a web user's computer, allowing identification and tracking of that user[4]. These cookies could then be read by other services too, and this allowed mass harvesting of data, along with other mechanisms and parameters, that gave certain companies and services providers masses of information regarding user demographics, behaviours, and preferences.

The third web

The next major stage of development, described as Web 3.0, or Web3[5], leverages recent advances in technology, such as blockchain and distributed ledger technology (DLT) with non-fungible tokens (NFT) and cryptocurrencies, to give users and platform operators more control. A key feature of Web3 is its decentralised and peer-to-peer nature. A website owner or service user can be freed from the hegemony of large services and platforms that tend to hoard user data, having greater control of their own data and how other services interact with that data.

This paradigm shift in control and self-determination represents a major opportunity. This has the potential to impact public services, education, social services, as well as retail, entertainment, and healthcare, allowing tailored services informed primarily by user data instead of algorithms, but with the consent of the user.

Already, Web3 as a concept leveraging multiple technology layers, is facilitating development and adoption of the metaverse, the visualisation of the next generation of the internet. This area alone is already thought to be worth more than $94 billion, according to Statista[6] , with some projections saying this could increase manifold by 2030.

However, these developments are not just a 3D visualisation of what is already there, Web3 represents a complete shift in how people can interact with digital services. By retaining complete control of both personal and interaction data, the user can choose with whom or what they share of data, with the ability to revoke such permissions at any time. Leading to the concept of self-sovereign identity (SSI) management, Web3 can fundamentally change how people engage digitally.

This has implications across everything delivered digitally and must be taken into account in developing new public services, health and wellbeing services, as well as consumer services, entertainment, and more.

Another aspect of this development is increasing application of digital infrastructure with which to provide platforms for the next generations of technology. This must be closely managed to ensure that all new developments can be done sustainably at scale. New data architectures and deployment models will require new computing and an increasing level of automation, artificial intelligence and machine learning (AI/ML) to operate, orchestrate, and optimise. This is a key objective for many working in the field.

Skills & Talent

This potential new generation of internet technologies will require new skills and talent development capabilities. While Web3 is to a certain extent, an extension of existing technologies, there are significant areas of innovation that will require immediate, medium, and long term measures to ensure that Ireland has the right availability and mix of skills and talent to take advantage.

A broad range of skills will be required, across technical, business, and soft skills. Community is a key area of Web3 that has arguably not featured as highly in previous such developments. Work must be undertaken to ensure the right channels and vehicles for education, skills, and talent development are available and informed by the needs of industry and society.

Ireland and Web3

Ireland is well placed to take advantage of the Web3 phenomenon. With a strong base of what could be termed a Web 2.0 ecosystem, Ireland has adapted well to all the technology areas that have both the developmental building blocks and development patterns likely to inform Web3 development, such as ecommerce, digital financial services, gaming, digital design, and cloud computing. Consequently, there is also a significant education and skills infrastructure on which to build for the needs of this new development.

However, Web3 is developing fast and is yet in its early stages. Work must be done now, to ensure that understanding is widespread for all stakeholders across the Quadruple Helix of government, academia, industry, and society to prepare now for a Web3 future, and all that it entails.

This report will leverage all related disciplines and organisations to build a cross-community capability to inform data gathering and community contribution in building a picture of our current capability and our future needs and develop those into recommendations for how best to take advantage of this next major iteration of the digital world.
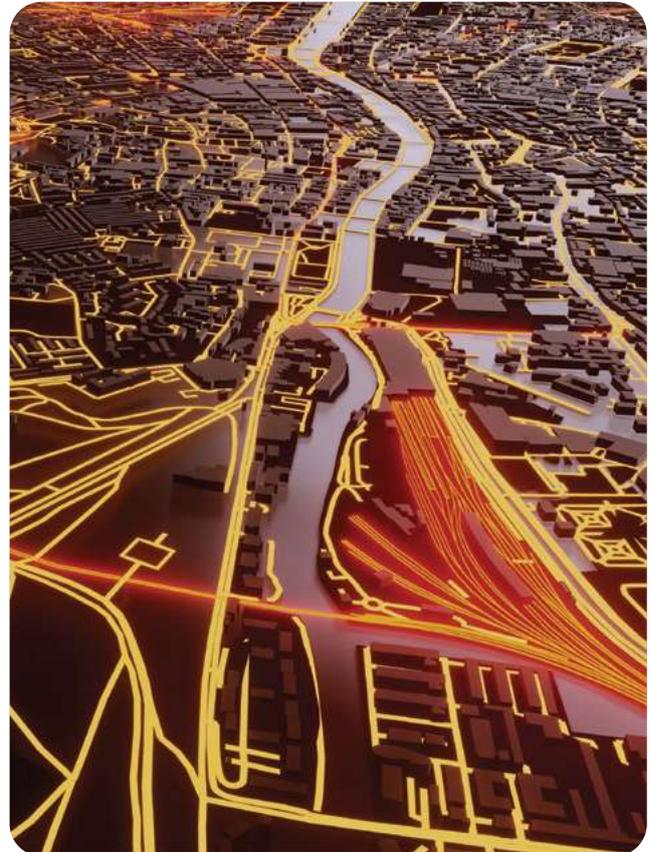
> "Ireland has adapted well to all the technology areas that have both the developmental building blocks and development patterns likely to inform Web3 development, such as ecommerce, digital financial services, gaming, digital design, and cloud computing."

Objectives

Objectives

The primary objective of this report is to take a talent-based approach to identifying the opportunities Web3 technologies can offer Ireland, researching the necessary resources and supports to allow people and business to take full advantage of these opportunities and make informed recommendations for businesses to embrace Web3 in a sustainable manner.

There are specific explorations of:

New Business Models in the Web3 Era

Existing and emerging business models leveraging or built on Web3 technologies

Fostering Talent for the Web3 Ecosystem

Mechanisms and pipelines to encourage and develop talent for the Web3 ecosystem

Assessing Web3 Readiness in Businesses

Examination of the preparedness of businesses for Web3 and its related technologies with a view to formulating recommendations for improvements

When discussing Web3 in this context, it includes related areas, such as, but not limited to, the Metaverse and Enterprise Metaverse.

The report aims to provide a comprehensive set of recommendations for government, public services, business supports, and academia to develop the necessary services and resources necessary to prepare Ireland for a Web3 future.

Methodology

Methodology

Stage 1: Discovery

Firstly, Stage 1 consisted primarily of desk research that examined current best practices and approaches to Web3 in Ireland, within EU countries, and exemplar countries globally.

This also looked at national and EU level policies, frameworks, and guidelines in Web3 and related technological areas.

There was an examination of existing skills and education resources for talent provision, including cross and upskilling programmes. Contributions were sought from relevant institutions working in the field and relevant adjacent areas.

Stage 2: Surveys and data gathering

In the second stage, research was conducted through surveys in business, technical, and public spheres. This aims to gauge the current state of the marketplace and ascertain future needs. Assessments were made of academic resources to identify Web3 cross and upskilling opportunities.

There was an evaluation of talent demand, through examining the nature and incidence of job vacancies in the area.

A broad range of subject matter experts were interviewed directly, with conferences, events and other publications also leveraged as sources.

A number of events were conducted or partnered within relevant spheres and communities to further widen the data sources and provide interactions to gather experiences and insights.

Relevant major events were attended to further facilitate interaction and fact finding.

Stage 3: Review Workshops

Workshops were undertaken with education and business experts to review the research, surveys and subject matter expert interview materials, all building towards the report recommendations.

The report approach, methodology, and surveys were developed with academic partners in Atlantic Technological University Galway, and Dublin City University (See appendix).

Consultations with technology associations, relevant industry bodies, and sector events, captured further industry insights. This included undertaking seminars and webinars on Web3 to capture and share feedback and insights directly.

Stage 4: Expected Outcomes

This report provides a basis for government, and Skillnet Ireland, to be informed as to the scope and magnitude of opportunities for Ireland around Web3 and its related technologies.

The report aims to provide sufficient information and recommendations to allow the respective parties to provide supportive frameworks across aspects of policy, regulation, education and training, and business, to allow Ireland to develop and thrive as a global centre of excellence for Web3.

With the specific focus on skills and talent development, the report provides a starting reference, identifying the necessary priorities that can be built upon incrementally, evolving as the technologies and their uses do, with society and business into the digital future.

With considerations for our indigenous small and medium enterprises (Web3 start-ups near doubling from 2023 to 2024), and FDI sectors, the report takes specific account of sustainable technology implementation in building an industry and workforce ready for the future.

Subject Matter Expert Interviewees

Individual	Title	Organisation	Org Type
Barry Lowry	Government CIO	OGCIO	Government
Leo Clancy	Former CEO	Enterprise Ireland	State Agency
Nena Dokuzov	Coordinator, Strategy of digital transformation of economy	Ministry of the Economy, Tourism and Sport, Slovenia	Government
John McGeown	Assistant Principal Officer	Department of Further and Higher Education, Research, Innovation and Science	Government
Horacio González-Vélez	Professor of Computer Systems, Founding Head of The Cloud Competency Centre	National College of Ireland (NCI)	Education
Professor Joyce O'Connor	Founding President, NCI; Co-founder Block W; Chair Digital Group IIEA; Chair Europe's Digital Future Network	INATBA	Industry body
Irina Tal	Assistant Professor, School of Computing	DCU	Education
Sara Jane Kenny	Junior Developer Community Advocate, Algorand Foundation; BlockConnect Co-Founder	Algorand Foundation	Industry
Frank Friel	VP Technology Management, Blockchain Incubator	Fidelity Investments, FCAT	Industry
Joe Farren	Founder/CEO	Web3 Media Labs, Fanzon3	Industry (Small business)
Giancarlo Sanchez	Founder/CEO	Webstudio.so; ETH Dublin	Industry (Small business)
Ryan Kemp	Co-founder @ETHDublin; Events @Chorus One	Chorus One	Industry (Small business)

Individual	Title	Organisation	Org Type
Moran Hertzanu Weiss	Chartered Blockchain Analyst	Independent	Industry (Small business)
Alexandra Overgaag	Lawyer, consultant, CEO	Thrilld Labs	Industry (Small business)
Anastasia Platonava	PhD Researcher	TUS Athlone	Education
John Ward	Founder/CEO	ServBlock	Industry (Small business)
Gonzalo Faura	Founder/CEO	Swappsi Software	Industry (Small business)
Radhakrishna Dasari	Technical Education Lead	Web3 Foundation	Industry body
Owen Healy	Specialist recruiter	Blockchain Talent	Recruitment
Lorcan Kelly	Research Assistant, Labour Market and Skills Team	ESRI	Research

What is Web3?

What is Web3?

The term Web3, or less commonly Web 3.0, is seen as the latest iteration of World Wide Web technology that is fundamentally different to previous iterations.

Whereas the first iteration of the web was primarily a read only experience, the second generation was referred to as read/write, as users were able to upload their own content in varying levels of sophistication over time. This development phase has led to the rise of social media we experience currently.

Web3 is another level of capability that is being referred to as read/write/own[7] . This development phase allows users to not just upload their own content, but to own and manage their identity, content, and digital assets, on decentralised applications and services, without the need for intermediaries.
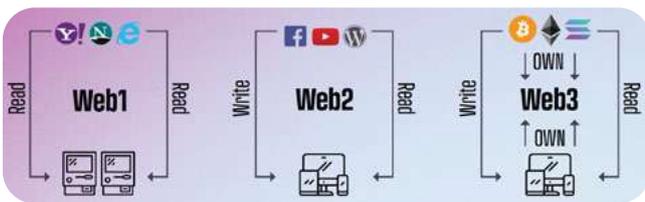
(Blockchain Ireland, reproduced by kind permission)

During the research phase of this report, the following definition was used:

"Web3 will be defined as a new iteration of the web grounded in principles such as decentralisation, composability of applications, service accessibility, data privacy, and the ability for users to own and exchange digital assets, while managing their own identities without intermediaries."

(Osservatori.net, 2023[8])

These key characteristics of decentralisation, composability of applications, and service accessibility are generally built on technological layers such as blockchain and cryptography, that facilitate data privacy and SSI management, which in turn support the use of digital assets, such as tokens (NFTs) or crypto-currencies which can be traded or received by users in the form of reward.

Typically, Web3 users can manage their own data, to the point of monetisation where applicable.

History and context

The term Web3 was first coined in 2014 by Ethereum co-founder Gavin Wood. Wood has been at the centre of technological development around Web3 for many years, leading Parity as CEO, before founding Polkadot.

Wood envisioned a different way to interact with and use the web, where users had more control, more input, and more privacy, controlled by themselves, without the need for a monolithic infrastructure and the potential to be exploited as a result of using it.

In various interviews and presentations[9], Wood talks about the need for less trust in the next iteration of the internet, as blockchains and cryptography increase privacy and control of data. Wood also maintains that the Web3 proposition increases reliability and accountability.

This move towards having to trust web applications less comes as a direct result of numerous and repeated exploitations of user data from many sources, such as Facebook[10] , Google[11] , Microsoft[12] , Twitter[13] (now X.com) , TikTok[14] , and others.

These kinds of incidents and practices are facilitated by the highly centralised nature of services, such as major social media platforms, concentrating data, and placing its value with the collector, not the source, resulting in effective monopolies.

This breakdown of trust has been further compounded by the use of large amounts of data, often copyrighted and without permission, to train large language models (LLM) in AI[15].

It is argued that in leveraging technologies such as verifiable identity, cryptography, and blockchains or DLTs, these kinds of incidents and practices can be minimised or eliminated altogether. Furthermore, there are also proposals for how blockchain, combined with artificial intelligence (AI), could be used to combat misinformation and disinformation[16], through verifiable sources being stored immutably on blockchains for reference and verification purposes.

Value of Web3

Currently many large, free online services and platforms, though in some cases paid too, have punitive terms and conditions that mean user data, input, and content, can be used by the service, or parent entity, in ways that benefit the provider, not the user.

One of the most recent examples was a change in terms and conditions from Adobe that would allow it to examine existing and newly created material, saying it "may access your content through both automated and manual methods, such as for content review."[17]

Though there have been significant efforts to combat this, through regulation, such as the EU ePrivacy Directive of 2002 (amended 2009)[18] and latterly, the General Data Protection Regulation[19], there have been numerous cases of exploitation of user data[20], in various guises, some legal, and some not, since. These cases have eroded trust and led to many defections and abandonments of once popular services.[21]

In this context, Web3 has the potential to be a paradigm shift for a number of reasons.

Firstly, its decentralised nature means that there is less chance of a single service monopolising a niche to the detriment of users. Decentralisation and composability of applications means that envisaged Web3 infrastructure does not facilitate the mass aggregation of users of data that characterised much of Web2, as it is seen today.

Secondly, blockchains and DLTs mean that much of the essential data, where appropriate, can be made visible to all users of the blockchain or ledgers (onchain)[22], meaning that value can be delivered back to users.

Smart Contracts

Smart contracts, which are self-executing programs automating actions required in an agreement or contract that once completed, are trackable and irreversible, further mean that centralised oversight and control are not necessary. Smart contracts can govern every aspect of the operation of a service or applications, bringing the key blockchain characteristics of efficiency, accuracy, and immutability.[23]

Smart contracts are also central to the organisation and governance of distributed autonomous organisations (DAO)[24], which are often set up to govern an aspect of Web3 communities or projects, such as MakerDAO that governs the Dai decentralised digital currency[25]. A DAO is a decentralised organisation emerging as a form of legal structure with no central governing body, whose members share a common goal to act in the best interest of the entity. DAOs are characterised by power being distributed across token holders who collectively cast votes, where all votes and activity are posted to a blockchain, ensuring all actions of users are publicly viewable.

Users engage with Web3 services using a verified identity and a safe repository called a digital wallet. Identity verification can be distributed across the nodes of the decentralised infrastructure, ensuring no single point of failure, and increased availability and resilience. The World Wide Web Consortium (W3C) has developed a standard for Decentralised Identifiers (DID)[26] to facilitate implementation.

Through the combined use of these technologies, services and standards, users can safely employ such facilities as digital currencies, value tokens or NFT to either trade amongst themselves, pay for goods or services, or receive rewards for their content, interaction with, or contribution to the management of, the platform[27].

There is also the facility to commit resources to the platform for a period of time, known as staking, which can also gain the user benefits. This has been described as akin to investing money in a high-yield savings account for a period[28].

These combined features and characteristics of Web3 are a significant change for the end user. The Web3 user is a content creator and contributor to services and applications used, not just a consumer, and derives direct benefits as a result. There is no longer a means, let alone a provider tendency towards, exploitation or monetisation of data, either transaction or user.

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> Blockchain games use cryptocurrencies, NFTs, and the blockchain as part of a game's architecture — accelerating the game development process.
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Web3 use cases and business models

The applications and use cases of Web3 are, as yet, limited. Later, in the presentation and discussion of survey material, there are specifics for Ireland, but broadly speaking, Web3 use cases tend to cluster in certain spaces, such as decentralised finance, decentralised identity management, gaming, and supply chain transparency[29]. In many cases, blockchain use cases are cited as Web3 use cases, though given the definition cited previously, many fail the test. Depending on the definition of Web3, if it extends to user rewards, not just SSI, few use cases stand up[30].

In a report from Deloitte in late 2023[31], it states: Web3 "can offer users the ability to own their experiences, create new ones for customers and counterparties, and enable them and entities to interact without a need for trust.

This is because the core constructs of Web3 — blockchain-enabled cryptographic securities, digital assets supported by "trustless" representation of information, and smart contracts facilitating complex processing of information — can provide the necessary assurance and trust framework. This paradigm shift could create opportunities for new economies and business models, can reduce intermediaries, and makes existing processes more transparent and efficient while also permitting interactions with customers in new and meaningful ways."

The Deloitte report lists some key Web3/blockchain use cases as:

• Peer-to-peer monetary transactions.
• Improved liquidity and speed of settlement for financial assets.
• Digitalisation of real-world assets for better recordkeeping.
• Retention of data ownership.
• More transparent and auditable recordkeeping.
• Creation of digital ecosystems where Web3 enterprises and participants can interact without the need for implicit trust.

Web3 offers the possibility of numerous benefits and addresses key concerns of today's companies and consumers.

Companies may no longer be able to afford to sit on the sidelines and should embrace the competitive advantage offered by Web3.

Despite these potential benefits, wide scepticism may be slowing enterprise Web3 and blockchain adoptions," writes Deloitte.

There are other spaces which are more niche, but worthy of note themselves, such as fan engagement and gaming. "Flight of the Primes"[32] is one such example[33] where intellectual property and collectible culture are merged for the hugely popular comic hero genre.

The platform uses NFTs to democratise IP ownership and offers fans early access to tokenised ownership of featured superhero characters that have been designed by top artists in the genre and which are scheduled to be featured in comics or on screen. The services turn fans into activists for the brand, as well as major stakeholders.

Web3 gaming

Web3 gaming is a near perfect use case and case study for Web3. According to one source, "Blockchain games use cryptocurrencies, NFTs, and the blockchain as part of a game's architecture — accelerating the game development process and creating new revenue streams for developers, while also unlocking true digital ownership to players with open in-game economies[34]."

This tackles two distinct issues with gaming currently. Firstly, the cost and resources needed by developers to compete with major development houses. Secondly, for players, in-game digital items are often locked into closed ecosystems, which means that players cannot derive value from their investment of time and money.

Web3 games offer not just an in-game digital economy, they also offer rewards for support, potential ownership through fractionalisation, and direction in terms of design and future developments.

Finally, Web3 applications and services behind these games allow interoperability between platforms, which means that there can be transferability of digital assets or value between them. A character, skin (character appearance or costume), or digital item, could be carried through to another game, say from Fortnite to Apex Legends, and rewards earned in either could be used in either game[35].

Public services

A noteworthy application on the public services side is that of land registries. Various studies have argued for the efficacy of blockchain-based systems for systems of land registry, such as one from IEEE titled Using Blockchain to Overcome the Issues in Land Registry Management: A Systematic Review[36]. There are also pilots in several other countries including South America, Africa, and Europe[37] and the UK[38]. Citizen interaction with these systems is expected to follow Web3 style engagement, with verified identities and digital wallets.

A step in business models

Web3 is also a significant step in terms of business models. According to one study, "Web3 is fundamentally different from other business models, by empowering value co-creation and value distribution, through the notion of tokenomics and the creator economy that flourishes on mutually beneficial interactions between business, community, and peer-to-peer in a distributed and collaborative environment. An essential theoretical contribution illuminated by our empirical work is the notion of value co-creation and dynamic capabilities emerging in Web3 business models, thus adding knowledge to the current literature on value configuration and the dynamic capabilities view in a Web3 context[39]. "

This concept of sharing value and co-creation is a major departure from previous models, digital or otherwise, and harks back to early cooperatives[40].

However, not all Web3 business models go to the full extent. Some are based more on allowing user input, SSI, and user rewards, but the rewards are not necessarily monetary, or interoperable. In such cases, user loyalty is the main goal, with Web3 loyalty programmes being a use case genre in itself[41].

In summary, there are significant use cases and business benefits to Web3, which include customer engagement and loyalty, customer advocacy and promotion, trust, transparency, security and resilience.

Small business appeal

The basis of decentralised infrastructure and applications, with a composability element and interoperable standards, combine to make Web3 most suitably attractive to small businesses.

The user engagement that Web3 provides, as well as the facilities for deep involvement from users or customers, means that small business, such as artisanal producers of all kinds, can have direct relationships, engendering deep loyalty from customers[42]. The world of collectibles in particular, has embraced Web3, with areas such as comics books, movies, theatre, and the arts more broadly, all seeing significant activity and investment[43].
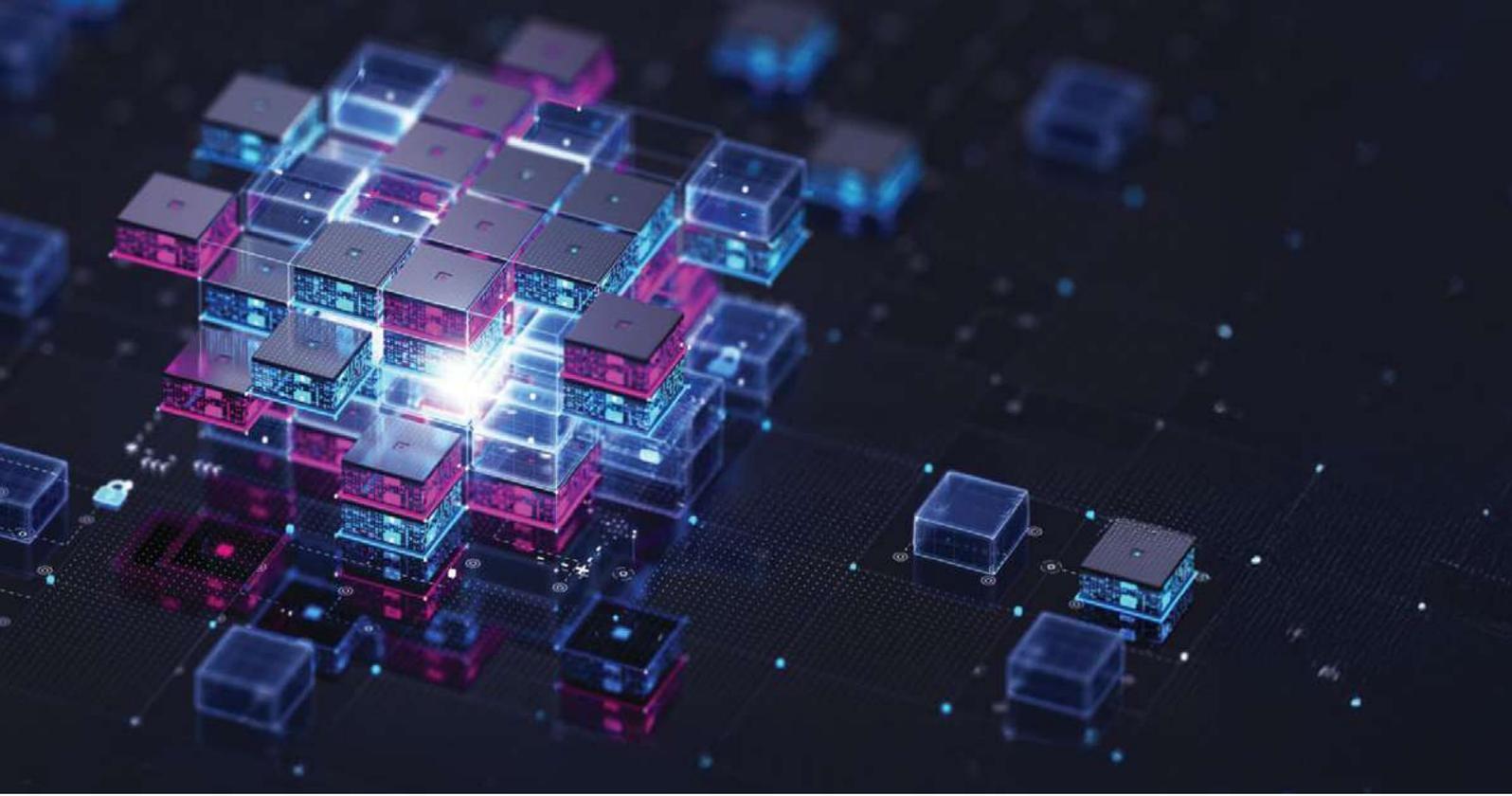
Big brand interest

A notable exception to the small business adoption, though very much on the same model, is found among the major toy brands. Familiar names such as Barbie, Hot Wheels, Lego, and Monopoly have all made significant forays into Web3 through digital collectibles[44]. Sportswear brand Nike launched. SWOOSH in 2022[45], which it describes as "a Web3-enabled platform that champions athletes and serves the future of sport by creating a new, inclusive digital community and experience and a home for Nike virtual creations."

The platform allows Nike members "to learn about, collect and eventually help co-create virtual creations, which are typically interactive digital objects such as virtual shoes or jerseys." After initial poor perception after the NFT crash of 2022[46], Nike pressed ahead, making acquisitions in the area and released digital collections in 2023.

Fashion world

The world of fashion in general, has embraced Web3 and leveraged its characteristics to great effect. The World Fashion Exchange evaluated the impact of Web3 for the fashion industry and noted benefits under supply chain traceability and sustainability; supporting the rise of independent designers; solving authentication problems; customisation and personalisation; rethinking ownership and intellectual property rights fashion brand products with NFTs; and supporting the use of defi in the fashion industry[47]. In a partner event in October of 2023, Blockchain Ireland explored these themes[48] with Aileen Carville of COLONII, Alan Kelly of TUS, and Paula Kilgarriff of TUD. Kilgarriff

explained the concept of phygital fashion[49], and how it blends the physical and digital experience to create something new. Digital fashion shows, digital design, and digital modelling can all be brought to bear to create a new way of presenting and experiencing design. TUS's Kelly described how supply chains and assurance are being changed, reducing waste and accelerating time to value, as designs are turned into garments and then manufactured for the shelves.

COLONII's Carville explained how digital design collections can be created, curated and shared, inviting collaboration from all levels of the industry. Her own venture COLONII not only uses digital design but has created digital characters to explore the personalisation and experience of digital fashion and creativity. Also worth noting in this space is another Irish entrepreneur leading in the fashion world, Alice Delahunt, co-founder of SYKY, a digital fashion pioneer. SYKY is a digital fashion collective that "provides designers with vital resources, education, mentorship, and opportunities to accelerate their journey toward becoming the iconic design houses of tomorrow." It leverages Web3 technologies to enable the design collective[50].

Mindset change

What is also evident in exploring Web3 business models is the mindset change that comes with democratisation, and the need for effective education to ensure understanding. As the previously quoted study found in exploring Web3 business models, "it became evident that there is a current knowledge gap, as no prior research to the best of our knowledge, has looked holistically at Web3 business models and identified key elements and components that are required for a business model to be suitable in a Web3 context[51]."

What makes Web3 different?

There are numerous characteristics of what is broadly accepted as Web3 that are different.

The decentralised nature of the applications and services require a different architecture and development approach, as well as specific hosting facilities.

Blockchain and DLT: almost all definitions of Web3 include blockchains and DLTs, though not all.

Smart contracts are a significant departure for web technologies, and represent a near unique aspect of Web3, fusing contractual, legal, and regulatory aspects of coding. Tokenisation is also a key differentiator as it not only allows an ecosystem economy within Web3, but also allows for real world objects to be represented by tokens, further extending capabilities.

Self-sovereign identity management: this is the facility by which users can manage their own identity, including personal information. This could extend to the likes of medical records, financial history, as well as transactional or in-person activity. A concept known as soul-bound tokens[52] allows reputational or attendance actions to be represented digitally as tokens, adding to the interaction verification capabilities of Web3.

Independence from intermediaries: the ability for Web3 platforms, applications, and services to operate with zero-trust and consensus mechanisms, through facilities such as smart contracts, means that most transactions and interactions can be accomplished without intermediaries, such as decentralised finance (DeFi[53]) where users can finance transactions, staking as a form of micro-investment, or trading digital assets. This also introduces self-custody, where users are in control of their private keys, taking full responsibility for the security of their digital wallet[54].

Web 3 examples

Sapien: Decentralised social news platform, prioritising user customisation and experience.

LBRY: A decentralised network space designed for file sharing and payments.

Storj: Decentralised storage platform that offers users a secure and distributed approach to storing data.

Secretum: A decentralised messaging platform, likened to a decentralised counterpart of WhatsApp, a core focus on elevated security and privacy.

Decentraland: Digital real estate and the Metaverse property platform, distinguished by a vibrant and multifaceted nature, grounded in a Decentralised Autonomous Organisation governance model.

DTube: A decentralised video platform built on Steemit, that allows users to earn monetary rewards in the form of cryptocurrency for creating and curating content, ensuring creative freedom, as content is not subject to censorship or removal based on copyright issues.

Brave: A privacy-first browser, featuring Brave Leo, an AI browser assistant prioritising user privacy, marks a major development. Brave's expanded features, including image, news, and video search results in its Search API, along with an independent image and video search feature, contribute to its comprehensive functionality.

Ethlance: A platform for employers and freelancers to interact in the gig economy in 2024, decentralised to eliminate the need for third-party intermediaries.

Everledger: A digital transparency company, notable for its battery passport pilot with the Ford Motor Company. A pioneering effort in the tracking and management of electric vehicle (EV) batteries throughout their lifecycle. Everledger's advanced technology platform plays a crucial role in ensuring the responsible management and recycling of EV batteries.

Beaker Browser: An open-source and free browser for Web 3.0, featuring peer-to-peer facilities to help users in publishing web apps as well as websites from the browser itself.

Sola: A decentralised social media platform based on the Ethereum blockchain, IPFS storage and distributed nodes. Sola leverages blockchain and artificial intelligence to create a combination of social networks. The Web3 social media platform capitalises on AI algorithms for distributing relevant information to users according to their preferences.

Steemit: Another social media application based on Web3 principles, characterised as an analogue of Reddit, featuring the ability for users to monetise user content.

Mastodon[56]: An open-source social media platform focused on microblogging, similar to X (formerly Twitter) that thrives on diversity. It is composed of independent nodes, known as instances or servers, each with its own rules and policies. Some commentators argue this is not Web3, as it does not run on a blockchain or DLT. However, it meets many of the other Web3 criteria.

Every user is part of a specific Mastodon server, yet they can seamlessly interact with users on other servers. Mastodon operates on the ActivityPub protocol, fitting into the Fediverse, a realm of services like Lemmy, Pixelfed, Friendica, and PeerTube.

Summary: While there is clustering in this list of Web3 examples at time of writing, around social media and content, these are listed by their order of magnitude in popularity.

There are more numerous use cases, depending on the definition of Web3 applied, that appear in a far wider range of application areas.

Web3 criticism and scepticism

There are abundant criticisms and scepticism of Web3. These sentiments appear to centre around two aspects of Web3, firstly, its use of technologies such as blockchain and tokens, but also, its apparent application of a technological solution to a mainly political problem — data privacy. A notable critic of Web3 is inventor of the world wide web, Tim Berners Lee[57].

Despite the fact that Berners Lee put forward many of the principles on which Web3 is founded in his semantic web proposals in 2001[58], he has been highly critical of Web3, differentiating it from Web 3.0, and a vision of a semantic web where users control their own data.

Berners Lee states that "It's a real shame in fact that the actual Web3 name was taken by Ethereum folks for the stuff that they're doing with blockchain. In fact, Web3 is not the web at all."[59]

Highly critical of blockchains in particular, Berners Lee strongly argues that they are not the right technology for this application. Speaking at the Web Summit in Lisbon in 2022[60], Berners Lee said:

"Blockchain protocols may be good for some things but they're not good for Solid [a web decentralisation project led by Berners-Lee]. They're too slow, too expensive, and too public. Personal data stores have to be fast, cheap and private."

"Ignore the Web3 stuff, random Web3 that was built on blockchain. We're not using that for Solid."

Other voices

Berners Lee is not alone in being a significant figure in the development of the web as we know it today, and criticism of Web3. Jack Dorsey, the co-founder of Twitter and founder of Block Inc (formerly Square), is also vocal in his criticism. Initially, Dorsey drew ire from Web3 communities by saying that venture capitalists (VC) would own Web3, not the users or builders, singling out one notable VC in particular, leading to a public spat[61].

However, Dorsey has gone further and recently coined the term "Web5" to suggest that such designations are meaningless, as the technologies being used in Web3, such as crypto tokens are inherently risky, characterising them as "unregistered securities". Dorsey said his company Block Inc was working on open source protocols leveraging bitcoin for payments, as an internet native currency.

Forbes quotes Dorsey as saying he believes that open-source development paired with bitcoin will enable everyone to participate in the future economy.

Vision overshadowed

Another notable figure, Vitalik Buterin, co-founder of Ethereum, has written with concern about the future of Web3, with VCs again contributing to a negative trend.

Buterin expresses concerns[63] that the vision of a decentralised internet is being overshadowed by the oppressive reality of escalating transaction fees on blockchain networks that create a barrier to entry that inhibits innovation and the more widespread adoption: "The number one culprit that I would blame as the root cause of this shift is the rise in transaction fees," wrote Buterin.

Furthermore, there are also concerns that the unique characteristics of Web3, from a technological and development point of view, may be too different from other areas of development, making it an unsuitable starting place for young developers[64].

Writing on Dev.to, Sk Shoyeb argues that instead of getting right into blockchain and Web3 for young developers, "It may be more beneficial to focus on building a solid foundation in programming and web development, and to gain a better understanding of the concepts of decentralisation before diving into more specialised and complex technologies like web3 and blockchain."

Negatives ignored

One sceptic, software engineer and writer Molly White, set up a website entitled Web is going Great, to document all of the less than flattering elements of Web3[65]. In 2023, White appeared at South by South West (SXSW) where she spoke out about the negative outcomes of the push towards Web3 and widespread crypto adoption, which she felt were going largely ignored[66].

There are also rivals to Web3, such as Web0, which not only decry Web3 as being unnecessary, but also offer an alternative. Web0 characterises Web3 as being "decentralisation + blockchain + NFTs + metaverse." It contrasts this with Web0 being "Web3 - blockchain - NFTs – metaverse" in other words "Web0 = decentralisation[67]." Web0 is a project of the Small Technology Foundation[68], with a "mission to evolve the Internet so each one of us can own and control our own place on it," itself a project of noted speaker and digital rights campaigners Aral Balkan, and Laura Kalbag, both based in Kilkenny.

Diverging views

In summary, there are a number of diverging views on Web3, Web 3.0 and what decentralisation and the ability of users to own and control their own identity and content means. Some commentators rightly differentiate between a technological solution to self-sovereignty in particular, and the need for regulatory and legislative measures to protect personal data and prevent its exploitation. This stance insists that a technological solution is desirable, but only as an implementation of the necessary regulation.

Web3
Technology Stack

Web3 Technology Stack

Despite many regarding the term Web3 as "nebulous" at best[69], there is a reasonable consensus as to its broad architecture and technology stack.

The Web3 development platform Alchemy, provides a fairly comprehensive outline[70], consisting of the following, in descending order:

- Decentralised applications (dApps)
- Presentation Layer
- Blockchain interaction layer
- Network layer

In each layer, there are number of subcomponents:

- Decentralised applications
- DeFi
- Identity and Authorisation
- NFTs
- Data
- Presentation Layer
- Web3 Native Libraries
- Developer environments

- File Storage
- Blockchain interaction layer
- Data Access
- Block Explorers
- Network layer
- EVM Blockchains
- Non-EVM Blockchains
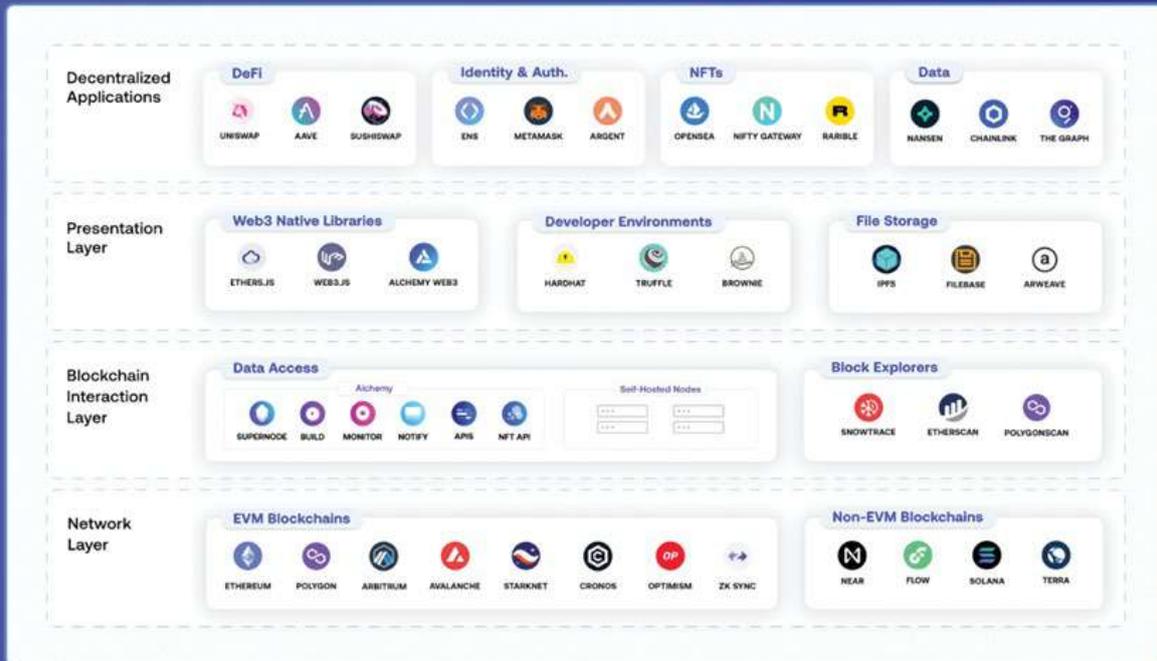
(Copyright Alchemy 2022)

A variation on the theme from Coinbase[71], features slightly different headings:

- **Access layer**
  (Low friction entry points for
  users to access Web3)
- **Wallet/Browser**
- **Aggregators**
- **Web2**
- **Use case layer**
  (User interface for interacting with
  infrastructure/protocol layer)
- **Gaming**
- **Content/Social**

- **NFT**
- **Financial services**
- **Infrastructure/Category Primitives**
  (Interoperable building blocks that are highly
  reliable, doing one specific task; can be
  combined to create applications)
- **Secure**
- **Store**
- **Analyse**
- **Communicate**
- **Govern**
- **Protocol Layer**
  (Underlying main blockchain architecture)
- **Layer 1 and Scaling solutions**
- **Bridge**
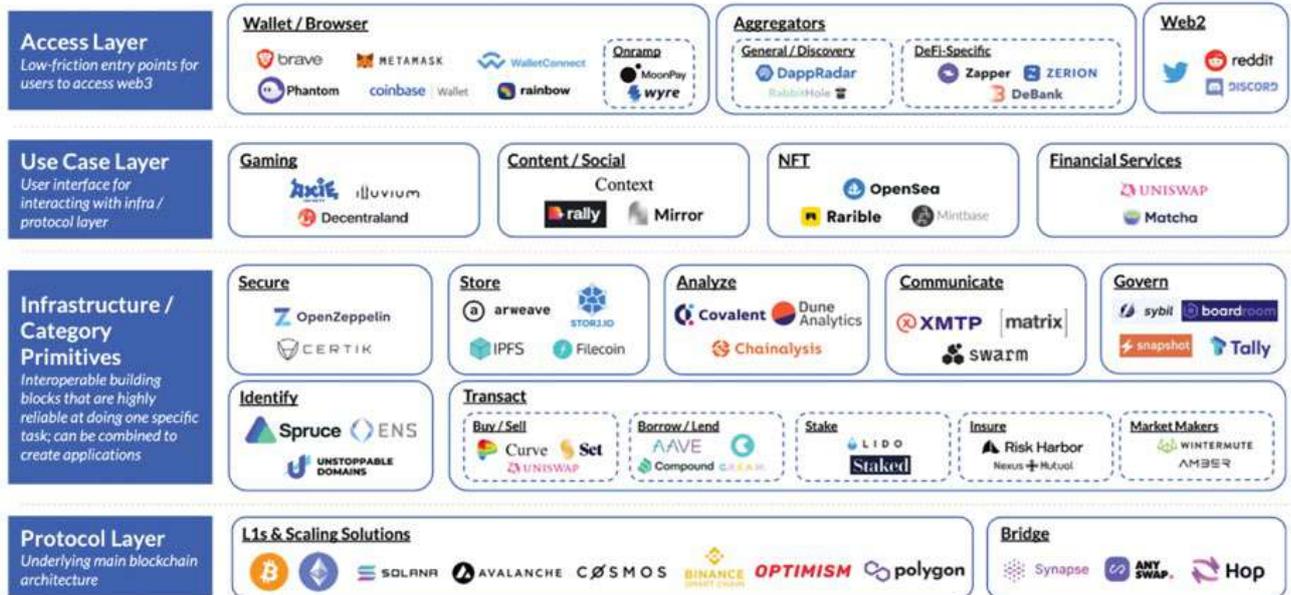
(Copyright Coinbase 2022)

From a neutral developer perspective, one developer, Akash Takyar, of Web3 development form LeewayHertz, puts the stack as follows[72]:
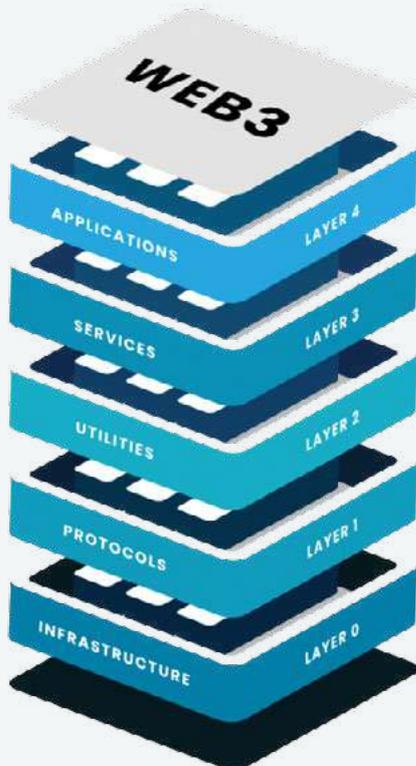
(Copyright LeewayHertz, 2023)

Layer 0 – Infrastructure

Layer 1 – Protocols

Layer 2 – Utilities

Layer 3 – Infrastructure

Layer 4 – Protocols

Layer 5 – Utilities

These three representative views coincide on enough to establish that there is a commonality, if not a standardisation, of what a Web3 technology stack contains.

This gives a certain amount of common ground for developers when embarking on, or evaluating, Web3 as a technological approach to solving a specific problem or addressing a need.

The Current State
of Web3 in Ireland

The Current State of Web3 in Ireland

Ireland is extraordinarily well placed to prosper in Web3, should there be the collective and collaborative will to do so. This is based on a number of factors which were explored under government, regulation, taxation, industry ecosystem, and education and training.

Government

From a government perspective, there has been long interest in the elements that will underpin Web3 development, namely blockchain and DTLs, crypto/digital assets, digital currencies and smart contracts. In this context, it is reasonable to assess the state of the wider blockchain and crypto landscape as a basis for Web3.

In that respect, it was with government interest and support that Blockchain Ireland came into being, developing from cooperative efforts as far back as 2015, to understand and assess blockchain, DLT and related technologies, along with Enterprise Ireland, IDA, and others. Blockchain Ireland is now an incorporated industry advocacy group that promotes knowledge, understanding and adoption of blockchain, crypto and Web3 technologies[73].

The Department of Finance had released a discussion paper entitled Virtual Currencies and Blockchain Technology, as early as 2018[74], with another paper in 2021 entitled A Detailed Analysis of Blockchain Pilots and Applications in Highly Impacted Areas[75]. This latter work was tasked with identifying areas of impact for the local public administration for blockchain and DLT.

The research provides significant value for researchers and practitioners to reinforce current work, align innovation directions, and develop blockchain roadmaps, including:

1. Managing Public Sector Assets using Blockchain and NFT

2. Managing Building Material Traceability using Blockchain and NFT

3. Blockchain-as-a-Service (BaaS) Architecture for DApps and Application for Veterinary Medicine Case Study in Ireland

4. Emerging innovation ecosystems - blockchain and agrifood

Another research initiative in Project Emerald, was a government led consortium of interested parties that set out to create a secure, scalable and privacy-respecting way for exchanging digital credentials locally and internationally[76]. In a broader context, leading initiatives in the public sector elsewhere include the European Blockchain Service Infrastructure[77] (EBSI), Chinese Blockchain Service Network[78], National blockchain test network in Slovenia (SIChain), Government blockchain test network in Estonia, and Singapore government blockchain innovation programme[79]. However, despite expressions of interest, and Irish officials from the Department of Finance being highly active in related European discussions and initiatives, Ireland has yet to establish a node for the EBSI as of June 2024[80].

In July of 2021, the government published the national AI strategy, AI - Here for Good: National Artificial Intelligence Strategy for Ireland. It featured smart contracts within blockchain[81]. As yet, the government has stopped short of producing a blockchain, DLT, and Web3 strategy. However, the Minister for Finance, and the Minister of State at the Department of Finance, through various office holders, have been visible supporters of groups and events in the ecosystem, with appearances, both virtual and in person, at events such as Blockchain Ireland's annual conference, Blockchain Ireland Week, since 2021. This is viewed as a significant support for the ecosystem here[82].

Regulation

Ireland has fared well in regulation, with the Markets in Crypto Assets Regulation (MiCAR) coming into force in 2024, through the Central Bank of Ireland[83]. Regulatory certainty is key support for the ecosystem, here and elsewhere. The harmonised regulatory proposal from the EU helps regulate currently out-of-scope crypto-assets and their service providers in the EU, and provides a single licensing regime across all member states by 2024. The Irish Department of Finance has been closely involved in this process.

The Central Bank of Ireland has been active in engaging with the community here, and has made significant improvements and expansions to its Innovation Hub[84], and sandbox programme[85]. In 2021, the government transposed 5AMLD into law by way of the Criminal Justice (Money Laundering and Terrorist Financing) (Amendment) Act 2021 (2021 Act) and the provisions of the 2021 Act that relates to Virtual Asset Service Providers (VASPs).

For the purposes of the legislation, VASPs are determined as those firms which provide any of the following services relating to virtual assets:

1. Exchange between virtual assets and fiat currencies
2. Exchange between one or more forms of virtual assets
3. Transfer of virtual assets, that is to say, to conduct a transaction on behalf of another person that moves a virtual asset from one virtual asset address or account to another
4. Custodian wallet provider
5. Participation in, and provision of, financial services related to an issuer's offer or sale of a virtual asset or both

As of June 2024, there are 15 Virtual Asset Service Providers (VASP) authorised in Ireland by the Central Bank of Ireland[86], with the addition of Crypto.com in June 2024.

The Central Bank of Ireland has also been active in publishing information and guidance on interpretation and impact of regulations, such as its paper on Impact of Markets in Crypto Assets Regulation (MiCAR) on Virtual Asset Services Providers[87].

The VASP legislation has been largely welcomed by the Irish blockchain, crypto and digital asset community, according to Blockchain Ireland[88], due to the degree of clarity it provides by setting out a clear 'rules of the road' framework. "Larger enterprises typically have access to in-house legal experts, and can call upon external legal counsel to help interpret questions and support applications. However, the same does not apply to smaller entities such as start-ups looking to establish indigenous businesses."

As of late 2024, the VASP authorisation process is giving way to the Crypto-Assets Service Provider (CASP) regime,

for which the CBI has been appointed as the national competent authority under MiCAR[89].

However, there has been some criticism of the government and CBI. The EU Blockchain Observatory and Forum in its May 2024 report EU Blockchain Ecosystem Developments 3[90], notes that although "the European Union has been at the forefront with landmark legislations such as the Markets in Crypto-Assets (MiCA) regulation and the Digital Operational Resilience Act (DORA)," it also states "the Central Bank of Ireland and the government's approach to crypto have been relatively conservative compared to other jurisdictions. The government has not issued any legislation outside the EU regulations, while the CBI prefers that entities seeking 5AMLD authorisation have a strong presence in the country, potentially holding another licence such as an e-money authorisation."

The report adds "MiCA has been pivotal in setting a harmonised regulatory standard for crypto-assets, issuers, and service providers, focusing on consumer protection, transparency, and market integrity."

Industry groups and representative bodies are also working to ensure that there is awareness, discussion and understanding of all applicable regulation, ensuring that Web3 organisations and businesses work within them. This is evidenced by events such as that run in June 2024 by the Start-ups and Web3 working group in Blockchain Ireland, entitled "Web3 innovation without breaking the law."[91]

Taxation

The Irish Revenue Commissioners issued guidance in 2020 on the taxation of cryptocurrencies, but it is of limited scope and refers primarily to capital gains tax (CGT) on cryptocurrency transactions[92]. While it is broadly welcomed to have some element of certainty as to the tax treatment of cryptocurrencies, it does not extend to more sophisticated instances, such as utility tokens and stablecoins.

In an Oireachtas debate of November 2023[93], such points were put to the Minister for Finance Michael McGrath TD, who assured the house that "the Revenue Commissioners are active in this space."

"Industry groups and representative bodies are also working to ensure that there is awareness, discussion and understanding of all applicable regulation, ensuring that Web3 organisations and businesses work within them."

The minister highlighted that there were "taxation obligations" in emerging areas "such as digital assets," and that in 2022, the Revenue Commissioners updated their guidance on crypto-assets. However, the minister said that overall guidance had not changed "with regard to the taxation of crypto-assets. Additional clarifications were provided to aid the general understanding of the mechanics of crypto-asset taxation. This included additional guidance on how to determine if a crypto transaction is trading in nature, how chargeable gains should be calculated for capital gains tax, purposes including the providing of illustrative examples and details of CGT payment dates for non-incorporated persons. It also included guidance that confirmed gifts and inheritances of crypto-assets may be subject to capital acquisitions tax, and that payments of crypto-assets to employees are benefits-in-kind that should be subject to payroll taxation in the ordinary way."

"However, the receipt of crypto-assets as payment by an employee may give rise to additional filing obligations for income tax or capital gains tax, for example, depending on the applicable facts and circumstances for that employee when he or she disposes of the asset at a future date. Guidance was also introduced setting out the record retention requirements relating to crypto-asset transactions."

"I am satisfied the guidance is there, but we perhaps need to find ways to amplify that and raise awareness for people engaged in buying and selling digital assets at this time," said the minister.[94]

While this guidance is welcome, it does not go far enough for many in the business world, and there have been calls for further guidance on wider issues such as stablecoins and broader digital assets categories.

The taxation issue was further highlighted by the recent Global Web3 Index 2024[95], from Coincub.

The index assesses countries under six categories:

• **Regulation**
• **Tax**
• **Ecosystem**
• **Population adoption**
• **Talent**
• **Finance**

The first two criteria are weighted roughly double the following four. Several per capita rankings are also made to identify countries that are 'punching above their weight'.

Switzerland, Singapore, and UAE are the top three countries in the ranking, respectively, primarily for favourable taxation and legislation measures.

Switzerland leads "due to its robust regulatory framework, favourable tax environment, and vibrant ecosystem".

Singapore scores second because of its "high crypto adoption and strong regulatory and technological infrastructure."

UAE scores third because of its "significant crypto ownership, progressive regulation, and a growing ecosystem."

In this overall index, the following countries rank:

Ireland:	Rank 59
UK:	Rank 18
France:	Rank 27
Germany:	Rank 08

Tax rate on cryptocurrency held for more than year

33% Ireland	20% UK
30% France	0% Germany

Regulatory sandbox

While the government has previously expressed a need for regulatory sandbox, there has yet to be significant progress made in this regard, such as an EBSI node.

The Central Bank of Ireland Innovation Hub does administer support and guidance for firms innovating in the financial services sector. Enabling the innovation hub to provide a regulatory sandbox function similar to the UK Financial Conduct Authority [96] (FCA), would give start-ups an opportunity to further test and refine their offerings, provide them with the prestige of being accepted to be part of a CBI regulatory sandbox programme.

This would allow Ireland to be looked upon more favourably by European peers as a 'go-to' fintech location. At present, it is argued[97], Ireland loses points on country fintech ranking indices due to the absence of a regulatory sandbox.

However, as highlighted, the CBI has engaged in significant outreach in 2024, such as consultation process 156, that sought to "Deepen our understanding of innovation in the financial services sector, so that we can better understand the opportunities and risks for consumers and the economy."[98] This process received 20 responses, from organisations such as Irish Funds, Insurance Ireland, Financial Services Ireland, Blockchain Ireland, E-Money Association, Fintech Payments Association, and the Irish League of Credit Unions[99].

Ecosystem

There is a strong, vibrant, mixed ecosystem for blockchain, crypto, digital assets and Web3 in Ireland.

This is evidenced by the government interest, involvement and supports already highlighted, the supportive regulatory environment, and the community activity of groups such as Blockchain Ireland[100], BlockW[101], Fintech Ireland[102], and others.

There are vibrant communities organised through development ecosystems and platforms, such as ETH Dublin[103], the Algorand Foundation[104], and Cardano Foundation[105].

There is also significant startup promotion and support, with initiatives such as TechStars accelerators for Web3[106], and various incubation and hothouse facilities and supports such as DogPatch Labs in Dublin[107], the PorterShed[108] in Galway, Republic of Work[109] in Cork, and RDI Hub[110] in Kerry, under the auspices of NDRC[111].

Combined with this is a list of larger enterprises, multinationals, and a host of supportive and specialists services such as advisories, legal, and business development.

As part of its strategy document from 2022, Blockchain Ireland published an ecosystem map for blockchain, crypto and Web3, that is reproduced by kind permission. It lists 25 categories of activity, ranging from infrastructure, education and training, and research, to international banks, consulting, legal, and HR. This was updated for 2023, with numerous additions, extending to 27 categories of activity.


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(Blockchain Ireland, reproduced by kind permission)

Through PhD research[112], this has been expanded to include regional breakdowns of the entrepreneurial ecosystem, across five key regions, Dublin, Cork, Belfast, Tipperary and Kilkenny.

(Blockchain Ireland, reproduced by kind permission)

There has been further depiction of the Irish ecosystem supporting blockchain, crypto and Web3 by Blockchain Ireland, with CryptoCracker, with an interactive map that lists 88 entities across the entire island.

INTERACTIVE MAP

IRISH BLOCKCHAIN ECOSYSTEM

Ireland is a gaining a strong reputation as a global hub for blockchain technology, with over 100 companies currently working in the space
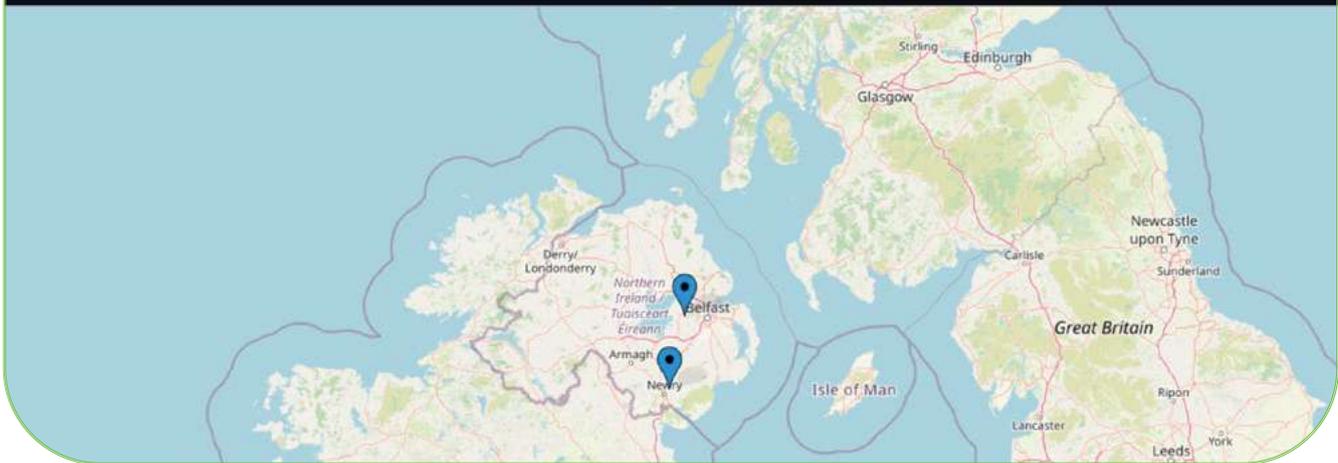
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It is worth delving into the detail of these mappings. For example, as has been highlighted, regulatory certainty is a desirable aspect of the ecosystem. Additionally, specialist legal firms and advisories are also advantageous. Among the listed legal firms with specific expertise in blockchain, crypto, and Web3 are William Fry[113], KPMG Law[114], DEH Law[115], Philip Lee[116], and Bird and Bird[117]. Specialist advisories include SIA Partners[118], Valentia Partners[119], and Provenance Compliance[120], while EY, Deloitte, KPMG, and Accenture also have specific blockchain development labs or centres of excellence here.

The presence of operations such as the Fidelity Centre for Advanced Technologies (FCAT), and some of the larger exchanges such as Kraken, Coinbase, Binance, Gemini, Crypto.com, Coinmama, and Revolut, all tend to create a certain gravity that attracts other aspects of the ecosystem.

Infrastructure

Infrastructurally, the presence of Amazon Web Services (AWS), Microsoft, Google, IBM, and Oracle, alongside specialist providers such as Consensys, Blockdaemon, Polkadot, Chainlink, VeChain, and others, makes access to the appropriate platforms and infrastructure easier and better supported. When this is combined with international banks that are highly engaged with the sector, such as BNY Mellon, JP Morgan (Onyx), Citi, State Street, Credit Suisse, and Deutsche Bank, and viability of a blockchain-based Web3 ventures becomes more solid.

Another critical support is the presence of venture capital and other means of capital sourcing. In that respect, Cosimo Ventures, Delta Partners, Finch Capital, Sure Valley Ventures, NEM Ventures, Draper Esprit, and Frontline Ventures add additional supports to establish or grow related ventures.

In addition to the established cohort of current web giants that provide a solid base for existing web businesses and services, the combination of supportive infrastructure, legal and advisory, financial and capital supports, makes Ireland an attractive and welcoming environment for blockchain, crypto and Web3 activity.

There is evidence of that status from the levels of entrepreneurial activity in the space. From an ongoing PhD study[121], Web3 Start-ups increased from 51 to 89, an increase of 43%, from 2023 to 2024.

Risks to the ecosystem

There is also a significant risk to the ecosystem. It has been noted that much of the activity of the technology, and Web2, multinationals here is primarily administrative and executory. As one subject matter expert noted[122], when pressure comes in the form of a downturn, it can leave operations here vulnerable, as was seen in the post-pandemic period, when previously speculative hiring practices resulted in inflated headcounts that were corrected as markets changed under higher interest rates and geopolitical pressures[123].

If the activity of the major businesses in the sector follows previous patterns, similar risks are to be expected. However, the broader research and development activities of business such as FCAT[124], and Mastercard[125], with its only European technology hub working in areas such as artificial intelligence (AI) and quantum computing, show the viability of research and development operations here in this sector.

According to the EU Blockchain Observatory and forum report in 2024[126], "Ireland has an active blockchain industry, as the business ecosystem and community grows in number each year. There have been public initiatives for blockchain adoption, such as the Irish Government's hackathon in 2023."

"Public and private initiatives to promote blockchain adoption are increasing, as are blockchain education initiatives. Blockchain companies in Ireland have collectively raised tens of millions in funding."

Incentives are also available, such as the 2023 funding of almost €60 million[127], as part of the Disruptive Technologies Innovation Fund, to encourage businesses to do more in research and development fields here in Ireland.

Business supports

Despite the overall positive landscape for start-ups in Ireland, Enterprise Ireland former CEO Leo Clancy admits that it can be difficult to support businesses in this space.

"Crypto is difficult for us, because the regulatory framework is yet to catch up with crypto," said Clancy[128].

"Even with traditional finance companies that we support, we tend to require they achieve some kind of regulation before drawdown of equity tranches. Crypto is even further out, as you can imagine, because of those strictures."

"More of it is because we are a state agency, and we are still exploring the edges of what we can do. For us, crypto is that much harder because there isn't a regulatory framework. If you look at blockchain more generally, you look at DeFi technologies that are based on real world assets, I think that's much easier to think about because it's essentially a technology for working with assets that we know very well and that have regulatory frameworks. It's just a different way of handling them," said Clancy.

New sector development

Ireland has a record of being able to develop new industries and sectors. This is evidenced by its record in financial services, pharmaceuticals and medical technology. The particular approach of the quadruple helix, harnessing and coordinating the efforts of government, academia, industry and society, has proven a powerful strategy in bringing real development. This was the assessment of Blockchain Ireland in its 2022 strategy document delivered to government[129].

"Ireland has an immediate opportunity to become an international hub for blockchain and digital assets, while improving existing Irish industries, as well as global companies that have established global, EMEA, or European headquarters here."

"The last 'big bet' started in 2003 with Google establishing its EMEA HQ in Ireland. As Web2 (websites that emphasise user-generated content, ease of use, participatory culture and interoperability for end users) gives way to Web3 (the new iteration of the World Wide Web that incorporates decentralisation based on blockchains), now is the time to place another 'big bet' for the coming decades."

After the turbulence of markets through 2022 and 2023, the global Web 3.0 market size was estimated at $2.18 billion in 2023 and is projected to hit around $65.78 billion by 2032, expanding at a CAGR of 46% during the forecast period from 2023 to 2032, according to Precedence Research[130].

Projected Growth of the Global Web 3.0 Market (2023 - 2032)
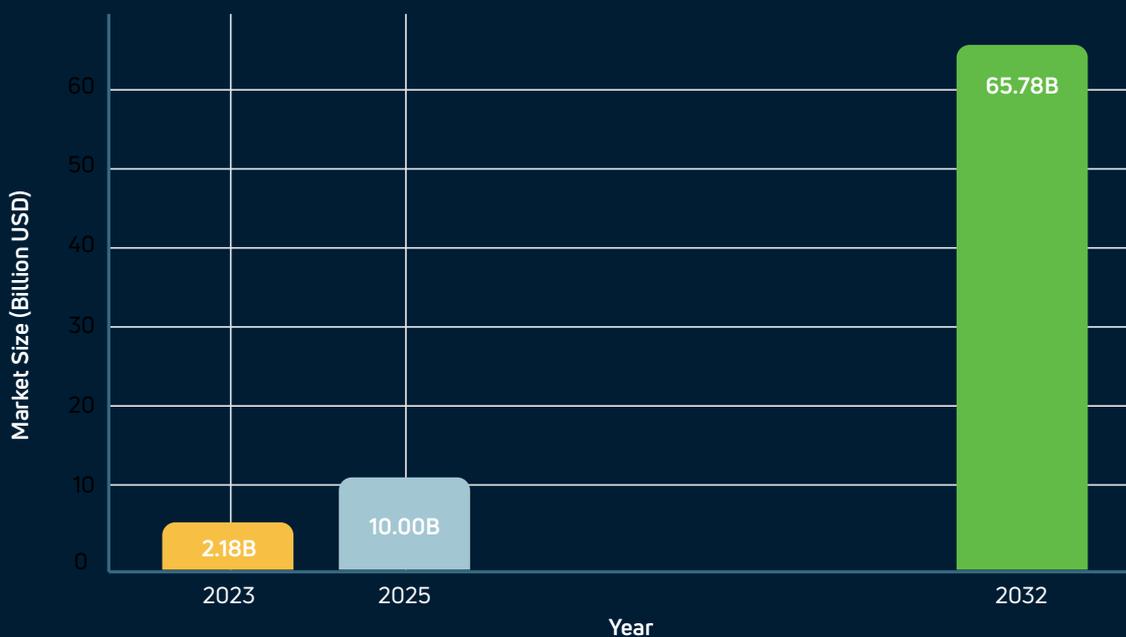
International Context

From an international perspective, Ireland does not generally rank in the top 10 of investment or supportive environments for blockchain, crypto and Web3.

Most such assessments are subjective in some way, depending on their methodology, but broadly speaking, parameters such as patents granted, venture capital, ecosystems, workforce availability and suitability, and education resources figure prominently.

One such assessment from the firm InsiderMonkey published by Yahoo Finance[131], ranks the USA, UK, and Canada as the top three, followed by South Korea and France.

The lower 10 are:

1. Hong Kong
2. Singapore
3. Germany
4. Japan
5. Australia
6. Brazil
7. Switzerland
8. Austria
9. Philippines
10. Mexico

Another assessment from the Blockchain Council[132], takes into account government regulation, investment and funding, innovation and research, and adoption rate. In late 2023, countries ranked as follows (descending order):

- USA
- China
- Switzerland
- Singapore
- UK

A comparative analysis from 2022 by Blockchain Ireland based on strategy, regulation, and ecosystem parameters, ranked Ireland eight out of the top 10, with a score of 3.6 out of a maximum of 5[133].

As with most areas of technology, developments tend to move fast, and no doubt there will be new entrants to these lists.

A more recent list from markets monitor CoinCodex[134] ranked the following based on supportive environments for Start-ups, regulatory frameworks, and tax regime.

1. Dubai (UAE)
2. Switzerland
3. Singapore
4. Malta
5. Estonia
6. Gibraltar
7. Lithuania
8. United States
9. Japan
10. South Korea

Overall, Ireland's assessment must be that a strong ecosystem, a welcoming environment for Start-ups, supporting regulatory environment through MiCAR and the VASP authorisation process, as well as specialist knowledge from advisories and legal firms, places the country well to succeed in a growing market. However, better access to funding, especially from government sources for early stage start-ups is a regular refrain.

Country	Summary	Strategy	Regulatory	Ecosystem	Average
Germany	→ Most comprehensive government issued blockchain strategy that helps focus on industries other than financial. → No dedicated taskforces to regulate cryptocurrency	4.5	5.0	4.5	4.66
Singapore	→ International focused financial blockchain initiative: Project Ubin → No official blockchain strategy or roadmap	4.0	5.0	5.0	4.66
U.K.	→ Consortium led blockchain roadmap and taskforce → Ecosystem is mainly privatised and government led projects have struggled.	5.0	4.5	4.5	4.66
Switzerland	→ Leader in blockchain applications and initiatives of financial services → No official blockchain strategy or roadmap	4.0	4.5	5.0	4.50
Australia	→ Government issued roadmap with newly incorporated roadmap items. → Crypto classifications are molded to fit current regulations	4.5	3.5	4.5	4.16
U.S.	→ States bring unique advantage for multiple regulatory sandboxes. Current ecosystem completely privatised. → Updated executive order on digital assets and cryptocurrencies.	4.5	4.0	4.0	4.16
Netherlands	→ Ecosystem filled with government led projects and initiatives. → Crypto classifications are molded to fit current regulations	4.0	3.5	4.5	4.00
Ireland	→ Government issued guidelines regarding tax of crypto. → Ecosystem is entirely privatised but rapidly expanding with talent and global businesses	3.5	3.0	4.5	3.66
Canada	→ Revolutionising government issued project Jasper → No official blockchain technology	3.0	3.0	4.0	3.33
Luxemborg	→ Striving to be EU's blockchain hub → Financial focused ecosystem	3.0	4.0	3.0	3.33

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Education and Training

Web3 specific education and training courses are still few in number, even in respect of broader blockchain and DLT resources.

In assessing Web3 education and training it is worthwhile tracking the emergence and development of blockchain and adjacent resources as they serve as a precursor and central plank of Web3.

The University of Nicosia is widely credited with the first Master's Degree in Blockchain and Crypto in 2014[135]. Since then, many major universities and third level institutions have instituted similar, with some covering blockchain, crypto currencies generally, and broadening into digital finance.

EduRank.org uses open source and publicly published data to rank 1,4131 universities from 183 countries ranked across 246 topics, in February of 2024[136]. For blockchain and cryptography, it lists more than 100 universities across Europe, with Swiss, Belgian, and Spanish institutions topping the EU[137]. Ireland ranks at 77 for University College Dublin, 81 for Trinity College Dublin, 164 for Dublin City University, 184 for Cork Institute of Technology, 201 University College Cork, 239 for NUI Galway, and 243 for Maynooth University. In total, EduRank lists 11 universities in Ireland for blockchain and cryptography[138].

The UK lists 98 universities, with many in the top 10 in Europe, led by University of Cambridge at number 4, Imperial College London at 9, and University College London at 14[139].

Globally, the rankings run into thousands[140,] with all the top 10 places going to the United States bar the Chinese entries Tsinghua University at 7 and Beijing University of Posts and Telecommunications at 8, with University of California – Berkeley at number 1, followed by Stanford University, and Carnegie Mellon University.

Of particular note internationally, is Singapore. One specialist job tracker ranks the top 10 universities in Singapore offering blockchain courses, led by National University of Singapore[141].

Ireland's first masters in blockchain was developed by Technology Ireland ICT Skillnet in collaboration with Dublin City University in 2019[142]. To date, the MSc in Blockchain has had 32 graduates. Furthermore, the MSc in Computing has had blockchain skills integrated into the programme of study, with 30 graduates graduating this year (2024)[143].

Also developed by Technology Ireland ICT Skillnet in collaboration with The Atlantic Technological University is a Level 9 Postgraduate Certificate in Blockchain for Leaders, which is a modular programme, building to a postgraduate certificate[144].

With regards to Web3 specifically, there are far fewer resources nationally and at a European and global level.

Of note is UCD's Management Information Systems module entitled MIS20060 Introduction to Cryptocurrencies and Web3, "focused on cryptocurrencies, blockchains and the emerging Web3 culture," that includes an introduction to "the Web3 ecosystem and its main applications: Decentralised Autonomous Organisations (DAOs), Decentralised Finance (DeFi) and NFT." [145]

Trinity Business School (TBS) offers a night course under its executive education programme entitled New Finance: Unpacking DeFi, FinTech, Crypto and Blockchain, that covers the fundamentals of "blockchain, crypto and Web3". [146]

Blockchain Ireland's Skills, Education and Innovation Working Group compiled a register of Course and Knowledgeable Academics in 2023, that lists blockchain, DLT and related courses available under 7 third level institutions, and 22 modules from 6 institutions. It also lists 30 academics with specialities across 11 institutions [147] (See Appendices).

Outside of universities, there are other bodies offering specialist training and various levels of certification. The Dublin-based Knowledge Academy offers the Web3 Professional Certification Training Course in six modules[148].

Coming from the professional education sector, ABlockofCrypto.com takes its approach from professional development programmes in technical areas such as accounting, and develops them through blockchain and cryptocurrencies to offer Web3 education. Leveraging meet-ups as a key tool, ABlockofCrypto has developed chapters in five other countries[149].

There are numerous online options, offered by the likes of the Udemy[150] and FutureLearn, which offers courses such as Doing Business in Web3[151], under the auspices of Australia's RMIT University.

There are also numerous initiatives allied to particular development platforms or environments, some more agnostic than others, such as the Web3 University as part of the Alchemy ecosystem[152], and the Web3 Foundation as part of the Polkadot ecosystem[153].

There are also more specialist online sources, such as 101Blockchains.com[154] that are often leveraged by businesses for in house training for teams and groups. Notable in this area is a commercial group called Blockchain Council. It describes itself as "an authoritative group of subject experts and enthusiasts who are evangelizing the Blockchain Research and Development, Use Cases and Products and Knowledge for a better world."[155] It provides various training courses for blockchain and adjacent technologies and features a range of courses under the heading Web3, Metaverse and NFT.

Additionally, Skillnet Ireland performs an important role in Ireland, providing vocational and specialist industry resources. Technology Ireland ICT Skillnet also provides specific courses in emerging technologies, digital transformation, and business leadership, covering the likes of AI, quantum computing, and fintech, up to the MSc in Blockchain with DCU[156].

A noteworthy initiative from the European Commission and Erasmus+ is the Blockchain Use Cases in Digital Finance. The project is designed to assist financial sector professionals in staying current with the latest developments and technologies in the industry, with a focus on the application of Blockchain technology in digital financial services, aligning with the objectives of EU digital policy. It features a 'train the trainers' initiative to ensure educators can confidently deal with the relevant material[157].

This is by no means an exhaustive list of Web3 and related resources available in Ireland or internationally, rather it is a representative selection of the kinds of resources that are either introductory to, facilitative of, or specialist in Web3.

The often ad hoc, disparate, and distributed nature of these resources is indicative of the nascent nature of the technologies generally.

As will be shown in the survey data gathered from developers, technologists, and builders in the area, as well as entrepreneurs and businesspeople, drawing together enough education resources to confidently apply to this area can be difficult, with many highlighting the difficulty in selecting good quality, appropriate resources, often being cited as a 'noise to signal' issue.

This point highlights another important aspect of Web3 generally, community. Many of the interviews and subject matter experts highlighted the importance of communities in finding and selecting the best quality resources and sources of information on the topic.

Community

The importance of communities in the worlds of blockchain, crypto and Web3 can hardly be overstated.

Much in the same way that technological developments such as Open Source software developed advanced collaborative techniques and methodologies to produce high quality services and applications without centralised authorities[158], Web3 communities work in collaborative and supportive modes to share knowledge, develop awareness, and increase adoption.

These communities can be grouped around a particular technology, platform, sector, or geography. Many of the large technology platforms in particular, create foundations to make resources available and support communities, such as Algorand Foundation[159], Cardano Foundation[160], Web3 Foundation[161], and more.

Communities featured highly in the developer/builder surveys as sources of knowledge and technical resources, as well as more informal help and support.

Locally, Ireland has various meetups and events organised by Web3 communities, such as Ethereum Developer Meetup[162], Hyperledger Dublin Meetup[163], Block W, Association of Women in Crypto (AWIC), ABlockofCrypto.

The importance of communities in Web3 is further demonstrated by a specific certification offered by Blockchain Council, entitled Certified Web3 Community Expert[164].

It has previously been acknowledged that Web3 world is particularly appealing to women. While it has been noted that Web3 has a gender balance issue, with only 13% of Web3 companies having a female founder, and only 7% of founders generally being women[165], the area retains qualities that attract women to it, extending to those with necessary but non-technical skills.

In an article from 2023[166], according to Níamh Linehan, content and partnerships director with the group Women of Web3[167], women are bringing skills from project and product management, as well as business development, marketing and communications to Web3, and sharing them with communities as they seek to help other women become educated and engaged. Linehan noted that a common experience with people getting into Web3 is that there can be a lot of noise to signal until they find the right channels, but overwhelmingly, people report a broad willingness in Web3 communities to help each other, spread skills and knowledge, and generally raise all boats.

> " The idea is that Web3 and the metaverse will build a new version of the internet that is equitable — but that isn't going to happen with the same cast of characters and ways. "
>
> **Níamh Linehan, Women of Web3**
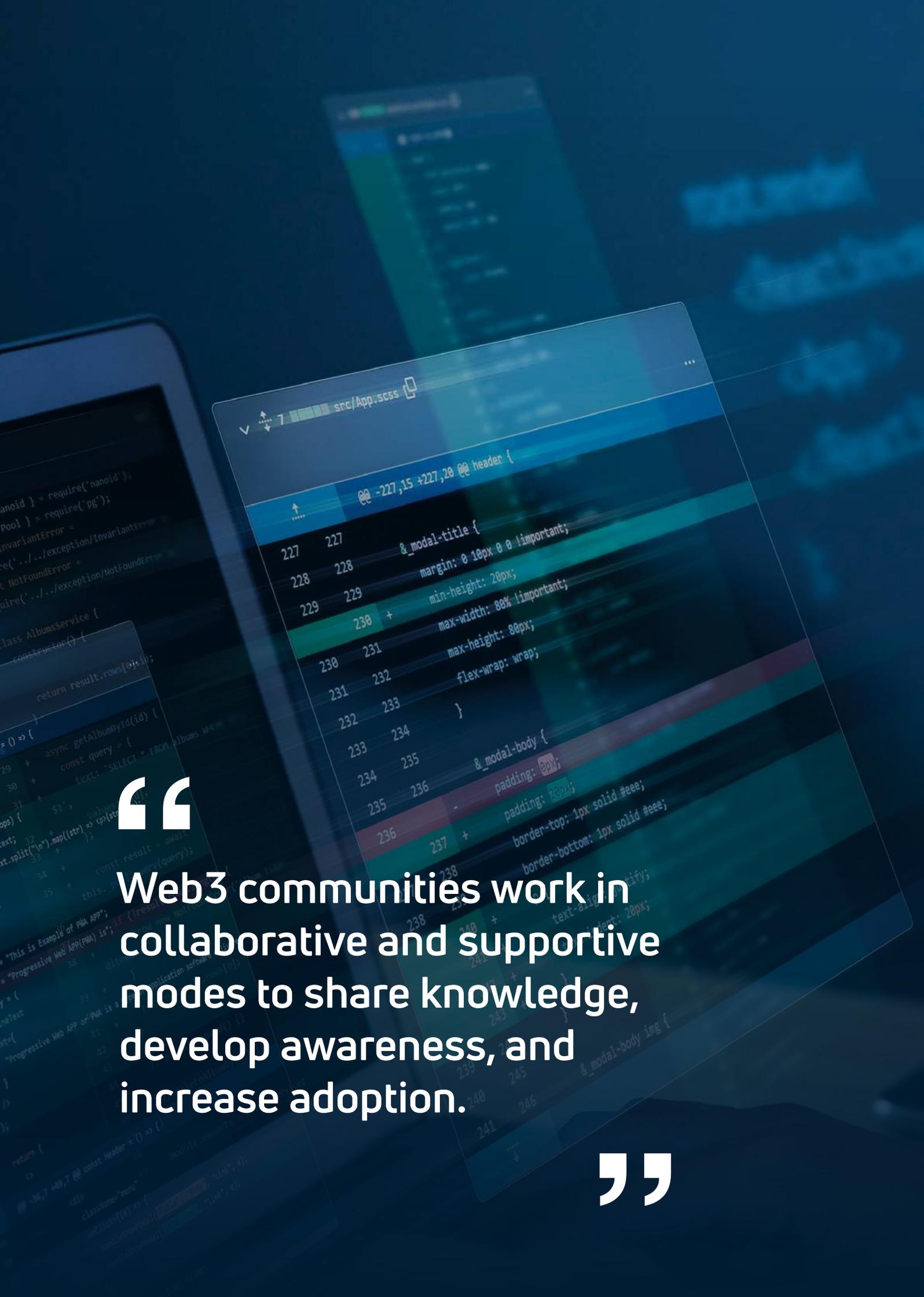
> **Web3 communities work in collaborative and supportive modes to share knowledge, develop awareness, and increase adoption.**

Web3 Skills

Web3 Skills

A broad range of skills are required in Web3, going well beyond developer and technical skills.

Given that Web3 encompasses the likes of smart contracts, digital assets, SSI management, and staking, there are complex and specialist requirements beyond pure code and service development.

From the developer perspective, it can be broken down into core and application developers, with the latter covering backend and front-end developers[169]. The former covers areas such as:

- Designing and developing layer 1 blockchain networks from the foundation
- Tailoring security patterns and consensus protocols for application network
- Designing network architecture and operational nodes
- Monitoring the complete network

Another roles and opportunities platform[170] lists six key considerations:

- Developers should be proficient in Solidity, Rust, or Vyper for smart contract development.
- Understanding blockchain fundamentals, cryptography, and cybersecurity is important.
- Web3 design requires knowledge of UI/UX specific to decentralised applications.
- Data analysis skills are valuable for interpreting blockchain data and market trends.
- Web3 marketing expertise is needed to build communities and promote crypto projects.
- Content writers can simplify complex crypto concepts for a wider audience.
- Crypto jobs include blockchain developers, data scientists, web developers, security architects, and more.

In the section on developer survey, greater detail will be given on specific technologies, platforms, and protocols.

Skills and talent development for Web3
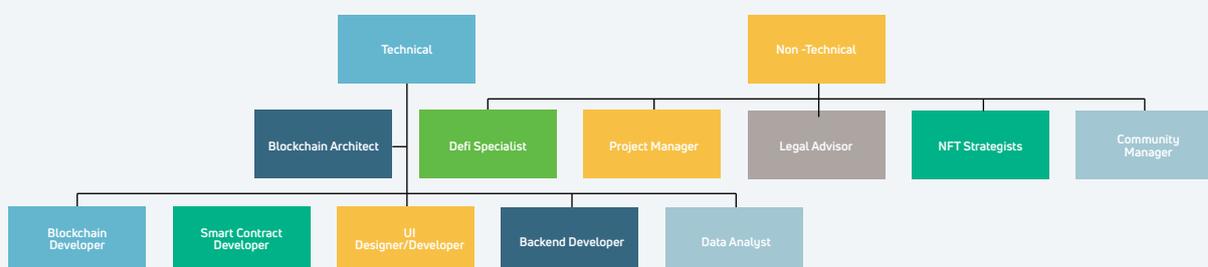
(A skills table developed by Akash Kulkarni, Digital Assets team, BNY Mellon).

In terms of skills demand, the professional network LinkedIn was used to gather global Web3 job vacancies for a 4 month period from January to April of 2024.

Analysis of the data showed that marketing and business development roles were in higher availability than either technical or community management. A significant proportion of intern roles, across all disciplines, were also available.

Marketing/Business Development:	**37%**
Developer/Technical:	**33%**
Community	**15%**
Intern:	**15%**

* Rounded figures

The jobs were in the majority remote or hybrid (73%)

Remote:	**57%**
Hybrid:	**16%**
In-Site:	**27%**

While vacancy appearance rates varied from 7 a day to more than 30, for a period from 4 April to 14 April 2024, there was consistently more than 30 vacancies per day.

From a geographical perspective, more than 40 individual locations were featured, with the top six comprising:

- USA
- Germany
- India
- UK
- Hong Kong
- UAE

It is notable that the USA accounted for more vacancies than the next two countries combined. It is also notable that Ireland did not feature in the collected data at all, though the EU did feature as a listed location.

This data demonstrates the need for skills beyond technical, reflecting the multifaceted nature of Web3.

This was characterised by comments from Níamh Linehan of Women in Web3[171].

"There are a lot of transferable skills that can be used in Web3," said Linehan. "Web3 is crying out for marketers, and there are a lot of project management and strategy roles in it too, that women can bring from other careers. What you need is a working knowledge of the environment and the technology and many skills are transferrable. You can make the move [from Web2] quite seamlessly, as long as you have that base knowledge, and the skills are needed in this space."

Further research by the CHAISE project and the International Association of Trusted Blockchains (INATBA)[172], has shown that in the context of a decentralised socio-economic model built on public permissionless blockchain infrastructure, there are required skills for personal everyday utility.

It lists these as:

- Decentralised mindset
- Responsibility and accountability
- Autonomy and independence
- Critical thinking and research skills
- Decision making
- Emotional intelligence and empathy

It further lists skills for professional utility:

- Entrepreneurship
- Interdisciplinarity
- Cooperation and teamwork
- Ethical awareness
- Operational and business model development
- Crypto-economics and organisation design
- Trial and error

While it could be argued that these skills are necessary for any business in the digital economy, they are particularly important in the Web3 context. In the business context, and for organisations generally, the INATBA report highlights the need to understand decentralised technologies and how to leverage them to access business information, and how it can be made transparent on-chain. Also, understanding how decentralised technology will impact legacy information systems will be important.

The report also highlights the need for user interface (UI) and user experience (UX) expertise to make the new decentralised applications and services usable, relatable and understandable. This last area of UI/UX is an area lacking maturity in Web3 and will be explored further in the section on Web3 users and audience.

Web3 Users and audience

Currently Web3 users and audience could be described as invested or enthusiastic, technically adept people exploring the technologies. It is very difficult to reliably assess figures for Web3 users, but in 2022, it is reported that there were 73 million gamers using Web3-based games such as Fortnite and Roblox. More recent figures report that Roblox in 2024 had 70.2 million daily active users, or 216 million monthly[173]. Similarly, Fortnite was reported to have 221 million monthly active users in 2024[174].

Beyond that, other indications of activity and adoption show robust trends. For example, unique, active address accessing blockchains topped 15 million in 2023[175]. Successful blockchain transactions in 2023 once again reached the peak of 2021 activity, topping 1.3 billion. However, the number of mobile wallet users has declined significantly from 2022 peaks falling to less than half at around 8 million.

The most recent report from blockchain analytics platform DappRadar, Q2 2024, reports users using Web3 applications reached a record high in the second quarter of 2024, with the number of daily unique active wallets (dUAW) reaching approximately 10 million over the quarter, representing a 40% increase from the first quarter and the highest overall number ever reached. The report details that each sector of the DApp industry has experienced notable growth, "contributing to an overall bullish trajectory.[176] "

However, decentralised exchanges saw trading return to levels not seen since 2022 to around $135 billion in one month, and generally over $100 billion monthly in 2023. The number of NFT buyers in 2023 topped 1 million in one month, while stablecoin monthly trading volumes were above $500 billion, and in late 2023, topped $750 billion.

However, when compared with broad market survey data on activity, perceptions and attitudes, a very different story emerges. A Consensys Global Survey on Crypto and Web3 from June of 2023[177] found that while 92% of respondents reported an awareness of cryptocurrencies, only 8% were very familiar with the concept of Web3, with a sample size of 15,00 adults from 15 countries.
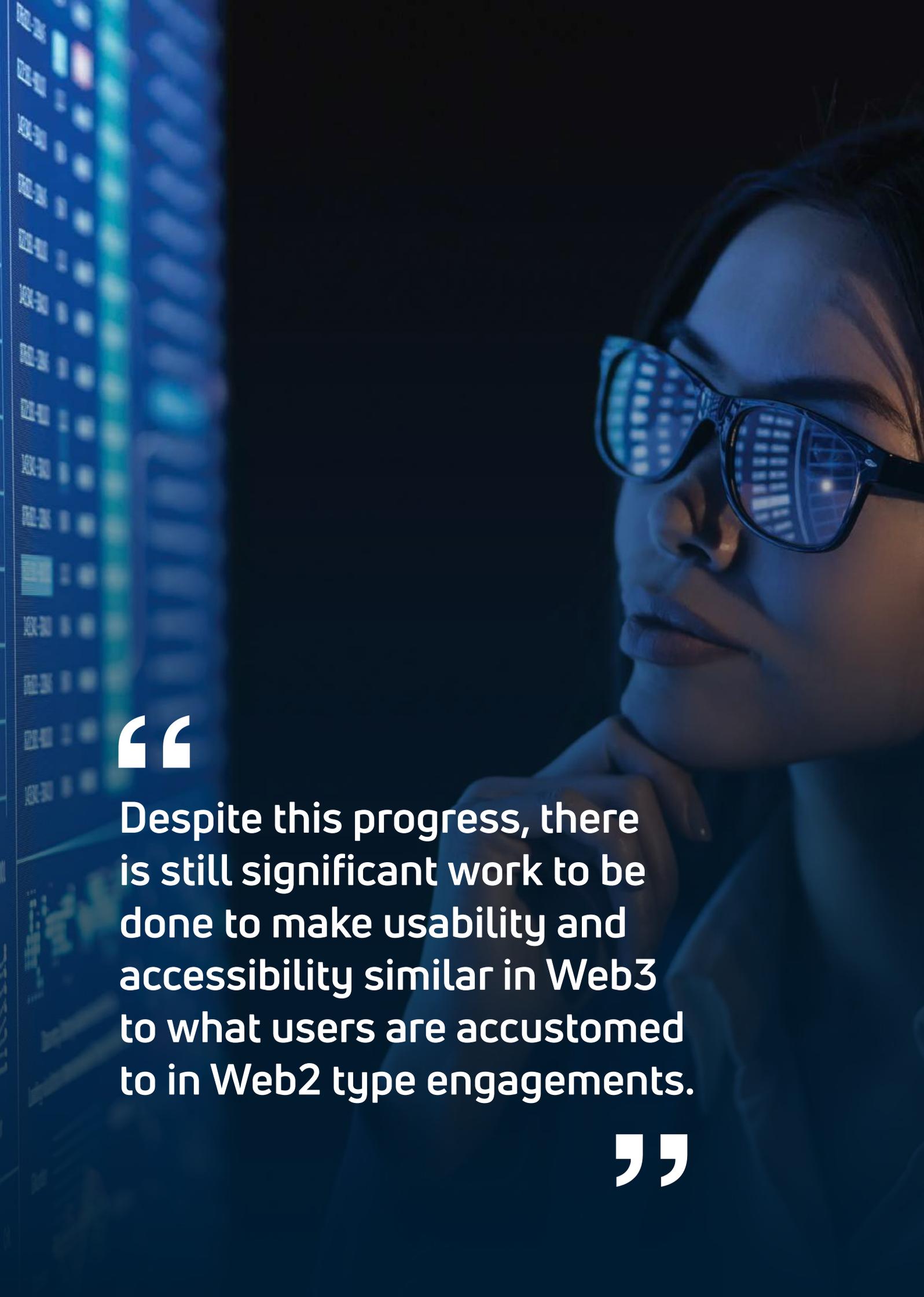
"

Despite this progress, there is still significant work to be done to make usability and accessibility similar in Web3 to what users are accustomed to in Web2 type engagements.

"

In cooperation with Blockchain Ireland and Amárach, a survey was carried out in March of 2024 among 1,000 Irish adults on activity, perceptions and attitudes on blockchain, crypto and Web3.

A selection of relevant terms was gauged for public awareness:

Digital wallet

Familiar: **62%**   Unfamiliar: **13%**

Defi

Familiar: **13%**   Unfamiliar: **73%**

Tokenisation

Familiar: **12%**   Unfamiliar: **74%**

Web3

Familiar: **9%**   Unfamiliar: **79%**

Note: All terms had a consistent neither/nor proportion of 12-13%

In a less scientific method, a straw poll was conducted on the decentralised social media platform Mastodon, often held up as an example of Web3 applications, as to awareness of the term Web3. On the Irish instance of Mastodon, mastodon.ie, in March of 2024, using the hashtag: #mastodaoine (denoting Irish users of Mastodon) and #Web3, users were asked:

Have you heard of Web3?

• 38% Yes
• 18% No
• 44% Yes, but no idea what it is
Sample size was 45[178].

While this is anecdotal, it is still indicative of a general lack of awareness of Web3, what it entails, and its associated applications and services. Returning to the Amárach survey, the main barriers to adoption of blockchain, crypto, and Web3 technologies:

• Lack of knowledge and understanding   35%
• Security   16%
• Uncertainty around the tech in the future   8%
• Regulation   8%

Adoption of Web3 is hampered by this general lack of awareness, but is compounded by the general level of usability and UX. Currently, users are left to do a lot of heavy lifting when it comes to the necessary prerequisites to use Web3 services, such as managing cryptographic keys, wallets, and digital assets.

There are efforts to simplify this by what is termed account abstraction[179]. The standard ERC-4337 covers account abstraction to unlock "the power of smart contract wallets, or 'smart accounts,' on the Ethereum blockchain (and EVM-compatible networks). ERC-4337 is one of the biggest upgrades to the way Web3 wallets work, creating an infinitely smoother experience for users, regardless of Web3 knowledge, through smart accounts."

According to one expert, account abstraction "allows users to use smart contracts as their accounts, providing a better UX. They decouple the account from the private keys, which allows the use of arbitrary verification logic, such as multi-sig verification, and enable sponsored transactions, where users can pay transaction fees in ERC-20 tokens or have them sponsored by any third party. They also provide enhanced security features, such as various account recovery methods and time-locks, and enable atomic multi-operations, which allow users to complete multiple operations with a single transaction" [180].

Despite this progress, there is still significant work to be done to make usability and accessibility similar in Web3 to what users are accustomed to in Web2 type engagements. This was the topic for an in-person seminar with the Blockchain Ireland Start-ups and Web3 Working Group in March of 2024, entitled Web3 UX: Opportunities for Growth[181].

Featuring Taylor Ferran, Developer Relations Engineer, Etherspot; Smriti Verma, Blockchain Security Researcher, OpenZeppelin; Fran Meggs, CEO, CryptoCracker; and Marlene P Naicker, founder and CEO, MULDOONEYS, the panel discussed ways of simplifying onboarding into Web3 services and applications leveraging examples from Web3 gaming, loyalty programmes and high fashion.

Muldooneys, for example, is a haute couture fashion house integrating blockchain technology to elevate customer experience, using QR codes to onboard users into an exclusive community with NFTs. Blockchain-based assurance systems upstream, confirming artisan produce materials going into high quality, low volume luxury goods are leveraged to produce NFTs associated with limited editions. New owners are easily onboarded and taken through each step via a scanned QR code and a smart device.

However, it was emphasised that this has to be done securely, with due care given at each stage of the process, across the various platforms and layers involved, not just in the on-chain environment. This is best handled through partnerships with the various parties responsible at each stage.

Returning to the A16z Crypto report, it lists 12 global brands [182] that have already begun Web3 journeys through NFTs, ranging from Budweiser and Starbucks to Tiffany & Co, Gucci, and Louis Vuitton. In between are Adidas, Reddit, DraftKings, Nickelodeon, Nike and TIME. Other heritage brands are also beginning Web3 journeys, such as Ducati Motorcycles[183].

However, while mass Web3 adoption is unlikely to arise from such niche applications, they do serve to raise awareness more broadly.

It has been speculated that the financial services aspect of Web3, and decentralised finance (DeFi) in particular, may produce a more mass appeal.

As highlighted in the INATBA report[184], "A hallmark of Web 3.0, the growth of decentralised finance, or DeFi, is a promise of promoting fairer and more democratic financial services. It can be thought of as creating a secure pipeline directly between the transaction parties without the involvement of banks or governments."

The report states that the unique features of DeFi applications allow consumers to control their assets more directly through personal wallets and consumer-centred trading platforms rather than institutions. "In some ways, DeFi may contribute to the redesign of the financial sector, freeing it from fractional reserve constraints and allowing consumer credit offerings at scale. DeFi can also contribute to financial inclusion in a boundless way, enhancing accessibility and the usage of financial services for those who do not have a banking account, as most of the DeFi products and services available today are analogous to those offered in conventional finance."

Web3, through DeFi, has the power to be more inclusive for the millions of unbanked citizens around the world, particularly in developing economies[185].

Furthermore, there is the potential for the first 'killer' use cases for Web3 to emerge from such environments. Certain countries in Africa have had microfinance system leveraging technologies such as SMS, since the first decade of the 21st century[186]. Cultural acceptance and business understanding of such systems are likely to allow these societies to leapfrog more developed nations in exploiting the advantages of Web3 through this acceptance and familiarity.

Many African nations have a well developed Web3 ecosystem already, with companies such as PwC working with indigenous groups and businesses. The State of Web 3.0 in Africa report documents such activity in Kenya, Nigeria, and South Africa[187].

The clear implications from Web3 users and audiences is that there is a significant effort required to educate the public in the digital literacy skills needed for Web3, as well as its advantages in terms of privacy, security, control and self-determination. While some subject matter experts have opined that once these features of the technology are widely known, the demand will make them inevitable, the common 15-year innovation cycle in technology, from first principles to mass availability, means that we are still potentially a decade away from such.

Sustainability

Sustainability is an important topic in the context of Web3.

It must be considered on many levels, technical and non-technical.

From a technical standpoint, the decentralised nature of Web3 can lead to inefficiencies and high maintenance costs, but advancements in edge computing and AI-driven data centre infrastructure management are improving efficiency[188].

However, much progress has been made in recent times to make edge computing deployments more efficient, through the use of the third generation of data centre infrastructure management (DCIM) systems, that are cloud-based and can span on-premises, cloud-based, and edge deployments[189 190].

Sustainable Software Engineering (SSE) is crucial for developers to ensure efficiency and resilience in decentralised applications. Web3's characteristics also support sustainability initiatives, such as regenerative finance, which integrates decentralised finance with sustainability principles.[191]

The next consideration for sustainability in the Web3 context is the potential impact for how sustainability practices can be implemented leveraging the unique aspects of Web3.

It has been noted by various commentators that Web3's inherent characteristics have benefits for sustainability initiatives. According to the World Economic Forum, "Web3, a new iteration of the internet that harnesses blockchain to "decentralize" management, has positioned itself at the heart of the regenerative finance movement, or "ReFi" — a new economic paradigm that operates at the intersection of climate action and Web3 communities."

"ReFi is anchored in decentralised finance, or DeFi, and the theory of regenerative economics. DeFi refers to an alternative financial system focused on the democratisation of financial goods and services. Regenerative economics focuses on the creation of systems that restore and preserve the physical resources essential for planetary well-being.[192]"

This concept has been built upon by others in the industry, who see that "Web3's impact extends beyond information exchange." Platforms such as VeChain are leveraging Web3 to enhance value exchanges that are not only economic but also environmental and societal, promoting collaborative efforts for a sustainable future[193].

Tokenisation and fractional ownership enable greater public participation in environmental initiatives, potentially fostering grassroots sustainability activism.

Ultimately, Web3 development must integrate sustainable principles throughout its lifecycle to fully harness its potential for sustainability.

Case Studies

Category:
Engagement

Daffy

Daffy is a Web3 platform for charitable donations. It is the Donor-Advised Fund, not-for-profit community that emphasises the commitment to give, not the amount given.

"Our mission is to help people to be more generous, more often through a seamless mobile experience that helps members set money aside, watch it grow tax-free, and donate to more than 1.5 million charities."

daffy.org

Flight of the Primes

Taking the hugely popular superhero genre and making it even more fan engaging, Flight of the Primes leverages NFTs to democratise intellectual property (IP) ownership. This novel approach provides fans with an economic stake in their chosen universe facilitating new levels of involvement in the traditional model of narrative consumption and fan engagement.

The company is led by Karo, an innovator between Web2 success and Web3, with the project backed by a team of Web3 natives, brand builders, and distribution experts. Karo has aims to merge extensive experience in creating multi-million-dollar brands with knowledge of Web3, setting the stage for a new approach in digital collectibles and IP engagement.

flightofprimes.io

Oxygean

Oxygean is an innovative engagement platform described as Individual to Business (I2B), that allows consumers to engage in real time with preferred brands on their own terms. The platform allows brands to engage in a more personalised manner with individuals who set their own preferences.

The platform aims to reduce cost of customer acquisition, while increasing loyalty and rewards for consumers. The Dublin based company reports that its app has had more than 1.5 million downloads.

Oxygean.com

Category:
Retail

Nike

Sportswear brand Nike created the Swoosh campaign, a Web3-enabled platform creating an inclusive digital community and experience and a home for Nike virtual creations. The platform has its own domain, welcome.swoosh.nike for members to learn about, collect and eventually help co-create virtual creations, which are typically interactive digital objects such as virtual shoes or jerseys. With both an ecommerce and a loyalty element, the initiative allows users to earn rewards as well as gain access to programmes and products not available elsewhere in the offering, through NFTs, digital assets, and a Web3 platform.

However, in 2024, cost cutting and a general cooling of the NFT markets has seen a pull back, with layoffs and reallocated funding.

www.swoosh.nike

Muldooneys

A luxury fashion brand, Muldooneys makes much of the provenance and quality of its designer products.

It offers blockchain-based assurance and traceability for its artisan producers of the materials for its products. It emphasises the exclusivity of its products by offering an NFT for certain items, with a QR code-based sign-up process to onboard users into the owner experience.

Muldooneys.com

TravelX

TravelX is a technology company in the airline space that tokenises airline inventory, transforming airline tickets into digital assets.

The value proposition is to use NFT tickets as digital assets opening new flexibilities for both issuer and user. TravelX aims are maximizing profitability and improving customer experience, for example, users can trade or exchange tickets via the platform, with the airline collecting revenues every time an NFT ticket is exchanged.

nfticket.travelx.io

Category:

Investment and advisory

DeRec Alliance

A cooperative alliance of blockchain and Web3 organisations came together to provide a decentralised service to recover lost digital wallet resources.

In its own words: "In order for the blockchain/DLT industry to go mainstream, it needs a safety net for users. It must be easy for a layperson to make sure they will never lose their keys, wallets, identities, or passwords."

derecalliance.org

Revolut Ramp

The financial services provider Revolut has expanded its services to include crypto purchase directly to MetaMask wallets through a service called Revolut Ramp that aims to allow seamless purchases of cryptocurrencies.

The service is accessible directly within MetaMask's mobile app, browser extension, or on MetaMask Portfolio. Customers will be able to top up MetaMask self-custody wallets seamlessly with low fees, using their Revolut account, Visa or Mastercard credit or debit bank card. Revolut Ramp is an out-of-the-box solution designed to be ready to integrate with wallet providers.

revolut.com

Thrilld Labs

This is a free and open-access business app that allows Web3 projects, professional investors, developers, and Web3 service providers from around the world to find each other and talk synergies in a streamlined manner, instantly.

thrilldlabs.io

Trrue

Trrue is an investment company focused on impact investing within the blockchain technology sector. It offers a specialised layer 1 blockchain protocol that enables the tokenisation of real-world assets and provides tools for ESG reporting and SSI verification.

It operates Trrue Chain, a Layer 1 RWA Blockchain Protocol. Built with Polkadot substrate, it enables interoperability between blockchains, bridging traditional financial markets with the Web3 landscape.

trrue.io

Category:
Music and Entertainment

Coum Technologies

Coum Technologies is an Irish tech start-up in the music genre, providing new routes into the music industry for creatives, with direct benefits and revenues to artists.

Working primarily in the mobile gaming industry, the company integrates music distribution and advertising into games and platforms, leveraging NFTs, AI, and blockchain to create new revenue streams, enhance user engagement, and transform gaming soundscapes.

coum.tech

Opulous

Opulous is a blockchain-based Web3 platform that allows musicians to keep control of the music they create and forge connections with their fans.

The company has its own token, OPUL, that it uses to offer staking, as well as new revenue paths for musicians and rights owners. It uses DeFi loans and music NFTs to change how artists access the funding they need.

opulous.org

Category:
Agritech/Food

Agrotoken

Agrotoken creates solutions for the agriculture industry to support sustainability and wellbeing among rural communities, through offering reliable and accessible financial products and services to all agricultural producers, through blockchain technologies and tokens backed by natural resources.

Through digitised production, the company offers services to farmers, merchants and commodity holders for better access to appropriate services with tokenisation.

agrotoken.com

Origin Chain Networks

Origin Chain Networks is a blockchain start-up providing proof-of-origin services to enterprise customers tailored to market needs. It provides companies with the opportunity to achieve success in a secure and enhanced-trust environment by ensuring traceability, transparency and trust. Origin Chain Networks focuses on optimising supply by bringing the benefits of emerging technology across blockchain and Web3 to the agri-food sector.

originchain.eu

Category:

Social Media

Farcaster

Farcaster is a protocol that facilitates the creation and connection of social media apps. It operates on a blockchain infrastructure, promoting transparency, security, and decentralisation.

Farcaster's model, unlike traditional social media platforms, operates on a fee-based model, charging users ongoing storage fees for hosting their data. These fees not only contribute to the platform's revenue but also serve to prevent spam and maintain decentralisation.

farcaster.xyz

Nostr

Nostr is an open protocol that enables global, decentralised, and censorship-resistant social media. The protocol is based on simple and flexible event objects and uses standard elliptic-curve cryptography for keys and signing. The only supported transport is websockets connections from clients to relays. This makes it easy to write clients and relays and promotes software diversity.

It is described as highly resilient due to its decentralisation for moving or storing data. It is verifiable because accounts are based on public-key cryptography making messages easily verifiable by the user in question. Like HTTP or TCP-IP, Nostr is a protocol; an open standard upon which anyone can build, not an app or service.

nostr.com

Mastodon

Based on the ActivityPub open protocol, Mastodon is a decentralised social media platform, similar to other micro-blogging social platforms. Each instance is owned and run by its instigators. It is distinctive in that each instance or server creates their own rules and regulations, which are enforced locally and not top-down, as with other corporate social media, making it flexible in responding to the needs of different groups of people. Users sign up based on interests, location, personal preferences, etc. allowing them to select an instance that is in harmony with their own values or outlook.

Mastodon does not have content serving algorithms. Users can choose to follow hashtags and keywords to find the content they desire, but they are not subjected to pushed content.

mastodon.social

Surveys and Findings

Surveys and Findings

Two surveys were carried out to ascertain current and future activity and experiences in Web3.

The first survey was aimed at developers and builders, the second was aimed at entrepreneurs, founders and business people getting into, or involved in, Web3.

Both surveys were carried between November of 2023 and May of 2024.

The developer and builder survey was circulated in partnership with Blockchain Ireland, via its weekly newsletter, LinkedIn page, X.com (formerly Twitter) account. The Technology Ireland ICT Skillnet network was also leveraged, as were a number of specialist groups, including: Ethereum Developer Meetup, Hyperledger Dublin Meetup, ETH Dublin, and Algorand Ireland Community. The survey was also publicised on site for delegates and attendees of Blockchain Ireland Week 2024. This survey received 37 respondents.

The business aimed survey was similarly circulated with Blockchain Ireland and Technology Ireland ICT Skillnet, and also via groups such as BlockW, Association of Women in Crypto, and A Block of Crypto. The survey was also publicised on site for delegates and attendees of Blockchain Ireland Week 2024. This survey received 24 respondents.

Findings – Developers and Builders

Respondents to the survey tended to be, on the whole, highly experienced.

How many years have you spent as a developer before working on Web3 projects?


How many years have you spent as a developer on Web3 projects?
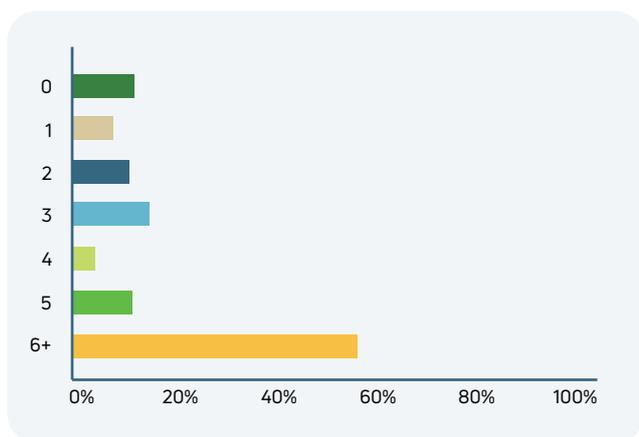
A significant majority (57%) had been a developer for six or more years before working in Web3.
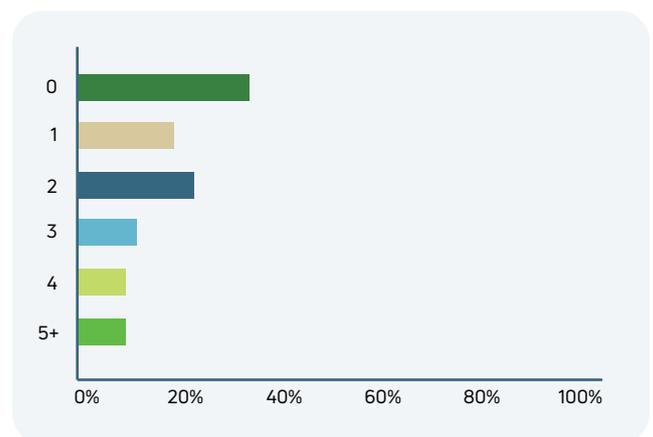
Similarly, the respondents had significant experience working on Web3 and related projects, with 8% having five or more years of experience, 8% having 4 years, 11% having three years, and 22% having 2 years.

## Are you working, or have you recently worked, on a web3 or related project?
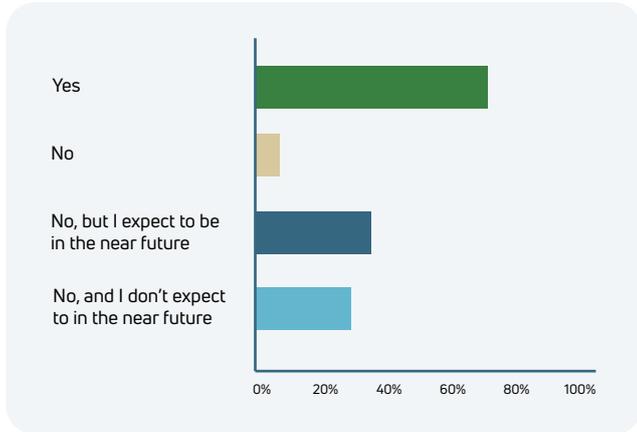
More than two thirds (68%) of respondents are working, or have recently worked, on a Web3 or related project. A further 24% expect to in the near future, with just 8% either not working on such projects or not expecting to in the near future.

## Rate your confidence in your current skillset to work on Web3 or related projects
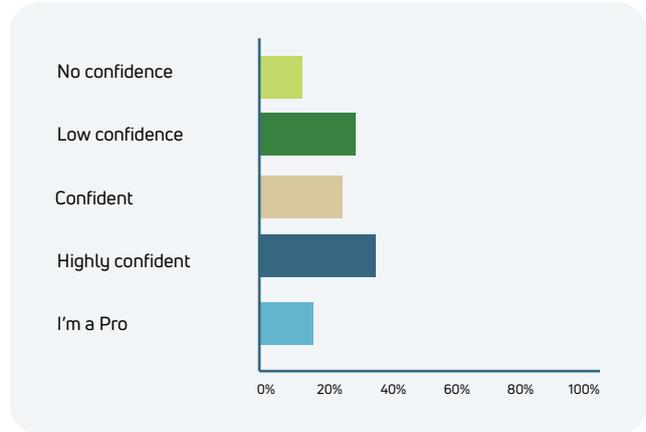
When asked to rate their confidence in their current skillset to work in Web3 or related projects, the majority were confident (22%), highly confident (30%) or regarded themselves as professionals (19%). Almost a quarter (24%) were low in confidence, with just 5% having no confidence in their current Web3 skillset.

Where do you go to find the information you need to improve your skills or solve your Web3 problem?
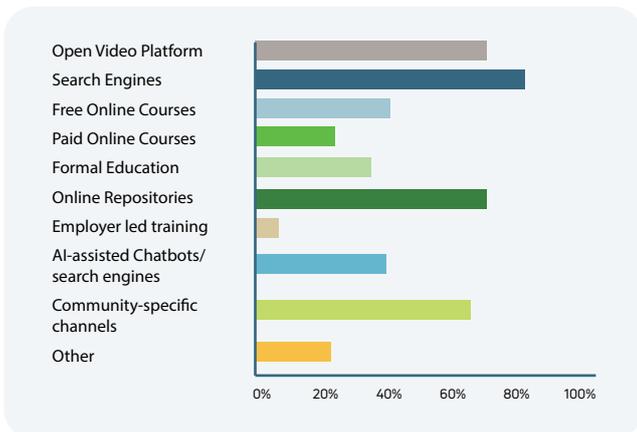
Information sources listed to improve skills or solve Web3 problems were varied, but search engines (84%), online repositories (76%), and open video platforms (76%) were the highest proportions in a multichoice option set.

## What are the current languages you currently work with on web3 and related projects?
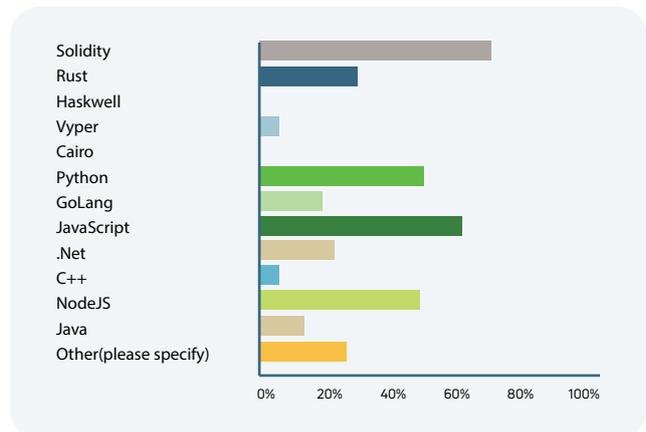
Of note in this is the low proportion of formal education sources, at just 35%, and employer led training courses at just 5%.

Another multi choice question detailed the current languages employed in Web3 and related projects. In line with broad industry trends, Solidity (70%), JavaScript variants (59%), and Python (46%) were the top three, but NodeJS (43%) and Rust (30%) also featured significantly.

# What are the platforms you currently work with on web3 and related projects?
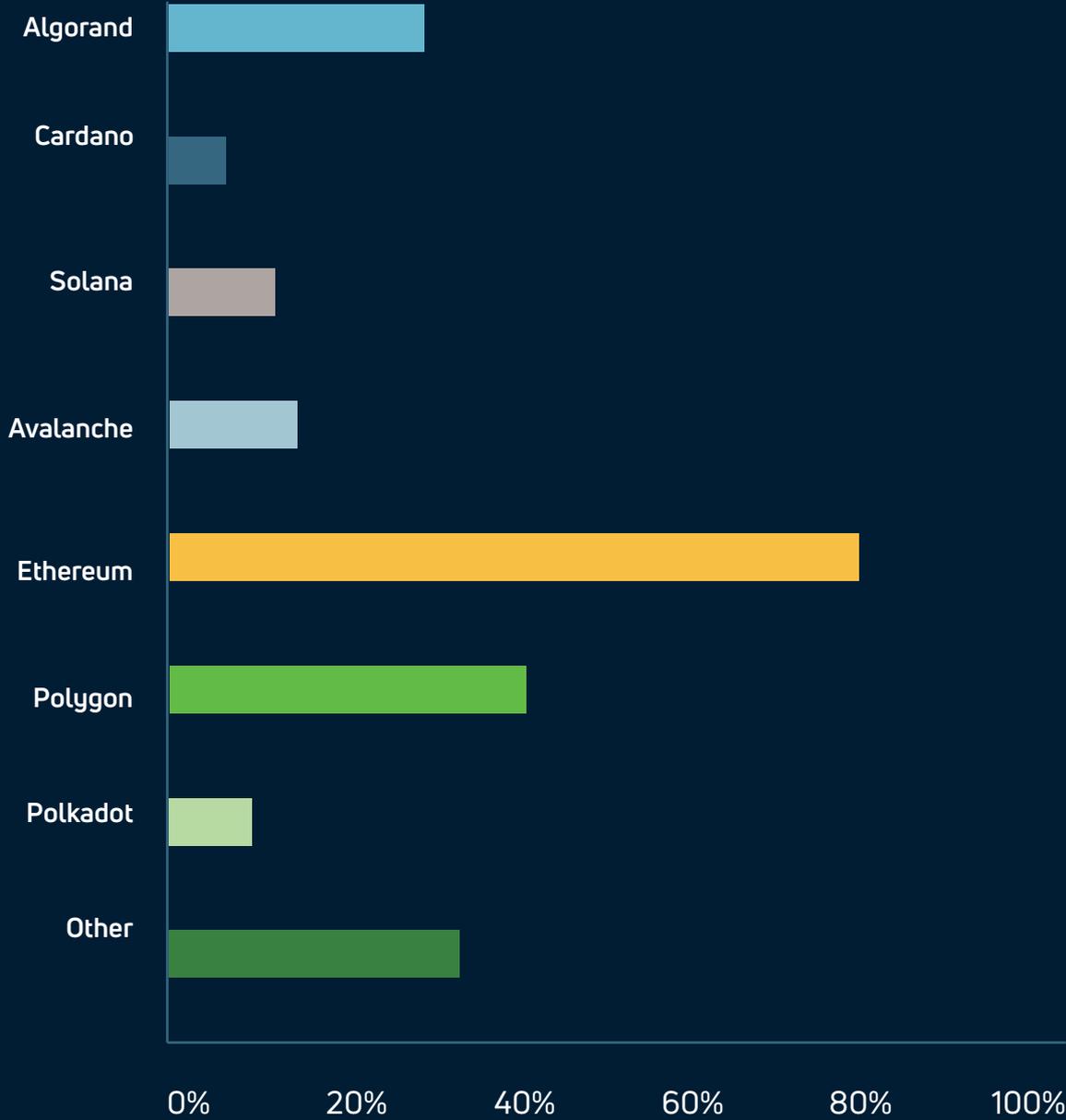
Similarly, platforms in use followed broad trends in a multi choice question. Ethereum topped the list by some margin (70%), followed by Polygon (38%), Algorand (22%), and Avalanche (14%). The Other option was significant at 30%, and included Polymesh, Axelar, and Arbitrum.

What are the tools and frameworks you currently work with on web3 and related projects? (Tick all that apply)
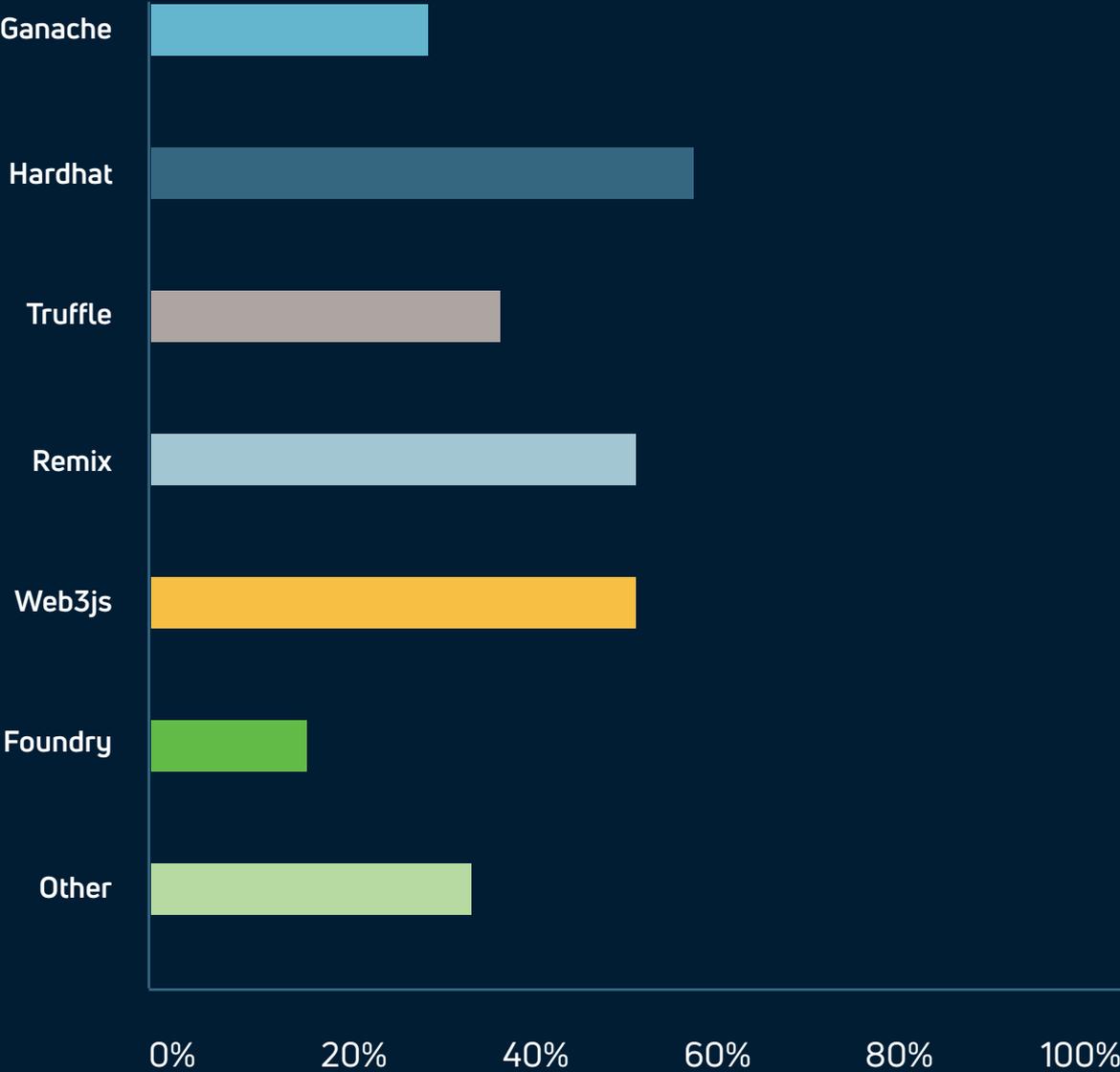

The tools and frameworks in use on web3 and related projects were more evenly distributed among the options, though again, the Other option was similar to the platforms, at (33%). Hardhat lead at 57%, followed by Remix and Web3js tied on 49%, and Truffle on 38%. Etherjs was named by more than one in the Other category, with Pyteal, Metaplex and Web3py also mentioned.

## Do you specialise in any one area of Web3 development?
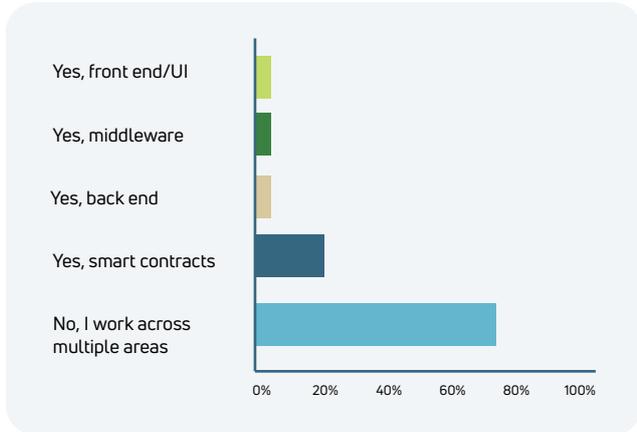
The respondents tend to work across multiple areas of Web3 (73%), with limited specialisation in areas such as smart contracts (19%).

Do you intend to look for further skills and training in Web3?
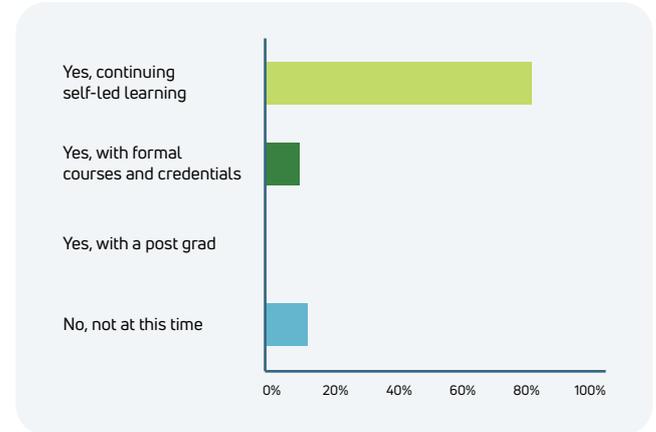
The clear majority of respondents intend to continue developing their Web3 skills and training, with the majority opting for self-led (81%) learning over formal courses and credentials (11%).

Have you any Web3 related skills that are beyond developer skills?
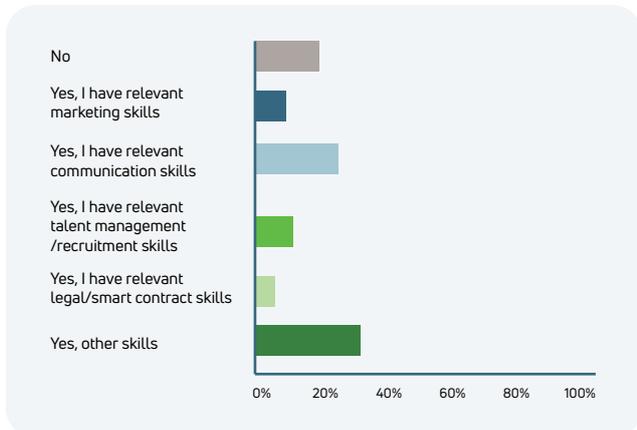
Transversal skills are a significant topic across all subject matter expert interviews, and a majority of respondents said they had some level of such, though almost a quarter (22%) reckoned they did not. These skills covered areas such as sales and marketing, communications, talent management and recruiting, and legal/smart contract skills.

In the Other section, developer relations, business management, product management, business analysis, and cyber security were listed.

## Do you intend to acquire non-technical skills related to Web3?
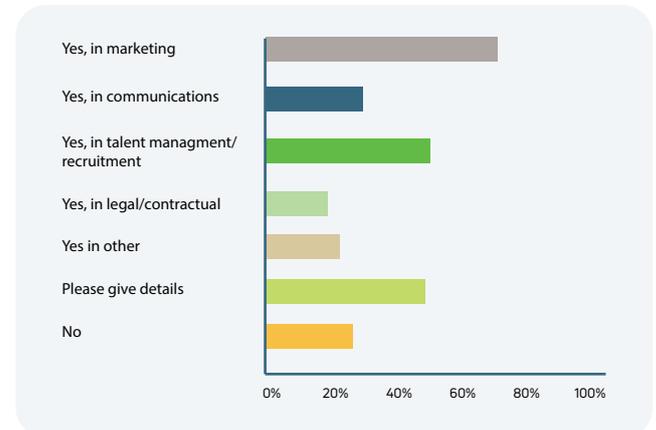
Following on from the transversal skills question, the survey asked if such skills were going to be acquired. A significant 38% said no, with the rest indicating they would across multiple disciplines, such as communications (19%), legal/contractual (14%), and marketing (11%).

How often do you participate in Web3 or blockchain-related community events or meetups?

Do you contribute to open-source Web3 projects, and if so, how often?
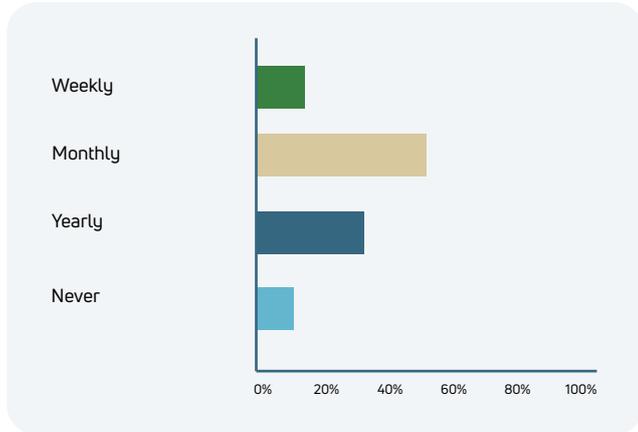
With the importance placed on community in Web3, the survey asked how often such activities were engaged in. A low proportion (11%) said never, but the majority reported yearly (32%), monthly (49%), and weekly (8%).
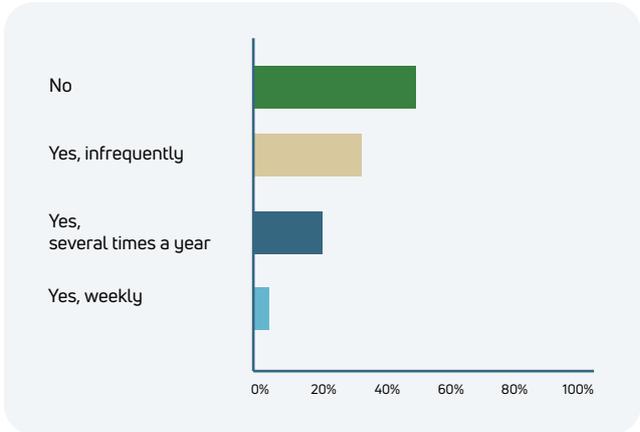
Contributions to open source projects were also confirmed by a majority (51%), though it left a significant proportion that did not (49%). Nearly a third (30%) contributed infrequently, 19% contributed several times a year, with 3% contributing weekly.

Survey Conclusions

The clear implications from the developer builder survey are that respondents were highly experienced individuals who generally were confident in their own skills, possess a range of transversal skills, and were intent on continuing their self-led learning through mostly informal sources.

"

The clear implications from the developer builder survey are that respondents were highly experienced individuals who generally were confident in their own skills.

"

Findings –Business Activity

What is your current sector of operation?

The respondents were across a range of sectors. With finance/insurance leading (25%), followed by professional practices/specialist (21%), education (13%), ICT/Telco (13%). Among the Other category were mentions of cyber security and artists.
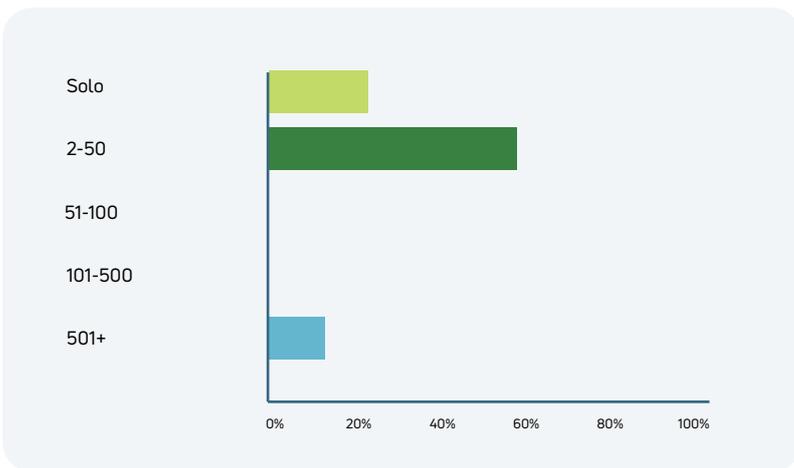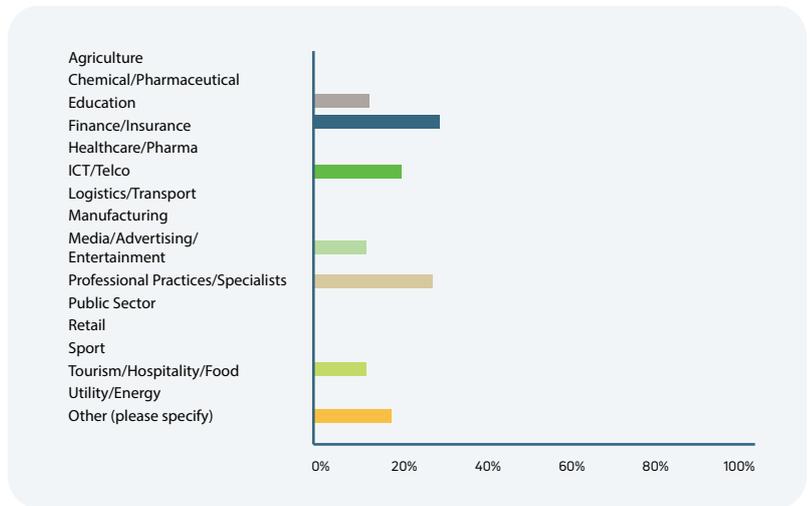
What is your organisation size?

Organisation size varied between the very large (13%) and the very small, with solo at 29% and 2-50 at 58%.

What is the maturity of your organisation?

Organisation maturity was a similar story, with a polarisation between mature (29%) and early stage/start-up (42%).
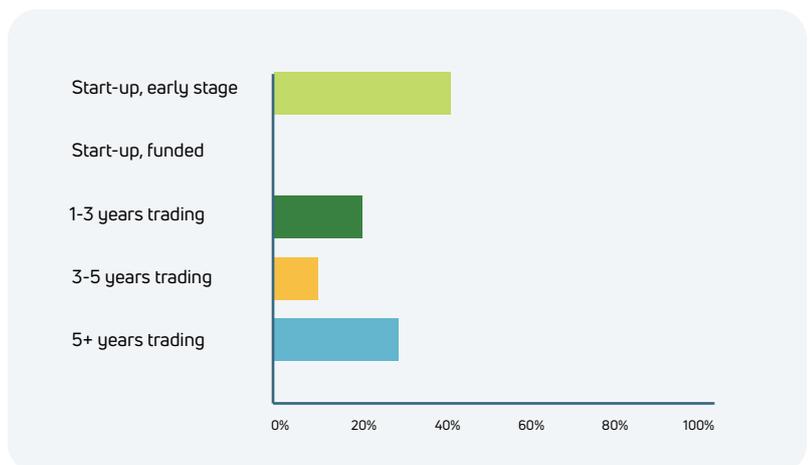
What use cases for Web3 have you observed, or are engaging in?
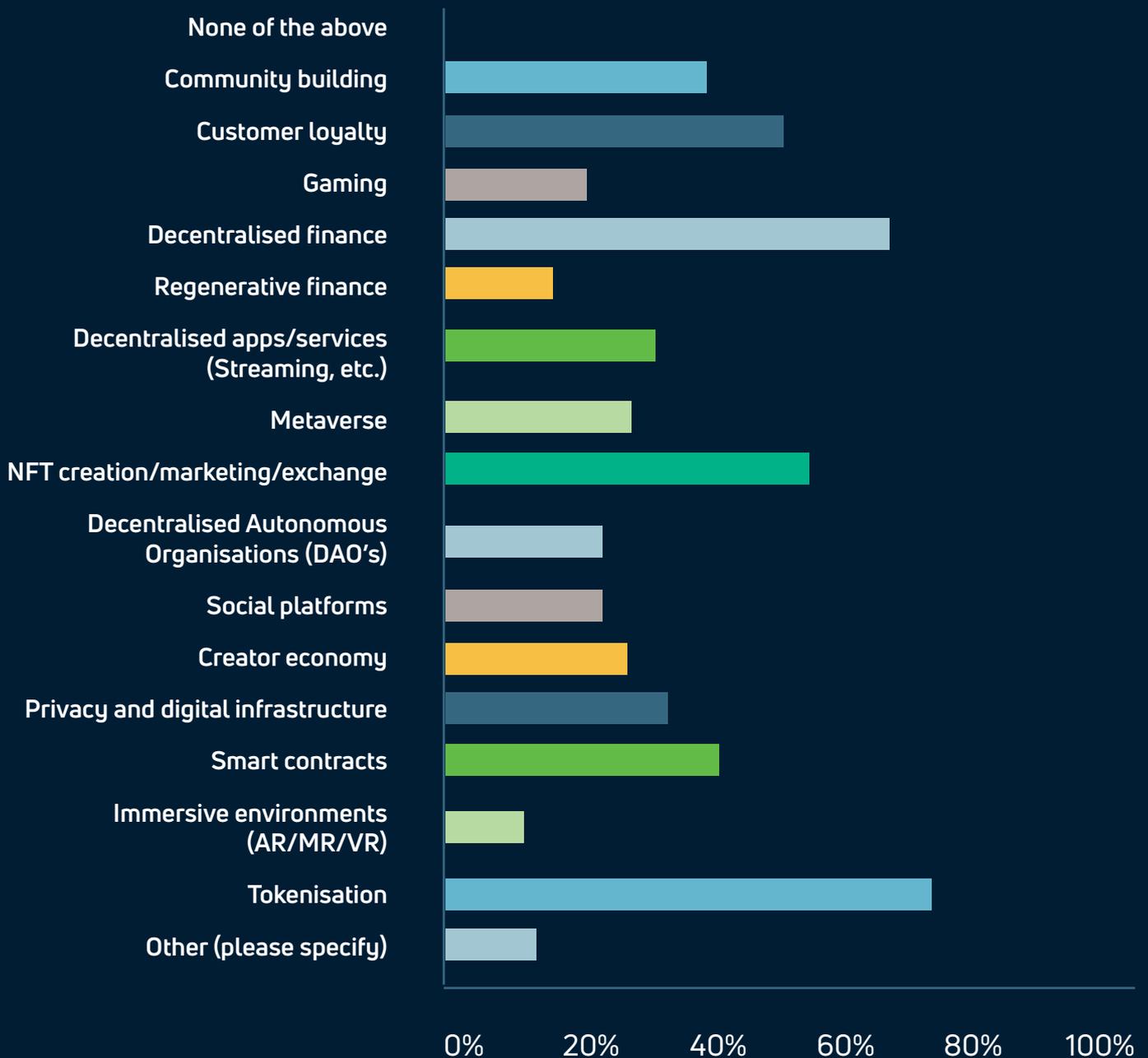
A complex picture emerges from observed, or engagement with, Web3 use cases. Tokenisation is a significant leader at 75% in a multi choice answer. It was followed by decentralised finance (63%), NFT creation/marketing/exchange (54%) and customer loyalty (46%).

What do you see as the primary utility/advantage of web3? Select 3

Category	Value
Audience/user engagement	
Identity sovereignty	
Decentralisation	
Democratisation	
User reward/remuneration/staking	
Digital asset storage/portability	
Programmable trust	
Smart contracts	
New business models	
Creator enablement	
Other (please specify)	
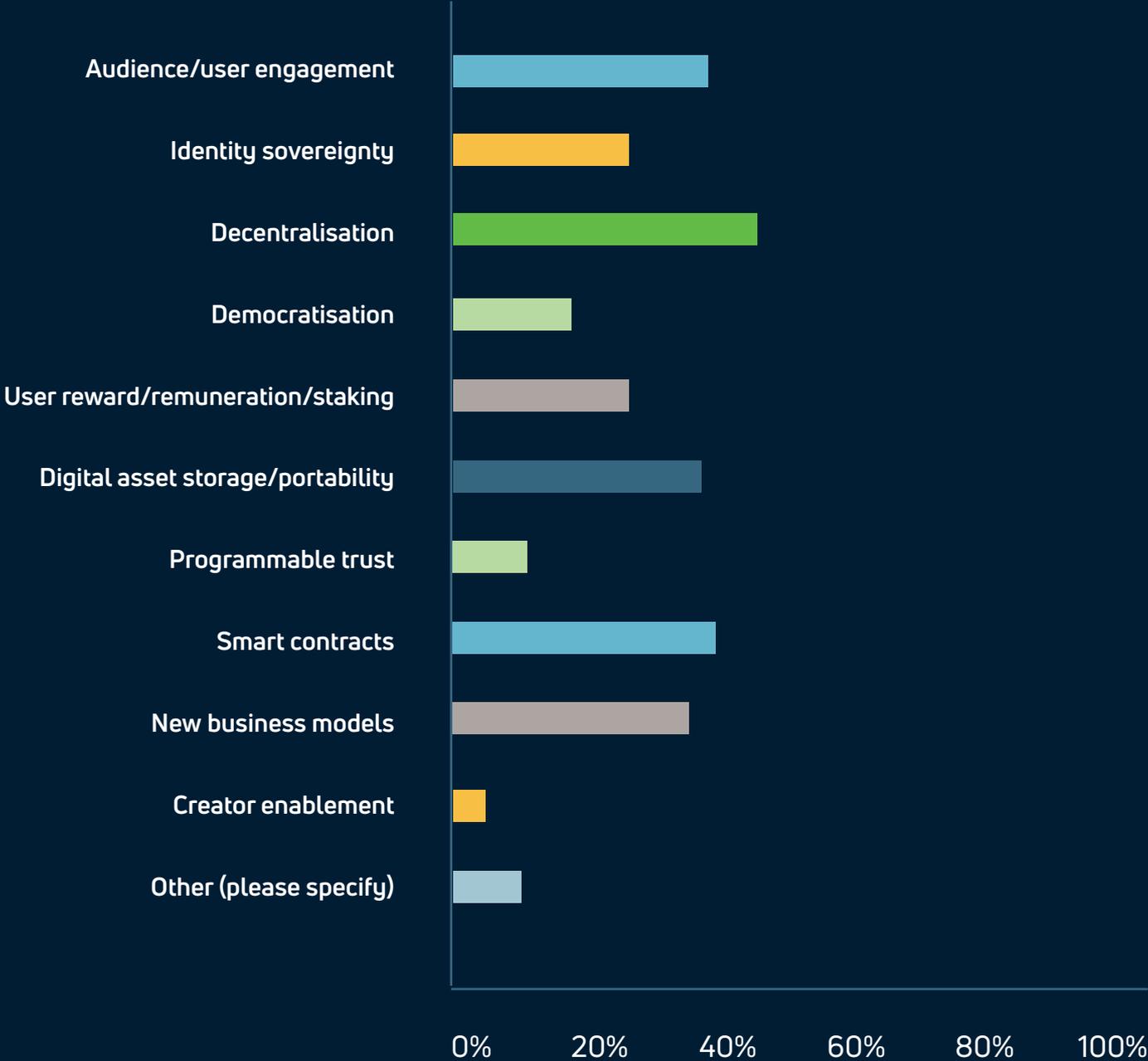
When asked to indicate the primary utility or advantages of Web 3, selecting 3, decentralisation led (46%), followed by smart contracts (42%), new business models (38%) and audience/user engagement (33%).

Are you currently building Web3 services or applications?

The strong majority of respondents (75%) are either actively engaged in building Web3 services and applications or intending to in the near future.
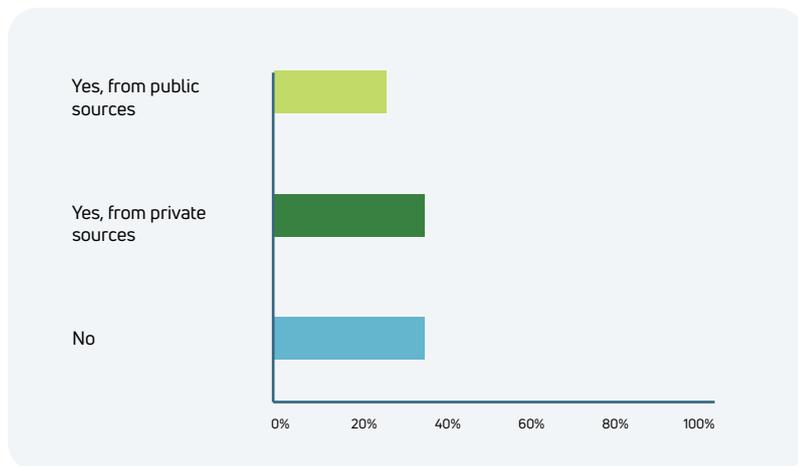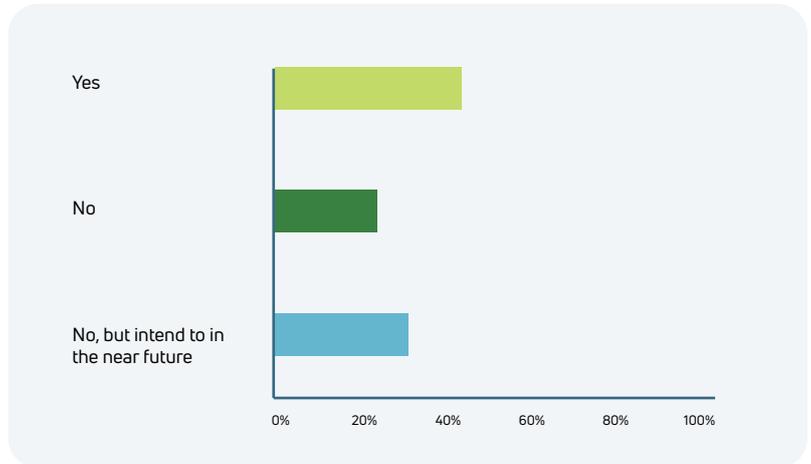

Do you plan to seek external funding or partnerships for your Web3 initiatives?

The respondents were asked about funding for their Web3 initiatives, and the possible sources for same. The majority (63%) confirmed they would seek funding or partnerships, breaking down as a quarter (25%) from public sources, with 38% indicating from private sources.

Have you experienced skills challenges either personally, or with hiring for Web3?

There was an even split across issues of personal and hired skills in the Web3 sector. More than quarter (26%) said they had struggled to develop personal skills, and the same confirmed a struggle to hire with the right knowledge and skills. Slightly more (30%) said they had been able to develop personal knowledge and skills and 17% said they had found the right knowledge and skills for hire.
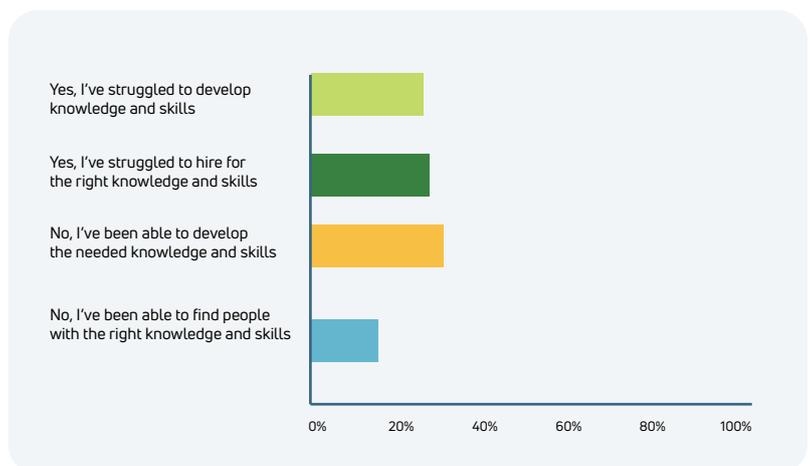
What areas, sectors, or applications do you perceive for Web3 in the future that do not currently exist?

Asking for some reasoned speculation, the respondents were asked about future sectors or applications for Web that are not currently in existence. While regulation (17%) came in highest, education, public services and electoral systems all came in at (12%). Energy and healthcare were lower at 8% each. The Other category was significant at (25%), and included real estate and agriculture/food.
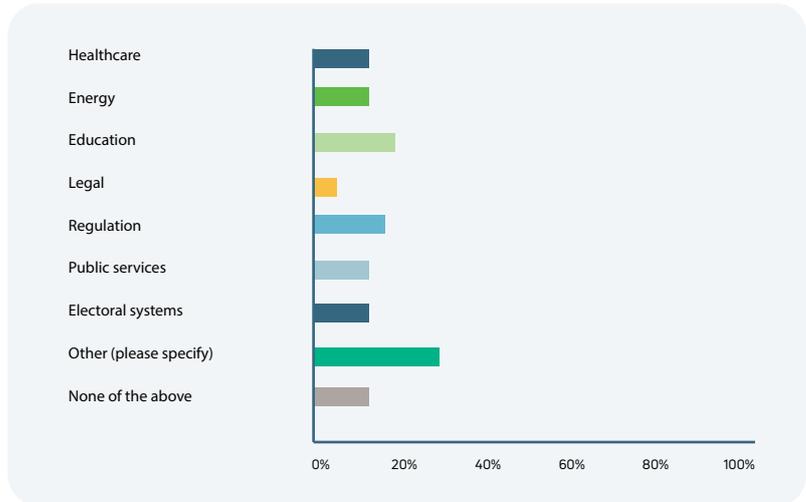
What Web3 business platforms have you used/observed in use? (Select all that apply)
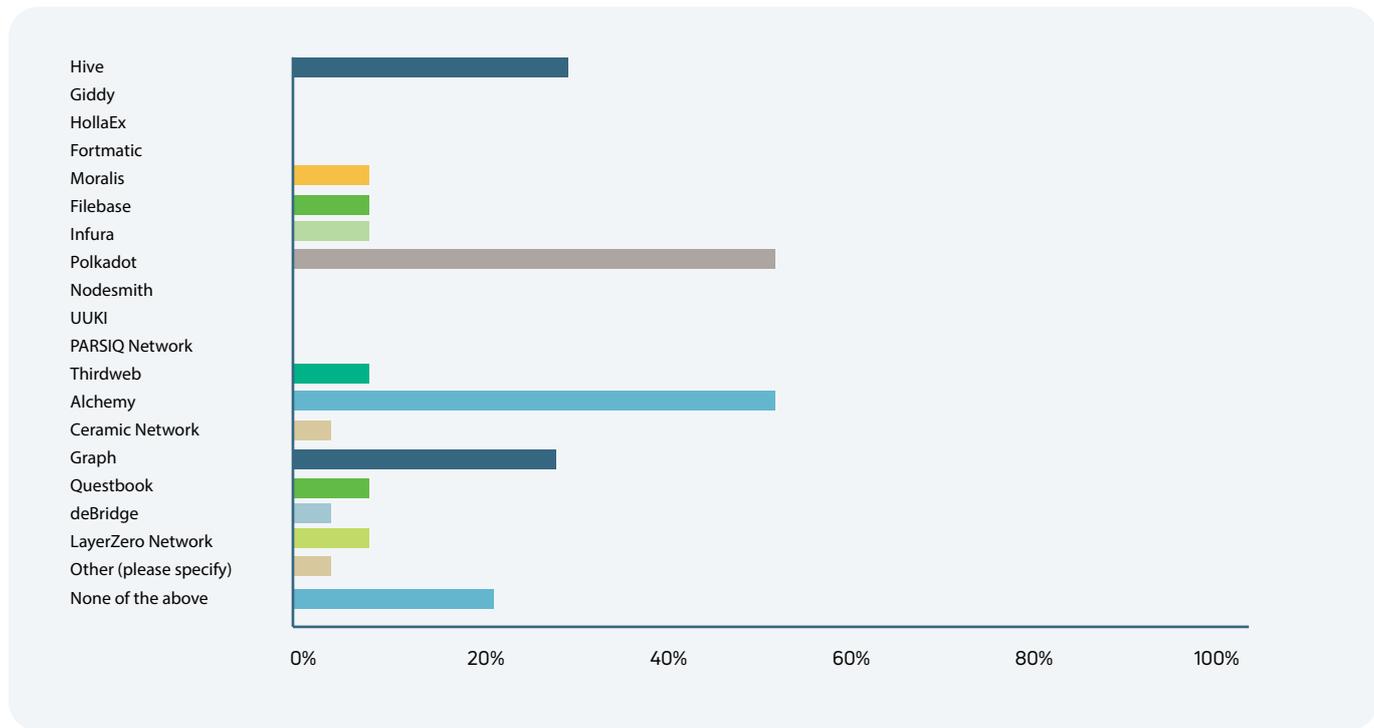
The last questions were inquiring about information sources for business people and entrepreneurs.

An open-ended question asked for suggestions as to how industry bodies or associations can support businesses in their Web3 journey.

A clear desire from the responses was more regulation. This was closely followed by funding, and information resources.

Web sites emerged on top:	Web sites:	93.33%
	Newsletters:	66.67%
	Communities:	66.67%
Popular sources were:	LinkedIn	
	YouTube	
	Twitter/X.com	
	Reddit	
Communities listed included:	Polkadot	
	Ethereum	
	Hive	
	Blockchain Ireland	

One response succinctly summarised:

"Industry bodies and associations can play a pivotal role in supporting businesses on their Web3 journey through several strategic initiatives: Education and Training, Regulatory Guidance, Networking, Innovation Hubs, Standards and Best Practices, Advocacy, Market Insights, and Access to Technology."

Another response also captured many salient points:

I believe there is a need to develop more leaders in this space that are able to speak both the technical and business language. Majority of players are highly technical with no business analysis and/or communication skills which are key in this industry for faster adoption especially when dealing with web2 companies."

More hands-on experiences were also highlighted, with suggestions for workshops, but also more events, short courses and meet-ups, but with less corporate influence.

Survey Conclusions

With a clear polarisation between larger, more mature organisations, and smaller, less mature ones, the major points of interest are the current and expected applications of Web3 technologies.

With strong showings for observed applications such as customer loyalty, community building, NFT creation, marketing and exchange, and gaming and creator economies, it indicates a vibrant, diverse business landscape in Web3.

Furthermore, the perception of utility or advantage in areas such as decentralisation, audience/ user engagement, and digital asset storage/portability, show that businesspeople are leveraging the key characteristics of Web3, potentially inspiring the expected new business models.

The extrapolation that Web3 will be applied to areas such as regulation, education, public services and electoral systems also shows a critical appraisal of the characteristics of Web3, and are already being borne out in some instances.

The suggestions also illustrate the need for industry groups and communities, as well as more formal resources and funding.

INDUSTRY INSIGHTS REPORT ON WEB3

Web3 Job Open Job Roles – Skills demand indicators:

A 4-month collection of Web3 job vacancy data globally, gathered from 23 January to 22 May 2024 on the LinkedIn professional network revealed that marketing and business development roles were in higher availability than technical or community management. A significant proportion of intern roles, across all disciplines were also available.

Marketing/Business Development:	37%
Developer/Technical:	33%
Community:	15%
Intern:	15%

The jobs were in the majority remote or hybrid (73%)

Remote:	57%
Hybrid:	16%
On-Site:	27%

While vacancy appearance rates varied from 7 a day to more than 30, for a period from 4 April to 14 April 2024, there was consistently more than 30 vacancies per day.

Popular knowledge and awareness survey

In partnership with Blockchain Ireland, Amárach was commissioned to carry out a survey among 1,000 Irish adults in March of 2024, that gauged awareness and use of blockchain, crypto and Web3 technologies.

Digital wallet

Familiar: 62%   Unfamiliar: 13%

Defi

Familiar: 13%   Unfamiliar: 73%

Tokenisation

Familiar: 12%   Unfamiliar: 74%

Web3

Familiar: 9%   Unfamiliar: 79%

This compares similarly internationally, where the Consensys "Global Survey on Crypto and Web3" from June of 2023, found that while 92% of respondents reported an awareness of cryptocurrencies, only 8% were very familiar with the concept of Web3 (15,00 adults from 15 countries)[194].

The strong inference from these results is that broad public awareness of these technologies is low in the Irish population, and that metric is mirrored in other markets, even more developed ones such as the USA.

However, a metric often cited in the US as to interest levels may also be illustrative here. It is that cryptocurrency awareness and ownership rates have increased to record levels in the USA, as 40% of American adults now own crypto, up from 30% in 2023. This could be as many as 93 million people[195].

By comparison, dog ownership in the USA in 2024 was estimated at just 65.1 million households[196]. While this is not a direct comparison, in terms of incidence it is illustrative of a level of involvement that is widespread, if not uniform or coherent.

By comparison, the Amárach survey found that just 13% of Irish adults own cryptocurrency or digital assets, with the highest proportion among younger males (18-34), at 17%[197].

The clear implication is that a broad awareness campaign, similar to previous digital literacy skills, would be necessary to educate the population as to the utility, advantages, and risks, of a Web3-style internet development.
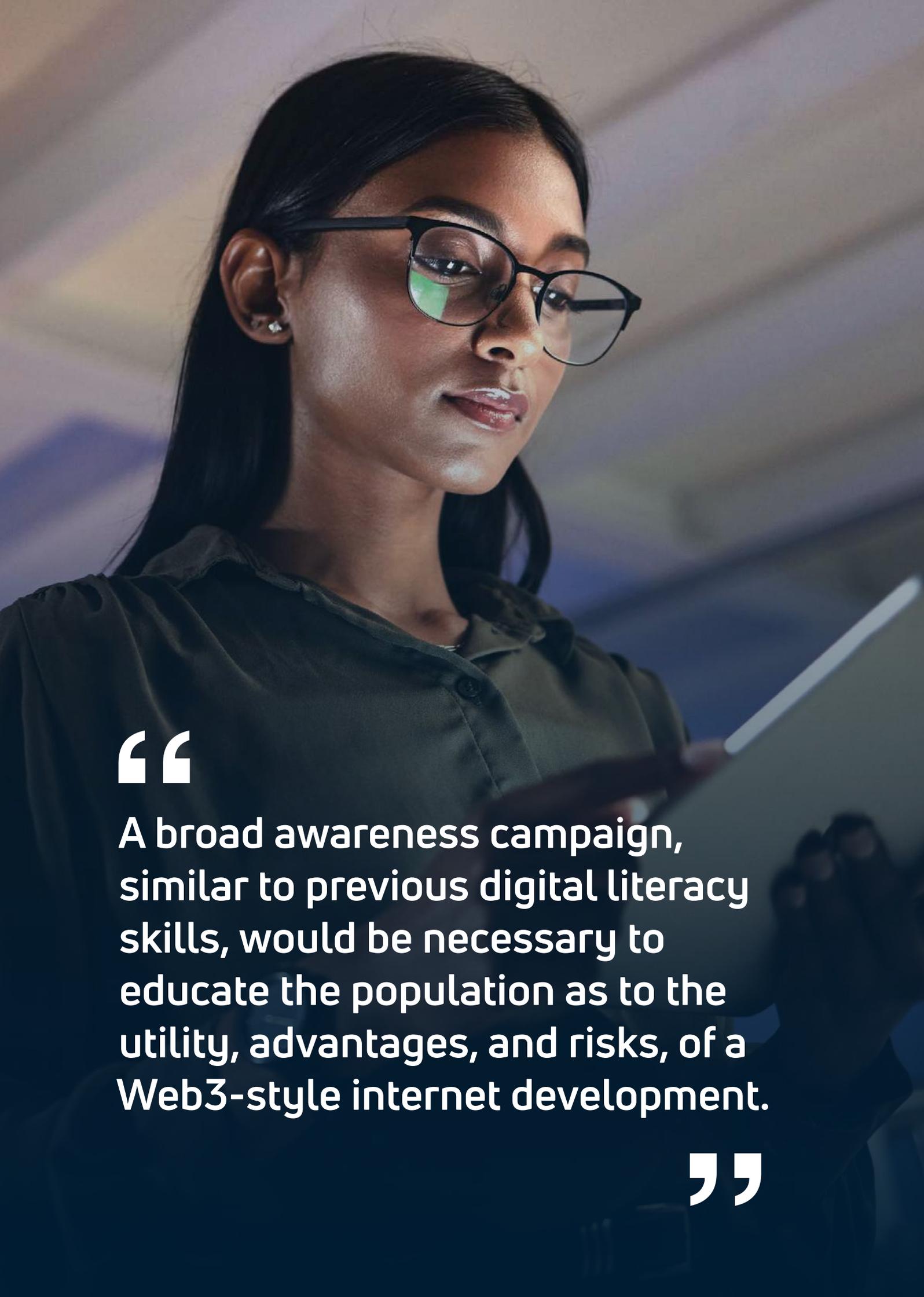
> "A broad awareness campaign, similar to previous digital literacy skills, would be necessary to educate the population as to the utility, advantages, and risks, of a Web3-style internet development."

Subject Matter
Expert Interviews

Subject Matter Expert Interviews

Interviews with subject matter experts (SME) were carried out throughout the entire period of the report project, from July 2023 to July 2024. The interviewees were drawn from a broad spectrum of government, policy groups, public services, enterprise, start-ups, education, and communities.

26 Interviews conducted across:

· Community
· Start-ups/SMEs
· Enterprise
· Government/Public services
· Policy
· Advisories/Analysts

There are 33 quoted sources in total: additionally including extracts from conference interactions and one-to-one conversations.

SME Interviewees

Barry Lowry
OGCIO

Leo Clancy
Former CEO, Enterprise Ireland

Nena Dokuzov
Coordinator, Strategy of digital transformation of economy, Ministry of the Economy, Tourism and Sport, Slovenia

John McGeown
Assistant Principal Officer, Department of Further and Higher Education, Research, Innovation and Science

Horacio González-Vélez
Professor of Computer Systems, Founding Head of The Cloud Competency Centre, National College of Ireland (NCI)

Professor Joyce O'Connor
Founding President, NCI; Co-founder Block W; Chair Digital Group IIEA; Chair Europe's Digital Future Network

Dr Irina Tal
Assistant Professor, School of Computing, DCU

Sara Jane Kenny
Junior Developer Community Advocate, Algorand Foundation; BlockConnect Co-Founder

Frank Friel
VP Technology Management, Blockchain Incubator at Fidelity Investments, FCAT

Joe Farren
Founder, Web3 Media Labs, Fanzon3

Giancarlo Sanchez
Founder of Webstudio.so; ETH Dublin

Ryan Kemp ETH Dublin
Co-founder @ETHDublin; Events @Chorus One

Moran Hertzanu Weiss
Web3 Specialist; Honoured DLT Super Talent 2024; Chartered Blockchain Analyst - CBA Level 1

Alexandra Overgaag
Lawyer, Consultant, Founder/CEO Thrilld Labs

Anastasia Platonava
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John Ward
CEO, Founder, ServBlock

Gonzalo Faura
MSc Blockchain, DCU; Founder and CEO, Swappsi Software; Founder of Chainzie Ltd (Blockchain Services); Co-Founder and CTO, Cirrutech Software Ltd

Radhakrishna Dasari
Technical Education Lead at Web3 Foundation

Owen Healy
Blockchain Talent
(Specialist recruiter in blockchain and Web3)

Laurence Kehoe
MSX CEO (USX Stablecoin); Blockchain Ireland Founder & Chair; Trinity College Dublin Adjunct Asst. Prof. PhD candidate

Lorcan Kelly
Research Assistant, ESRI - Labour Market and Skills Team

Key observations from SMEs

1 **Web3 is in a nascent phase of development.**

This was characterised by a reluctance on behalf of some experts in adjacent fields, such as blockchain (a foundational technology in the Web3 stack), to comment in an official capacity.

2 **Web3 is a ground-up phenomenon**

Unlike recent developments such as cloud computing, AI, or quantum computing, which are very much top-down developments.

3 **Web3 is a collection of technologies and principles**

But more importantly it is also a philosophy about trust, control, democratisation, and value.

4 **Web3 hindered by Web2**

Web3 may well be frustrated by incumbent Web2 companies, particularly in areas of effective monopolies, as it is not in their interests to promote due to the inherent threat to existing business models.

5 **University degree courses are not suitable**

Degree courses are suited to the basics and theory, but do not keep pace with the rate of development of the technology or markets.

6 **Targeted courses**

Short, targeted courses and micro-credentials are preferred by existing practitioners.

7 Record not qualifications

Currently, people get hired in blockchain and Web3 for their record, not their qualifications, as evidenced by projects completed, code donated (to open source repositories), or ecosystem/community contributions.

8 Attracts women

Web3, through its early stage nascency, and democratic nature, attracts many women, with organisations such as the Association of Women in Crypto (AWIC), Women of Web3, and HerDAO, representing women's interests.

9 Web3 & metaverse link

While Web3 and the metaverse were initially perceived as closely linked, the term was used very rarely in the SME engagements. Most notably, in the two-day conference programme of Blockchain Ireland Week 2024, there was not a single mention of the term by a speaker or panellist.

10 Positive impact

Web3's capacity for positive impact is very high on the agenda for many involved in the ecosystem, through bringing financial services to the unbanked, and being a trustless system behind areas such as ecological conservation, and general interoperability to bring communities together in a secure, open fashion.

11 Sustainability

Web3 from both a technological and practical, operational standpoint, has sustainability as a central principle, despite the challenges posed by the perception of blockchain and decentralisation as being profligate for energy.

Workshops

Workshops

The workshops for this report were given the themes of business and education. The aim of each was to take digests of findings from desk research, surveys, and SME interviews and discuss them with a view to formulating ideas for recommendations in line with the overall goal of the report.

Education panel

For the education panel, the reviewers were:

Dr Trevor Clohessy:
Lecturer in business information systems and transformative technologies at ATU Galway School of Business since September 2018. His research interests include blockchain, business analytics, digital transformation, digital addiction, digital politics and cloud computing.

Paula Guilfoyle:
CEO of A Block of Crypto, an education platform and service for blockchain, crypto and Web3.

Paula is an accountant and was a Microsoft Most Valued Professional in digital education for Excel. She began her own Excel accountancy training series, before moving into blockchain, crypto and 3Web, where she now runs meetups and seminars, listing chapter groups in three international territories.

Education Workshop Discussion Summary

The burgeoning field of Web3 presents a complex interplay of technological advancements, business models, and societal implications. While the potential for decentralised applications and user-owned data is immense, numerous challenges persist, hindering its widespread adoption.

One significant hurdle is the lack of a standardised Web3 company model. Unlike traditional businesses, Web3 ventures often require unique adaptations to fundamental aspects like accounting and finance. This necessitates a degree of experimentation and interpretation, even for basic operations.

Despite the involvement of major corporations like Reddit and Nike, a clear blueprint for a successful Web3 company remains undetermined. This uncertainty, coupled with the ongoing challenges surrounding cryptocurrency, creates a complex environment for businesses and users alike.

The issue of cryptocurrency conversion to fiat currency is paramount. While the ability to cash out is essential, it requires robust services, support systems, and widespread education to ensure legal and efficient processes. Regulatory frameworks like MiCAR, while helpful, do not fully address these concerns.

The geographic disparity between developer activity and user base presents a challenge. While developers may be concentrated in regions like Singapore and Europe, the majority of users are located in less developed nations, particularly in Africa, Asia, and Southeast Asia.

The naming and terminology surrounding Web3 also contribute to confusion. The term itself is often misunderstood, and even online definitions can be inconsistent. This highlights the need to move beyond technical jargon and focus on the underlying concepts of future web development.

The metaverse, once a separate concept, is now increasingly seen as an integral part of Web3. However, the dominance of centralised Web2 infrastructures poses significant obstacles to achieving true decentralisation and user ownership.

Gavin Wood's original vision of Web3, a permissionless world where everyone owns their identity, may be difficult to realise. The current reality is often characterised by permissioned models and limited transparency in AI systems.

The technological infrastructure required for a fully realised Web3 is still under development. Blockchains, originally conceived for decentralised networks, are frequently used in permissioned models. While advanced concepts like zero-trust models and zero-knowledge proofs hold promise, their practical implementation remains uncertain.

Educational institutions face challenges in keeping pace with the rapid advancements in Web3. Traditional degree programmes may not adequately prepare students for the evolving landscape. There is a growing need for more flexible and industry-relevant education models, such as internal universities and micro-credentials.

The proliferation of online gurus and misinformation further complicates the educational landscape. While industry-led initiatives can offer more tailored and up-to-date training, academia can play a vital role in providing a broader understanding of Web3's philosophy and approach.

Ultimately, the successful development and adoption of Web3 will depend on a combination of technological advancements, regulatory clarity, and effective education. Addressing these challenges and fostering collaboration between industry, academia, and governments, can pave the way for a more decentralised and user-centric digital future as envisioned by Web3.

> "
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> "

"

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"

Business Workshop Panel

For the business panel, the reviewers were:

Helen McMahon, Enterprise Ireland:
Helen is Senior Strategic Policy Advisor, responsible for formulating policy position on key strategic matters. Helen leads ongoing engagement with Government Departments, Agencies, and other stakeholders in the area of skills and talent.

John Durcan, IDA Ireland:
John is the Chief Technologist with IDA Ireland, with specialist areas of Data Analytics, Machine Learning (ML), Artificial Intelligence (AI), Blockchain, Cyber Security, Data Ethics and Privacy.

Business workshop discussion summary

The transition to Web3 presents a unique set of challenges for both established companies and aspiring entrepreneurs. While the potential benefits of decentralised technologies are significant, the lack of clear revenue models and the complexities of the Web3 ecosystem can hinder adoption.

To address these concerns, a hybrid approach involving safe spaces for experimentation and collaboration between large and small companies would be beneficial. This would allow established businesses to explore Web3 concepts without immediate risks, while also providing opportunities for start-ups to showcase their expertise.

Fostering a culture of innovation and entrepreneurship within Web3 is essential. This includes providing mentorship, promoting cross-functional collaboration, and particularly supporting the development of new business models. To facilitate investment and adoption, concrete examples of successful Web3 businesses and their case studies are crucial. These resources can help institutions and industries make informed decisions about allocating resources and developing relevant educational programmes.

Tailored education and information resources are vital for both industry professionals and newcomers to Web3. Transversal skills like complex problem-solving, design thinking, and project management are essential for navigating the complexities of this nascent field.

Micro-credential courses can provide a flexible and efficient way for individuals to acquire the necessary skills. By focusing on specific areas and building towards broader accreditations, these courses can cater to diverse learning needs.

Leveraging existing examples of blockchain adoption and highlighting the added value of Web3 can help make a compelling case for investment in skills development. Focusing on popular and mass adoption areas such as social media, gaming, and loyalty programmes, can further enhance the appeal of Web3.

Effective communication is crucial for fostering understanding and adoption. Companies, vendors, and technology providers must actively communicate and promote the capabilities and benefits of their Web3 solutions. Close collaboration between industry and training bodies is critical to ensure that educational programmes align with market needs.

Addressing negative perceptions associated with bitcoin and NFT crashes is essential for building trust and credibility. Providing guidance and support to founders in navigating the complexities of Web3 business models can also contribute to successful outcomes.

Ultimately, the level of investment in Web3 will depend on the compelling business cases presented and the demonstrated impact on the industry. While educational institutions can play a role in shaping the future, industry-led initiatives and demand-driven approaches are likely to be more effective in driving adoption.

Micro-credentials will be a key component of the skills and education landscape, but their design and implementation must be carefully considered. Clear terminology and a focus on practical applications are essential to attract the right talent.

Recognising prior learning and experience is crucial for individuals who have entered Web3 through non-traditional pathways. This can help them access micro-credentials and avoid unnecessary barriers to entry.

Flexibility and accessibility are key to attracting a diverse range of learners. Leveraging innovative education models and pathways, as well previously successful ones, can help individuals acquire the necessary skills without requiring a traditional degree.

Work placements and hands-on experience are invaluable for developing practical skills and building professional networks. Integrating these opportunities into training programmes, can ensure that learners are equipped to contribute effectively to the Web3 ecosystem.

In conclusion, fostering the adoption and innovation of Web3 requires a multifaceted approach that addresses the challenges, opportunities, and educational needs of various stakeholders. Facilitating and promoting collaboration, providing tailored support, and leveraging emerging trends in education, can pave the way for a successful strategy to take full advantage of the value proposition of Web3.

Conclusions

Conclusions

The world of Web3 is a nascent phenomenon, full of potential but still lacking in clear definition and widespread adoption, creating both excitement and uncertainty.

Web3 is more than just technology; it is a philosophy built on decentralisation, empowerment, and community. Unlike previous technological advancements like AI, Web3 is driven by enthusiasts and grassroots movements. This community focus is reflected in the demand for non-technical roles like communication and community management. Additionally, Web3 is attracting diverse talent, including women and underrepresented groups.

Despite its democratic nature, Web3 faces resistance from established internet giants who see their business models threatened by decentralisation. However, many believe the future internet will inevitably be shaped by Web3 principles like data ownership and self-sovereignty.

Early adopter companies are already incorporating Web3 elements into their offerings, paving the way for a hybrid "Web2.5" phase. While mass-market applications are still rare, they are emerging in areas such as social media, gaming, and even artistic expression. However, a lack of clear success stories and the need for regulation are potentially hindering wider adoption.

The supporting infrastructure for Web3 is being built, but often by entities outside the Web3 ecosystem itself, raising concerns about compatibility and utility. Interestingly, there seems to be a thriving market of specialist service providers emerging to cater to Web3 companies.

While the regulatory environment is evolving, it is struggling to keep pace with the rapid development of Web3. Uncertainty around fundamentals, such as taxation and accounting practices is a major concern for Web3 businesses. The skills gap is a major challenge. Web3 developers are typically self-taught and hungry for quick, up-to-date learning resources. Traditional academic institutions are seen as slow and outdated, despite calls for prior learning recognition. However, universities are acknowledged as the best place to learn fundamental Web3 concepts.

The solution lies in close collaboration between skills agencies and the Web3 industry to create relevant and timely training. Existing academic frameworks can be adapted, focusing on specific industry needs through partnerships with companies. Additionally, short, targeted courses and public awareness campaigns can help introduce and demystify Web3 for broader audiences.

Developing strong transversal skills such as project management and communication is crucial for all Web3 roles. Education needs to start early, with suggestions for the concepts to be introduced at the secondary school level to prepare the next generation.

Support for Web3 start-ups needs to improve. Ireland, with its vibrant tech culture and history of fostering new sectors, is well-positioned to become a leader in the Web3 space. However, it requires a coordinated effort from government, academia, and industry to overcome the challenges and unlock the vast potential of Web3.

In conclusion, Web3 is a **double-edged sword**: an exciting opportunity for first movers but also a risky proposition due to its early stage and lack of definition. **Success will depend on close collaboration and a commitment** to building a future internet that is accessible, innovative, and inclusive.

Recommendations

Skills and education

In order to build a skills and talent pipeline for Web3, a range of measures in the immediate, short, medium, and long term are necessary.

There is an immediate need for an education course that brings together all the currently recognised fundamentals of Web3 aimed at business leaders and entrepreneurs to allow them to understand the overall value proposition of Web3.

In the short term, all existing, relevant technical and business resources in Web3 need to be publicised by skills agencies and circulated to the communities. New resources also need to be developed addressing business fundamentals as they pertain to Web3, such as financial services, taxation, and growth strategies.

In the medium term, existing education and skills frameworks must develop new materials and courseware, refined by industry consultation to ensure an ongoing pipeline of informed business and technical skills. Technology vendors and platform providers can be coopted to provide education and skills resources to developers, with supervision from skills agencies to ensure that even platform or ecosystems specific skills can be a basis for professional recognition and entry to formal learning pathways.

Short, focused courses, with micro-credentials that can be integrated with formal learning pathways can complement more formal, academic systems, but that also recognise and validate prior learning.

Focused and specific skills and education forums need to be instituted to ensure a close, collaborative environment for policy, industry, and education and skills, to ensure that resources are keeping pace with development and the needs of industry. This is as important for transversal skills as it is for technical development skills.

Such forums could be hosted by industry groups or consortia of education and skills institutes, and scheduled regularly, with findings being reported to policy makers, as well as the participant stakeholders.

Public awareness needs to be addressed with campaigns to begin to educate the populace as to this new phase of development, informed by the success of previous such initiatives.

Existing successes need to be highlighted and use cases developed and communicated widely to improve knowledge and understanding.

Policy and Regulation

While regulation and policy developments are welcome, they do not go far enough to meet the needs of this emerging industry. More regulatory certainty is needed to truly foster an innovative business environment, especially as there is such potential for business model innovation. Taxation, accounting, and growth planning are areas highlighted for improvement.

This topic could be a complementary line of discussion with the education and skills forums, feeding back to policy makers and regulators.

Development and Supports

Specific, industry informed supports are necessary, from mentoring and funding, to financial, taxation, and advisory services.

Case studies that illustrate successful applications, services, and business models are necessary for all to improve awareness and understanding on all sides.

Support agencies are in particular need of closer industry ties and dialogue to ensure that facilities and supports are commensurate with needs and evolve with developments.

Specific community supports would be beneficial in this sector. Facilitation in terms of spaces and funding would be beneficial and contribute to the open and accessible nature of the sector.

The particular strengths of Web3, as they pertain to sustainability efforts should be capitalised upon, and publicised. This could be a subsequent topic for businesspeople beyond Web3 fundamentals. While sustainability will be a constant thread through all aspects of Web3 education, it should also be highlighted as a specific opportunity.

The aspects of the Web3 communities that have and continue to attract women and less represented groups should be further examined and supported. Anything that can broaden opportunity, increase the appeal for the underrepresented, and address imbalances must be recognised and supported.

Future developments

It has been noted, and widely expressed, that even if the major concepts of Web3 become commonplace, that round of development may not, by then, be called Web3. Great care must be taken in the cross-sectoral collaboration to be mindful of terminology and nomenclature to ensure that all resources to support these developments are representative enough to be easily discoverable and interpretable by those seeking them.

Despite the rapidly evolving nature of the technologies, lessons of previous development and transformation cycles are still illustrative of likely timeframes.

It may be 10 years before what is currently envisaged as Web3 sees widespread availability and adoption. This time must be used for broad preparation, but now is the time to begin to understand the implications. For example, the advent of the Cookie Directives and subsequent GDPR regulation has not seen a significant willingness in the general public to take greater ownership of their privacy entitlements yet. A major implication of Web3 is ownership and administration of personal identity and data. Unless this is facilitated in such a way as to make it easy and advantageous for users, they will not do so, and a central value proposition of the development is lost. However, the potential for Web3 technologies to restore trust in internet services and providers, as well as combat disinformation, cannot be underestimated. With so much focus on social media and the general perception of untrustworthiness in traditional media, the stack of technologies that is currently dubbed Web3 could provide a new surety that few other architectures can currently.

As much was learned from the trust exercise of the Irish COVID Tracker app, so too public initiatives such as the EU Digital Identity Wallet will reveal much about public appetite and willingness to adopt more self-custodial facilities.

There is little doubt that the set of facilities offered by Web3, as it is currently described, offer a new form of engagement with data services for all users, as well as valuable new ways of providing public services. However, their ultimate success is far from guaranteed due to a number of factors.

The decision must be made as to whether this vision of a future internet is one that is of sufficient value from public service, economic, and societal perspectives as to make a potential decade of preparation and planning worthwhile.
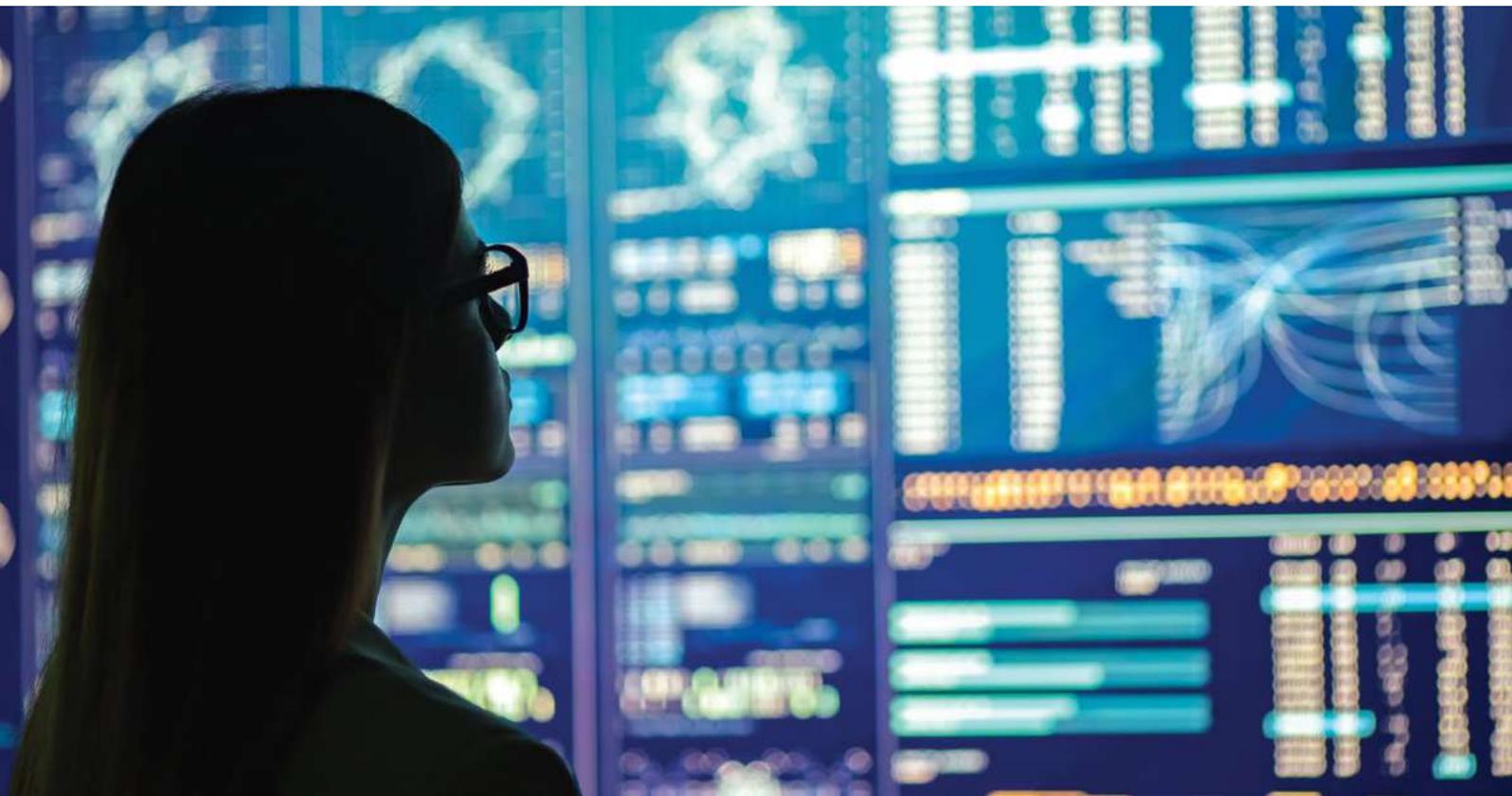
Appendices - Academic Partners

Dr Trevor Clohessy

- Atlantic Technological University Galway
- Department: Enterprise and Technology
- Role: Lecturer
- Work Area/Key Responsibilities: business information systems and transformative technologies

Academic biography: Trevor Clohessy is a lecturer in business information systems and transformative technologies at ATU Galway School of Business since September 2018. Prior to this post, Trevor was a Lecturer at the National University of Ireland Galway business school and a post-doctoral researcher with Lero. His research interests include blockchain, business analytics, digital transformation, digital addiction, digital politics and cloud computing.

Trevor completed his PhD from the National University of Ireland Galway. His doctoral thesis investigated the digital transformation impact of cloud computing on IT service providers. Trevor also holds a MSc in Information Systems Management and a MSc in Occupational Health and Safety from the National University of Ireland Galway.

Trevor has lectured business information systems, business analytics, databases, and cloud computing topics in traditional class room settings and blended / online learning settings. Trevor and his research associates conducted one of the first blockchain Irish organisational readiness reports in 2018 entitled "Organisational factors that influence the Blockchain adoption in Ireland."

Trevor is a member of the Connaught University Alliance (CUA) GMIT programme group for graduate studies and a member of the GMIT Business school research ethics committee.

Research interests
- blockchain
- business analytics
- digital transformation
- digital addiction
- digital politics
- cloud computing

Dr Irina Tal

- Dublin City University
- Department: Faculty of Engineering and Computing
- Role: Assistant Professor
- Work Area/Key Responsibilities: Computing

Academic biography: Irina is an Assistant Professor, School of Computing, Dublin City University (DCU), and Academic Lead MSc in Blockchain – Distributed Ledger Technologies (partly funded by Technology Ireland ICT Skillnet). She is teaching mainly in the Cyber Security area.

Prior to joining DCU as an Assistant Professor, Irina was a Lecturer with National College of Ireland and Programme Director MSc Cybersecurity (part-time) and BSc in Computing and Business Information Systems (3rd and 4th years). She was also a Postdoctoral Researcher at DCU working on a H2020 EU project in the area of technology enhanced learning. Her research interests are in the following areas: technology enhanced learning, cyber security, especially usable security, applications of blockchain, adaptive systems, vehicular communications and smart cities.

Irina is the PI of the SFI funded project: PRIVATT - Irish Attitudes to Privacy in COVID19 Times. She is also a collaborator on the SFI Discover project: AI In My Life: AI, Ethics & Privacy Transition Year Workshops.

Research interests
- cyber security
- usable security
- applications of blockchain
- technology enhanced learning
- vehicular networks
- smart cities

Author

Paul Hearns

Paul Hearns is an independent consultant in content strategy and services with more than two decades of experience in information technology.

Hearns has worked as a web developer, network and domain administrator, and cybersecurity instructor and practitioner, while freelancing as a technology journalist. Hearns edited Ireland's IT professional journal for 15 years, and developed a CIO technology briefing series alongside a technology research service. He has sat on academic curricula development panels and spoken extensively at events and conferences, as well as mediating expert panels and conference hosting.

In 2019, Hearns was made a Fellow of the Irish Computer Society. Hearns is co-chair of the Blockchain Ireland Events and Communications Working Group, and a steering group member.

Glossary of Terms and abbreviations

Account abstraction:
Account Abstraction (AA) is a standard that describes the use of higher-level infrastructure to enable smart contract accounts to become the primary type of account for users without requiring protocol-level changes.

Blockchain:
A blockchain is a distributed database that maintains a continuously growing list of ordered records, called blocks. These blocks are linked using cryptography. Each block contains a cryptographic hash of the previous block, a timestamp, and transaction data. As there is no way to change a block, the only trust needed is at the point where a user or program enters data. This aspect reduces the need for trusted third parties, which are usually auditors or other humans that add costs and make mistakes.

Capital gains tax:
Capital Gains Tax is charged on the capital gain or profit made on the disposal of an asset.

DAO – Decentralised Autonomous Organisation:
A decentralised autonomous organisation, sometimes called a decentralised autonomous corporation (DAC), is an organisation managed in whole or in part by decentralised computer program, with voting and finances handled through a blockchain. In general terms, DAOs are member-owned communities without centralised leadership. The precise legal status of this type of business organisation is unclear.

Digital Wallet:
A digital wallet (or electronic wallet) is a software-based system or an application that runs on any connected device. It stores payment information and passwords of numerous payment methods and websites.

DLT – Distributed Ledger Technology:
Distributed ledger technology (DLT) is the technological infrastructure and protocols that allow simultaneous access, validation, and record updating across a networked database. DLT is the technology blockchains are created from, and the infrastructure allows users to view any changes and who made them, reduces the need to audit data, ensures data is reliable, and only provides access to those that need it.

Fractionalisation:
Fractional ownership, also known as asset fractionalisation, is a financial concept that involves dividing high-value assets into smaller, more manageable units known as tokens. Each token represents a specific share of the asset's value and ownership, allowing a more diverse group of investors to participate in its ownership. This innovative approach makes it possible for individuals to own a proportional share of the asset without having to buy the entire entity. Fractionalisation can be applied to various types of assets, including collectibles, Real-World Assets (RWA), NFTs, and more.

NFT – Non-Fungible Token:
A non-fungible token (NFT) is a unique digital identifier that is recorded on a blockchain and is used to certify ownership and authenticity.

Phygital:
Phygital is the concept of using technology to bridge the digital world with the physical world with the purpose of providing a unique interactive experiences for the user.

Roll ups:
Roll ups are Layer 2 scaling solutions that process transactions off-chain and then bundle the transaction data into batches to submit them on the corresponding Layer 1 blockchain. This reduces congestion and computation load on the main blockchain, thereby increasing transaction throughput.

Smart contracts:
A smart contract is a self-executing program that automates the actions required in a blockchain transaction. Once completed, the transactions are trackable and irreversible. The best way to envision a smart contract is to think of a vending machine—when you insert the correct amount of money and push an item's button, the program (the smart contract) activates the machine to dispense your chosen item. Smart contracts permit trusted transactions and agreements to be carried out among disparate, anonymous parties without the need for a central authority, legal system, or external enforcement mechanism.
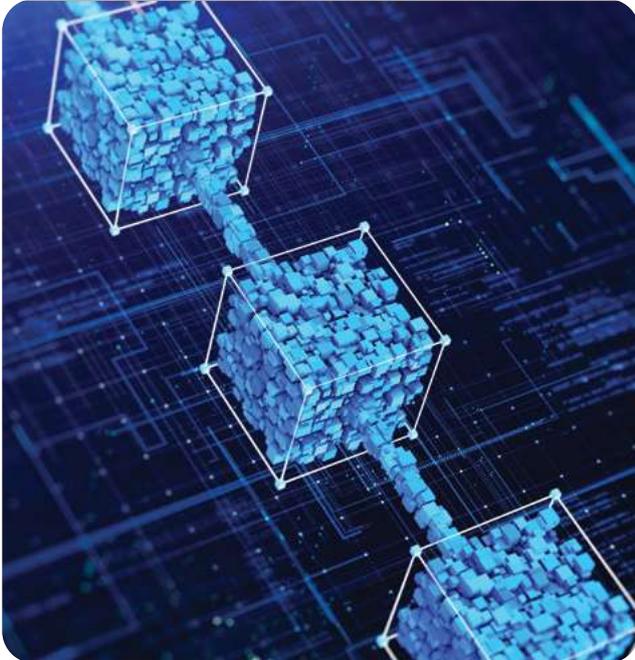
Tokenisation:

Tokenisation is the process of replacing sensitive data with unique identification symbols that retain all the essential information about the data without compromising its security. Tokenisation, which seeks to minimize the amount of sensitive data a business needs to keep on hand, has become a popular way for small and midsize businesses to bolster the security of credit card and e-commerce transactions while minimizing the cost and complexity of compliance with industry standards and government regulations.

User Experience (UX):

User experience is how a user interacts with and experiences a product, system or service. It includes a person's perceptions of utility, ease of use, and efficiency.

Zero Knowledge Proofs:

Zero-knowledge proofs (ZKPs) are a cryptographic method used to prove knowledge about a piece of data, without revealing the data itself.

Soulbound tokens:

Soulbound Tokens (SBT) are a theoretical concept of non-transferable digital tokens that could potentially represent a person's identity and achievements in the Web3 ecosystem.

SSI - Self-sovereign identity:

Self-sovereign identity (SSI) is a model for managing digital identities in which individuals or businesses have sole ownership over the ability to control their accounts and personal data. Individuals with self-sovereign identity can store their data to their devices and provide it for verification and transactions without the need to rely upon a central repository of data. With self-sovereign identity, users have complete control over how their personal information is kept and used.

Staking:

Staking is a strategy used across crypto and Web3 that empowers users to participate in keeping a blockchain network honest and secure. Locking up tokens is common across Web3, and is often what is happening when there is reference to "staking" tokens.
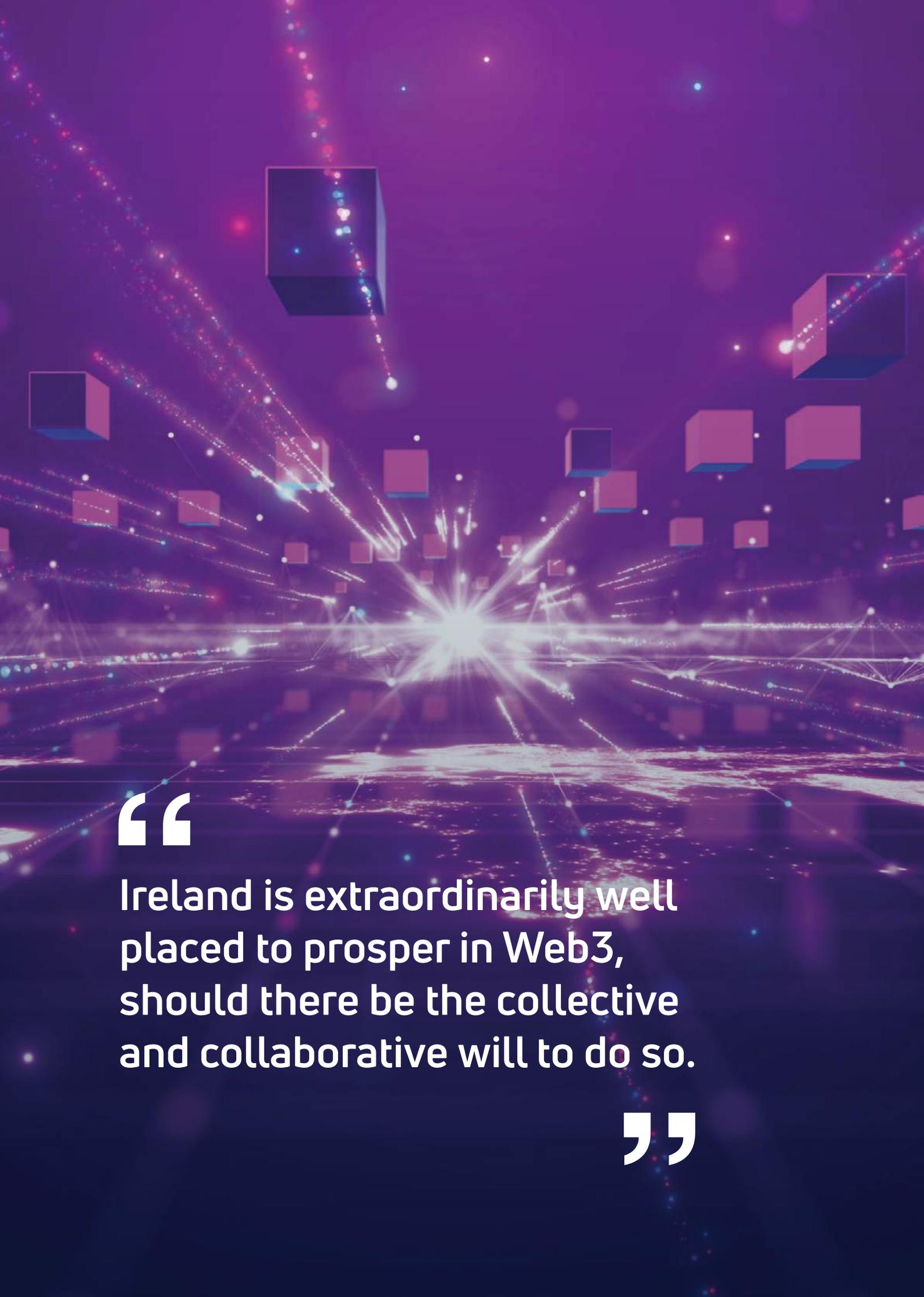
"

Ireland is extraordinarily well placed to prosper in Web3, should there be the collective and collaborative will to do so.

"

Web3 subject matter expert interviews and sources

Subject matter expert candidates:

- 53 Shortlisted
- 48 contacted
- 31 responded

5 either no longer relevant or unavailable (maternity, sick leave, no longer involved in field)

26 Interviews conducted across:

- Community
- Start-ups/SMEs
- Enterprise
- Government/Public services
- Policy
- Advisories/Analysts

33 quoted sources; additionally including extracts from conference interactions and one-to-one conversations.

Subject Matter Expert Interviewees

Barry Lowry
OGCIO

Leo Clancy
Former CEO, Enterprise Ireland.

Nena Dokuzov
Coordinator, Strategy of digital transformation of economy, Ministry of the Economy, Tourism and Sport, Slovenia

John McGeown
Assistant Principal Officer, Department of Further and Higher Education, Research, Innovation and Science

Horacio González-Vélez
Professor of Computer Systems, Founding Head of The Cloud Competency Centre, National College of Ireland (NCI)

Professor Joyce O'Connor
Founding President, NCI; Co-founder Block W; Chair Digital Group IIEA; Chair Europe's Digital Future Network

Irina Tal
Assistant Professor, School of Computing, DCU

Sara Jane Kenny
Junior Developer Community Advocate, Algorand Foundation; BlockConnect Co-Founder

Frank Friel
VP Technology Management, Blockchain Incubator at Fidelity Investments, FCAT

Joe Farren
Founder, Web3 Media Labs, Fanzon3

Giancarlo Sanchez
Founder of Webstudio.so; ETH Dublin

Ryan Kemp ETH Dublin
Co-founder @ETHDublin; Events @Chorus One

Moran Hertzanu Weiss
Web3 Specialist; Honoured DLT Super Talent 2024; Chartered Blockchain Analyst - CBA Level 1

Alexandra Overgaag
Lawyer, Consultant, Founder/CEO Thrilld Labs

Anastasia Platonava
PhD Researcher, TUS Athlone

John Ward
CEO, Founder, ServBlock

Gonzalo Faura
MSc Blockchain, DCU; Founder and CEO, Swappsi Software; Founder of Chainzie Ltd (Blockchain Services); Co-Founder and CTO, Cirrutech Software Ltd

Radhakrishna Dasari
Technical Education Lead at Web3 Foundation

Owen Healy
Blockchain Talent (Specialist recruiter in blockchain and Web3)

Laurence Kehoe
MSX CEO (USX Stablecoin); Blockchain Ireland Founder & Chair; Trinity College Dublin Adjunct Asst. Prof. PhD candidate

Lorcan Kelly
Research Assistant, ESRI - Labour Market and Skills Team

Education workshop discussion: key points

Arguably, from the developer stats, it can be seen that there are good technical skills out there and people seem to be able to get up to speed, but from a business perspective we are not necessarily seeing the development of the other skills stacks that are equally as important: marketing, finance, operations, etc. These need to be built out as roles, functions, processes etc, just as in any other business.

The diversity of potential business models in Web3 means that there is no standard Web3 company, therefore, there is an element of adaptation and interpretation for even the most fundamental things, such as accounting and finance.

Some larger companies have delved into the Web3 world, such as Reddit and Nike, but nothing that has given a blueprint, as such, for a Web3 company.

Cryptocurrency is still a big problem in the Web3 world. At some point, there has to the cashout option to the real world. There needs to be more services and supports to facilitate that, but also education as to how it works, how it can be done legally, and how it can be done efficiently to support the business but also make it easy for users.

While MiCAR is welcome it doesn't necessarily go far enough to cover cryptocurrency, leaving a gap for businesses and uncertainty.

While it is good to track developer activity and see that there are concentrations in places like Singapore, and places within Europe, that is not where the user base is. While high volume transactions might come from those places, but the user numbers are coming from less developed nations, places in Africa, Asia and South East Asia.

Naming is also an issue. Nobody speaks of using Web 2 or 2.0, so similarly, Web3 is, to all intents and purposes, a technical term. Users don't necessarily care what Web3 is, they are drawn in by the utility of it.

Even online definitions of Web3 are often inconsistent and conflicting in certain points. We need to get over what the terms are and talk about concepts like future web development.

Users don't care: there are certainly digital literacy and skills gaps, but users will follow what makes their life easier or more secure or cheaper to do what they need to do. The term metaverse is being drawn down a more technical path. Opinion is that metaverse is being subsumed into Web3 currently and may not reemerge as a standalone entity. It is now an element of, or a tool for, Web3.

With the predominance of Web2, with massive, centralised infrastructures and monolithic applications, it is very hard to see how ownership and DApps is going to come about because the big players do not want this, they don't want people to know about it.

Taking a step back, the term Web3 was coined by Gavin Wood to envision the future where everything is permissionless. Everyone owns their identity. It is not necessarily the best term to use in the overall context.

Web3, as envisaged by Gavin Wood, may never come true.

Web 3.0 is encapsulated with AI, but at the moment with most AI, it is black box, with transparency as to what the algorithms are.

The aspiration is for everything to be decentralised with DApps, DeFi and smart contracts, but is it in reality. No one is using it.

From a technology perspective, the tech stack for the full envisioning of Web3 is still not there, it is incomplete.

Blockchains are being used in a permissioned model, which was never how they were envisaged.

It is great to have a verified once identity, zero trust models and ZPFs, but it may not pan out that way. It is likely that there will be a more permissioned usage model.

Third level institutions here move too slowly [on new materials and topics], and there are quality assurance processes that can further complicate things.

A course could take two years to get full approval with existing syllabi, by which time it is already outdated. In a six modules course, there could be four or five other lecturers who don't know anything about the core subject, such as blockchain.
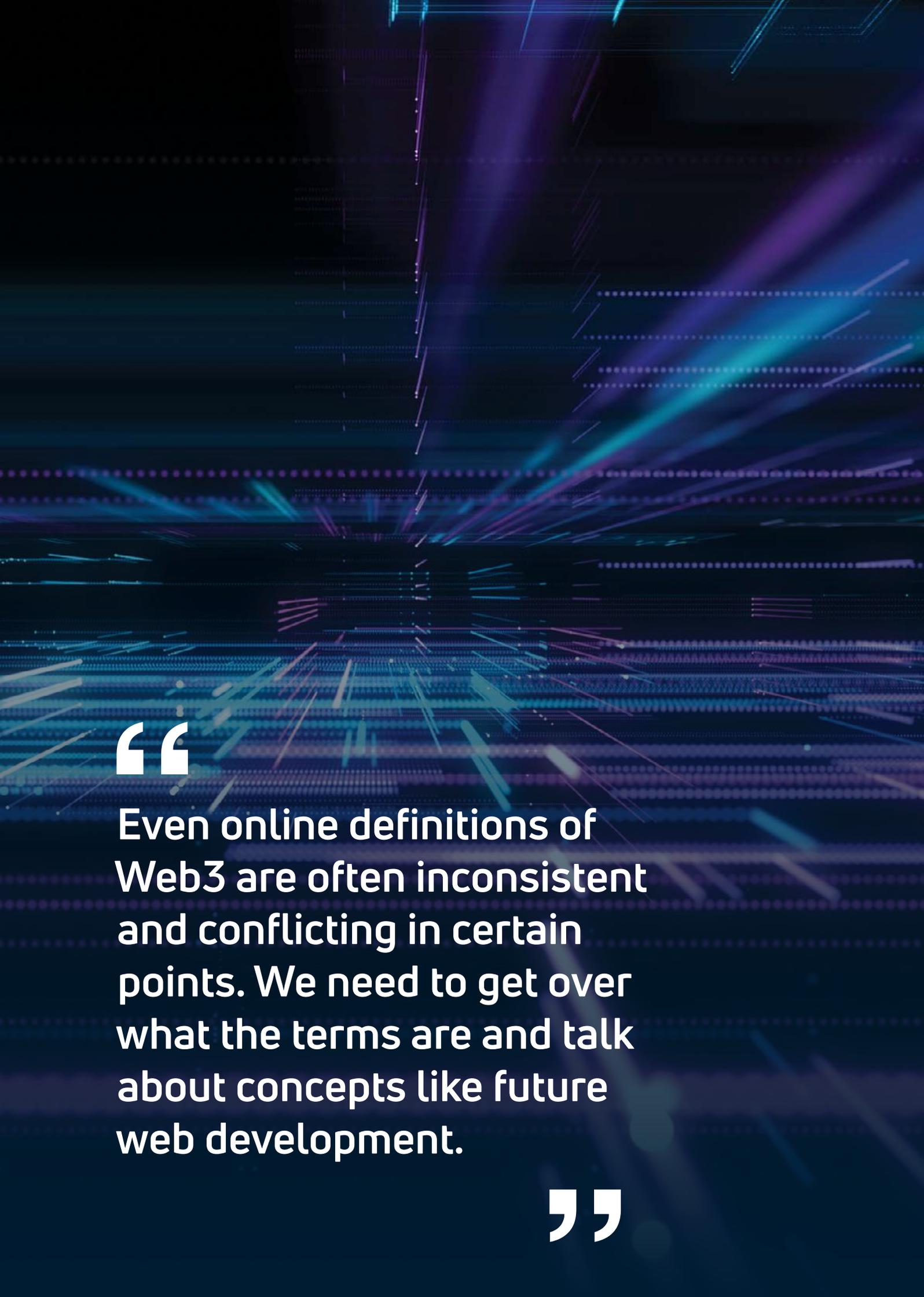
"

Even online definitions of
Web3 are often inconsistent
and conflicting in certain
points. We need to get over
what the terms are and talk
about concepts like future
web development.

"

In one industry example, a large company created an internal university, with education board setting up courses in a month. As people were onboarded, they went through, rapid specialist training and got a token at the end.

The people who did that stayed longer with the company, overturning previous trends of people leaving after a few months because they were lost in the subject, such as blockchain, and couldn't apply their specialist skills.

There are lessons there for rapid, tailored education to meet specific needs, delivered in an easily consumable means.

The future here is micro-credentials, internal universities and onboarding systems.

There is an issue with people setting themselves up as gurus on popular channels such as LinkedIn, often without any real knowledge or understanding but still garnering large audiences.

There is a lot to do in education, but the slightly pessimistic view at the moment is that the future is with industry, and the internal university, onboarding type approach.

Businesses can generally move faster, industry can update courseware every six months if needed or for each run of a course. Academia is falling behind and will not meet immediate needs.

As it is still very early days for the tech and the business models of Web3, Academia has a part to play. It can take the longer view of teaching the philosophy and approach of Web3, with the industry taking over the practicalities and doing the rapid, focused, even role specific education.

Academia can plant the seed in the minds of our future leaders, of future businesspeople, future technical people. And if they don't have the seeds now, they're going to go out into the workforce, know nothing about it. Academia can give them the seeds to take out into the world.

Model of European Computer Driving Licence (ECDL): awareness, literacy, broad understanding is needed. This would teach the basics such as self-sovereign identity, self-custody, wallets, keys, etc.

Basic financial literacy skills are what is needed too. There's little point targeting the unbanked if the banked don't understand the system they are engaged in.

Web3 allows people to earn for themselves because of the ownership element. It might be low, $2-3 per day, but in certain developing economies, that's worthwhile. This is likely to foster mass adoption in those areas.

The influence of AI, and AI-generated content is significant here.

It could be argued that Web3 or Web 3.0 is Gavin Woods vision, bespoke to decentralisation and Ethereum and blockchain and Bitcoin.

It is hard to tell the difference between AI content and non-AI, and that is being monetised. Today, you can go onto a website and interact with a chatbot to create an order that goes to a warehouse, is picked by a robot and dropped into a box on an automated line that is delivered by a drone to your door. That, it could be argued, is really Web3.

It can be argued that a step back is needed and to clarify what is being discussed in relation to Web3 and its features, as delivering education materials on something which isn't fully mature will lead to more confusion.

By the time society gets to the philosophical vision of what we currently envisage as Web3, it may not be referred to as Web3.

There is a need to name things better to make them more about the evolution and development of the web, rather than a version number, or bespoke nomenclature that is not reflective of reality, and that has huge implications for education resources. If they are incorrectly named, they will not fulfil their purpose.

Arguably, what is meant by Web3 is actually more like Blockchain 4.0 and what it enables. (Blockchain 4.0: The Road to Mainstream Enterprise Adoption).

Ethical questions around AI, and literacy around the implications of it are way more important than decentralised Apps when considering Web3.

Example cited of Cardano Foundation course,
AI presenter, rapid development. Easy access,
on demand consumption models.

In certain areas, university degrees are going to
become old hat.

People will do online courses from academies
associated with the likes of a Cardano foundation,
they will have a credential in their vault, and for most
companies that will be good enough. This will put
significant pressure on universities. This may well be
the future of education. No lecturer halls, no lecturers,
less ivory tower. Recruiters often say they have a
graduate come out of a 4 year degree and they spend
the next two years in industry being 'rewired' to learn
how it is done. That is the future.

Currently, it is still enthusiast and hobbyist led, but
that will change as more enterprises come onboard.

It is an irony that a grass roots development trend
is having most activity at the web-scale end with
the likes of Nike, and at the grass roots level with
enthusiasts and entrepreneurs.

Analogy with the accountancy profession where
the qualification model went from shadowing to
apprenticeship and on to university, and is now
moving back again to more vocational means.
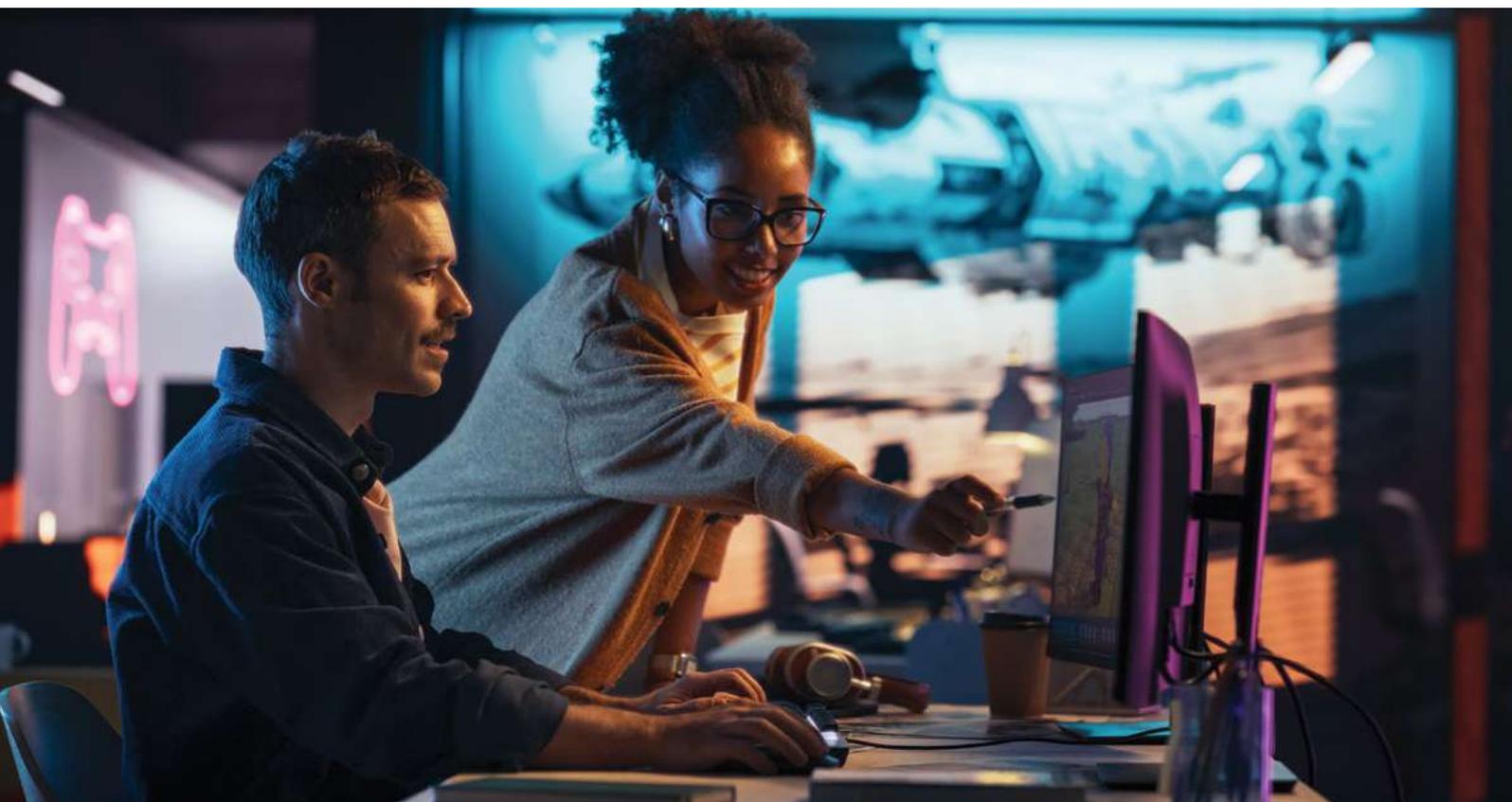
Business workshop discussion: key points

Concern for Web2 incumbents that if Web3 technology is free and out in the wild, there is no direct, immediate revenue streams for them and no control, with no reason to invest.

An intermediate solution may be a safe space, such as a sandbox to test ideas, test models and allow the big companies to interact with the fast-moving smaller companies in the space and explore safely.

High potential Start-ups could be harnessed to work with the larger companies to teach them how to work within Web3concepts and frameworks.

Because of propensity of new business models in this tech area, teach business innovation practices alongside some of the transversal skills such as project and product management.

Mentoring could be provided from other high potential start-ups so that potential is not lost early, or scale-out not considered early enough.

As there are so many new business models in the area and potentially more, concrete examples of working businesses are needed, case studies, and long term studies to help institutions make the case for investment from authorities, but also from industry.

Education and information resources need to be tailored to industry needs, while also having broad business appeal for those coming into the sector, or moving from another.

Transversal skills required: complex problem solving, design thinking, creative thinking, leading multi-generational teams, diverse teams from coming from different perspectives and the various different technologies. Research and Innovation expertise. Project management skills.

From experience in other programmes, transversal skills have best impact when they are embedded within a specialist programme as opposed to stand alone or alongside. For example, a Web3 business model innovation module could have within it problem solving and working across functional teams; project management specific to that environment.

Micro-credential courses would be beneficial to allow people to access resources quickly, build fast and tailor to their own needs. Broad module associations are needed that build towards accreditations.

Take existing examples of successful use of blockchain by companies and extend them out to Web3 usage and show the steps involved and increased value of doing so. This works on the basis of existing value from the fundamentals of Web3 to build out the supporting arguments.

Also, use the fact that many good Web3 examples come from mass popularity areas, such as social media, gaming and loyalty programmes. By talking about examples with mass appeal, it will be easier to make the case for funding for skills development resources. This would go towards use cases and case studies to show it is worth investing in developing necessary curricula and courses.

There is a major need for communication, both from the companies involved and from the vendors and technology providers to show what their technology is capable of and where it drives value. Close working relationships between skills and training bodies and industry to ensure each one knows what the other can provide and is working on.

This is necessary as there are negative connotations from bitcoin and negative associations from NFT crashes and the collapse of some exchanges and other bodies.

With new business models, founders often need help to chart the course for development and growth because it is different. They need help to define goals, and aspirations, and priorities, and also identifying the resources, skills and supports they need to achieve those.

Fundamentally, it will be down to the business cases put forward, what level of interest is going to be garnered. Impact on the industry is going to be key to elicit the investment necessary.

This is not necessarily something for the Irish Universities Association to talk about future needs. It needs to be flipped in the other direction and led by demand from industry

Micro-credentials will be an essential part of the skills and education mix, but needs to be done right.

Micro-credentials will be an essential part of the skills and education mix, but needs to be done right.

Terminology could be an issue. If you call something a Web3 micro-credential, are you going to get the right people doing it? Might it need different nomenclature to reflect something more along the lines of future web development.

Hard lessons have been learned previously by using terminology that is too narrow to a field, when what is being offered is of wider appeal. Base naming on existing technologies, to include the likes of blockchain, and then add specifics.

In conversations with companies in the course of respective duties, not hearing the term Web3 much. This would be an issue in encouraging businesses to have their people take up these resources.

As the developer/builder survey showed that most people engaged in Web3 development have significant career experience prior, recognition of prior learning is essential. If someone has significant experience in the field but did not come to it through traditional routes, they need their existing experience to be recognised so they can access a micro-credit in the university system because otherwise they will be blocked from doing so.

Emphasis on availability of micro-credentials outside of university system, as survey results showed that respondents were not looking for university education resources. There is much innovation in education, with more areas and disciplines opening up to vocational and experience-based pathways, apprenticeships, etc. leverage those lessons and frameworks to develop ways to get people in from other disciplines so they don't have to start with a degree in something to get where they need to be. Recruiters are increasingly doing this for companies. They identify people at lower skill levels, below L8, and ensuring they have base skills and experience to develop in the job towards the necessary levels.

Ensure that pathways are there to encourage those with an interest. Capitalise on the ability for anyone to start experimenting with the technologies and the ground-up nature of it. Work with the providers and technology vendors to have resources to go beyond developer packs to qualifications. Capture enthusiasm and encourage professionalisation.

Ensure that any training programmes have work placements as part of their make-up. Hands on experience, in real value positions.

With regard to public awareness: people only tend to do this kind of thing if they have to. E.g. COVID tracker app and certification.
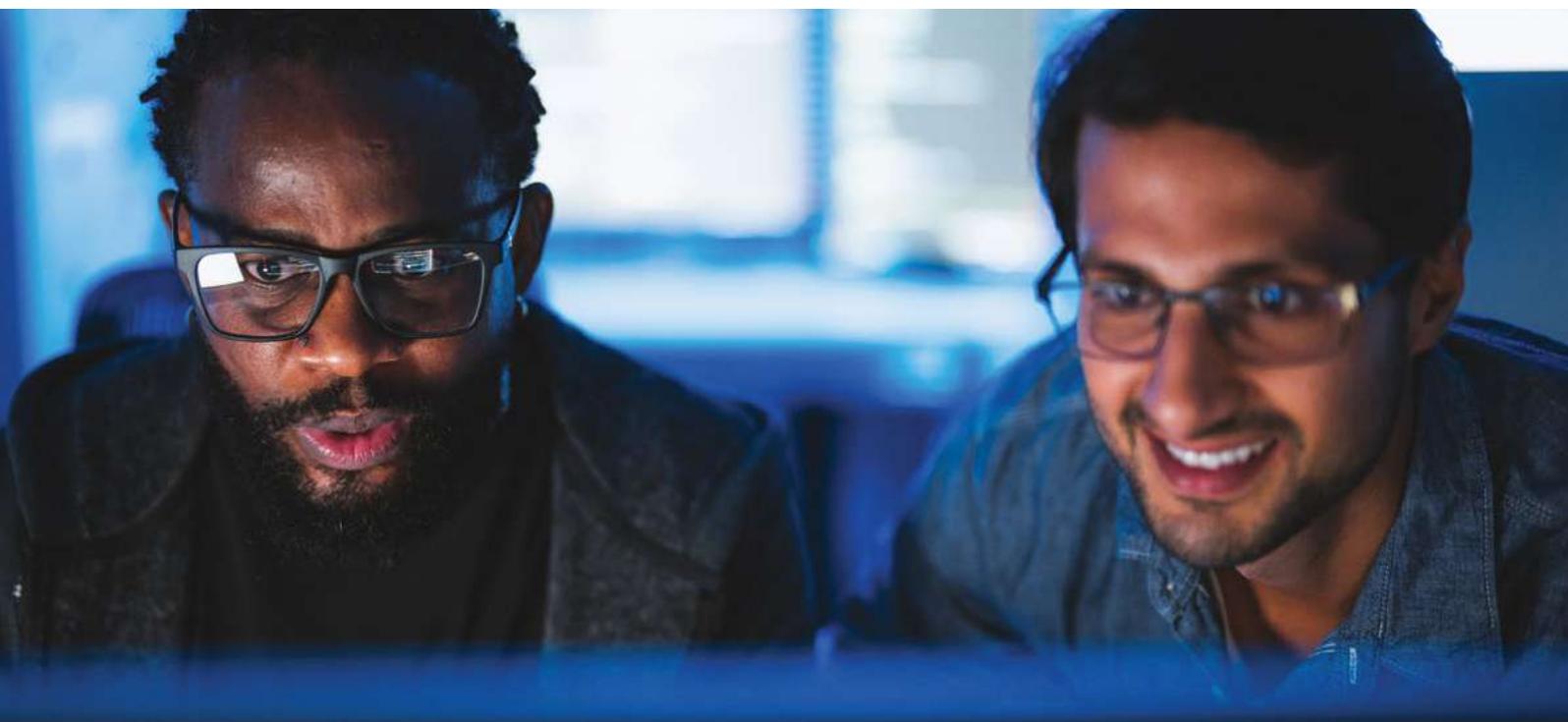
Conclusions: Key points

The Web3 sector is far from defined, agreed, or commonly interpreted.

Nomenclature and references are similarly undefined and open to wide interpretation.

Even taking a broad set of characteristics that are most commonly used to refer to Web3, developments, applications and services are at a very early, nascent stage.

This characteristic of nascency has led some in supporting or adjacent fields to be professionally reluctant to comment. Web3 is a collection of technologies and principles, but more importantly it is also a philosophy about trust, control, democratisation, and value. The term mindset was used repeatedly to characterise it.

Web3 is a ground-up phenomenon, unlike recent developments such as cloud computing, AI, or quantum computing which are very much top-down developments. Current activity appears to be dominated by enthusiasts, evangelists, and interested parties.

The importance of community in the Web3 sector cannot be underestimated from technical, economic, and social perspectives.

This is also reflected in the skills and role demand where non-technical roles appear to be in higher demand than technical ones.

Web3, through its early stage nascency, and democratic nature, attracts many women and generally underrepresented groups, with specialist organisations representing their interests.

While Web3 and the metaverse were initially perceived as closely linked, the term was used very rarely in the SME or broader engagements.

Web3's capacity for positive social impact is very high on the agenda for many involved in the ecosystem, through bringing financial services to the unbanked, and being a trustless system behind areas such as ecological conservation, and general interoperability to bring communities together in a secure, open fashion.

The current web incumbency, as characterised by centralised, concentrated, near-monopolies such as Meta (formerly Facebook), X.com (formerly Twitter), Amazon, and Google — often dubbed Web2 or 2.0) is likely to either actively resist, or at the very least, not actively support, Web3 development, due to the risk to existing business models.

This is commonly attributed to two key characteristics of Web3 in decentralisation and disintermediation.

Many commentators, from various viewpoints, expressed an inevitability to the development and adoption of a future internet that would be based on what are seen as the key characteristics of Web3, particularly around the areas of decentralisation, SSI, data ownership, and control.

Some pioneering companies have begun to incorporate aspects ofWeb3 into their products or services, such as Nike, Revolut, Reddit, and others, leading to progressive offerings that are being termed Web2.5.

The areas of most significant progress in terms of a more complete Web3 offering, by the most common set of criteria, appear to be smaller, often artisanal areas, such as arts, crafts, and music.

Mass appeal applications of Web3 are less common, but do appear in sectors such as social media, gaming, specialist art genres (comics/superheroes), and sports related activities.

There are recurrent calls for case studies in Web3, to illustrate value, utility, and opportunities.

Web3 supportive infrastructure and services are progressing rapidly, but these tend to be driven by other forces, such as the broader financial industry, or other adjacent sectors. This risks unsuitability for Web3 specifically.

There would appear to be at least as many Web3 supportive companies, offering specialist services such as hosting platforms, bridging services, financial services, etc, to Web3 companies, as there are Web3 business themselves.

Despite the advent of regulatory frameworks such as MiCAR, and the Virtual Asset Service Provider regime, the general perception seems to be that regulation is not keeping pace with development and the uncertainty leads to hesitancy that may be stifling development in certain areas.

Taxation, accounting practices, and cryptocurrency handling are areas of particular concern in Web3 business models.

Developers in the field are generally highly experienced, but self-taught from informal sources.

These developers express desires for short, rapid, sources to develop their skills further, but are confident in their own ability to source and consume them.

There are fears of courseware in more formal settings being outdated or becoming obsolete too quickly, which tends to put people off academic institutions.

Despite this, there are expert calls for prior learning recognition and certification to allow people to access the academic system and start or continue certification paths.

There are certain beacons of education that are circulated within the sector and deemed useful bases from which to start a learning path, such as the University of Nicosia, Frankfurt School of Finance and Management, etc.

Generally speaking, academia was seen as the most appropriate means to provide the fundamentals of concepts, systems, and architecture for Web3.

Close partnership between skills agencies and industry were suggested as the best way to meet immediate and day to day needs of developers and builders.

Overall, existing academic frameworks for developing new courses were seen as adequate, if imperfect, to meet the needs of Web3.

Similarly, there was confidence from policy commentators that the current skills agency networks and blueprints for development were sufficient, with reasonable adaptation, to meet expected needs.

There was a recurrent emphasis on closer working with industry to keep with and meet the needs of specific opportunities, such as exchanges.

The model of specific feeder courses at academic level, developed in partnership with specific companies or consortia was also suggested as way of developing longer term resources. A range of education and skills measures are required for short, medium, and long term development of skills and education. A campaign of broad public awareness of the full range of new financial, identity, and asset management facilities offered is necessary, with lessons from ECDL and Digital4Business initiatives could easily be adapted and applied.

Broadly, there is a risk in providing education resources that a lack of acceptance and common interpretation of naming conventions and labels could mislead and misdirect potential learners.

The needs for transversal skills across the entire Web3 ecosystem is critical. These include many of the established soft and business skills, but with specific needs around project and product management, as well as high potential business skills.

Communication has been highlighted as an issue on various fronts, in terms of expressing Web3 utility and value, and also internally between founders, businesspeople, and technical teams.

There were numerous calls for education resources at secondary school levels. These were based around concepts, not specifics, due to the transformative nature of the Web3 characteristics.

Start-up supports need to improve in the area of Web3 to be competitive and meet needs.

The improving situation with the Central Bank of Ireland's Innovation Hub and sandbox needs to be matched elsewhere. Specific funding supports are also necessary, that understand the development paths and growth trajectories of Web3 and similar companies.

This is applicable from the top down, as demonstrated by IDA Ireland's reticence in supporting companies leveraging cryptocurrencies.

Overall, Ireland's past record in developing new sectors is a strong basis to suppose that it can once again, benefit from a Web3-type phenomenon.

The presence and activities of so many of what are termed the Web2 major players, as well as a vibrant indigenous technical culture and capability, in combination with commensurate education and skills development capabilities, means that Ireland is very well placed to develop a next generation internet sector, whether that is eventually termed Web3 or not.

Web3 broadly speaking, is at such an early stage of development that there is both a large opportunity to get in early and be a first mover, but also a great risk in that it is so ill defined as to be uninterpretable.

Only close work with industry and communities will ensure the opportunity can be capitalised, while reducing the risk of a lack of clarity.

Blockchain Ireland: Registry of Courses

Blockchain courses:

Course	College	Duration	Mode of Study	Campus
Master of Science in Computing - Blockchain Technologies and Applications	ATU	1 year	Full Time & Part Time	Donegal
Professional Diploma in Blockchain, Bitcoin and NFTs	City Colleges	10 weeks	Part Time	Blended
Diploma in Blockchain	City Colleges	10 weeks	Part Time	Blended
Master of Science in Blockchain - Distributed Ledger Technology	DCU	2 years	Full Time	Online
Certificate in Fundamentals of Blockchain	Dundalk Institute of Technology	2 semesters	Part Time	Online
Higher Diploma in Science in Computing (Blockchain)	National College of Ireland	1 year	Full Time	Blended (Springboard)
Unpacking Crypto and Blockchain	Trinity Business School	8 weeks	Part Time	Online

Blockchain modules:

Course	College	Module	Credits	Campus
Higher Diploma in FinTech	ATU	Blockchain Technology Innovation and Application	5	Donegal
Bachelor of Science(Honours) in Digital Accounting	ATU	Blockchain	5	Galway
MSc in Computing with a Major in FinTech and Technology and Innovation	DCU	Blockchain Basics and Applications	7.5	Dublin
MSc Electronic and Computer Technology	DCU	Optional Module: Blockchain Scalability	7.5	Dublin
MEng Electronic & Computer Engineering	DCU	Optional Module: Blockchain Scalability	7.5	Dublin
Master of Science in Artificial Intelligence	MTU	Optional Module: Distributed Ledger Technology	5	Cork
Master of Science in Cloud Computing	MTU	Optional Module: Distributed Ledger Technology	5	Cork
Master of Science in Cybersecurity	MTU	Optional Module: Distributed Ledger Technology	5	Cork
Postgraduate Diploma in Science in Cybersecurity	MTU	Optional Module: Distributed Ledger Technology	5	Cork
Master of Science in FinTech	NCI	Blockchain Technologies		Dublin

Blockchain modules:

Course	College	Module	Credits	Campus
Postgraduate Diploma in FinTech	NCI	Blockchain Technologies		Online
Master of Science in Cloud Computing	NCI	Blockchain Concepts		Dublin
Postgraduate Diploma in Cloud Computing	DCU	Blockchain Concepts		Online
Bachelor of Business (Honours) in Business Information Systems	DCU	Optional Module: Blockchain Scalability	7.5	Dublin
MEng Electronic & Computer Engineering	SETU	Blockchain & Distributed Ledger Technologies 1 Optional Module: Blockchain & Distributed Ledger Technologies 2	5	Waterford
Masters of Business in Finance and Business Analytics	SETU	Distributed Ledger Technologies and Blockchain	5	Waterford
Bachelor of Science (Honours) in Computer Games Development	SETU	Optional Module: Blockchain Technologies	5	Carlow
Bachelor of Science (Honours) in Computing in Interactive Digital Art and Design	SETU	Optional Module: Blockchain Technologies	5	Carlow

Blockchain modules:

Course	College	Module	Credits	Campus
Bachelor of Science (Honours) in Cyber Crime and IT Security	SETU	Optional Module: Blockchain Technologies	5	Carlow
Bachelor of Science (Honours) in Software Development	SETU	Optional Module: Blockchain Technologies	5	Carlow
Masters of Science in Cybersecurity, Privacy and Trust	SETU	Blockchains and Distributed Ledgers	5	Carlow
Bachelor of Business in Managment Information Systems	UCD	Introduction to Cryptocurrencies and Web3	5	Dublin
Master of Science in Digital Innovation	UCD	The Etherum Ecosystem	10	UCD Business School

Blockchain Ireland: Knowledgeable Academics

Academic	HEI	Specific Areas of Interest
Dr Trevor Clohessy	ATU Galway	Blockchain Digital Transformation
Dr Irina Tal	DCU	Blockchain Education/ Application of Blockchain in Smart Cities/ Smart Contract vulnerability analysis
Prof Gabriel-Miro Muntean		Blockchain Education/ Application of Blockchain in Smart Cities/ Smart Contract vulnerability analysis
Prof Jens Ducrée		Blockchain standardisation, Blockchain for Scientific Research Projects
Prof Martin Crane		Ethereum Gas Price Prediction
Dr David Sinclair		Efficiency and Proof of Ownership/Stake/Work
Ray Walshe		Blockchain standardisation, Blockchain for Scientific Research Projects
Mohammad Fardad		Blockchain technology/ Blockchain for communications
Dr Susan Rea	MTU Cork	Smart contract verification, data provenance and distributed trust for IoT networks

Academic	HEI	Specific Areas of Interest
Dr Mubashir Rehmani	ATU Galway	Blockchain for communication networks, Blockchain and smart grid, Consensus algorithms, Privacy preservation for blockchain, Cryptocurrencies and blockchain, Metaverse, NFTs, DeFi , Blockchain and Cyber Physical Systems, Energy trading using blockchain
Dr Cliodhna Sargent		Blockchain Education, the development of Blockchain clusters
Prof Joyce O'Connor	National College of Ireland	Applications of Blockchain / DLT Web3.0 technologies, Use cases, Blockchain / DLT other emerging technologies Skills development, research applications, Educational access for primary and secondary and third levels students
Sean Heeney		Crypto Assets - BTC, AltCoins, NFT, Tokenisation, DApp Development - NodeJS / Python , Truffle, Suite, Web3 Libraries, Smart Contract Development - Solidity, Hyper-Ledger Fabric, AWS Cloud, Defi - FinTec
Eoin Connolly		Efficiency and Proof of Ownership/Stake/Work
Dr Pierangelo Rosati		Understanding the antecedents of organisational adoption of blockchain, Measuring the ROI on blockchain investment, Initial token offerings

Blockchain Ireland: Knowledgeable Academics

Academic	HEI	Specific Areas of Interest
Dr Malika Bendechache	Lero | Science Foundation Ireland Research Centre for Software, NUIG	Blockchain and Distributed Ledger Technology
Dr Takfarinas Saber	SETU Carlow	Software Engineering/Testing of Blockchain-Based Applications
Dr Martin Harrigan	SETU Carlow	Network analysis, complex networks, digital currencies, blockchains and visualisation
Dr Aidan Duane	SETU Waterford	Programming, Data Analytics, Distributed Ledger Technologies/Blockchain, Machine Learning, Artificial Intelligence.
Lory Kehoe	TCD	Blockchain, crypto and Web3 entrepreneurial ecosystems
Prof Brian Lucey	SETU Waterford	Cryptocurrencies and sustainable fintech issues
Dr Donal O'Mahoney	TCD	Core Blockchain technologies, Layer 2,Blockchain Identity, De-Fi, Confidential Blockchains

Academic	HEI	Specific Areas of Interest
Dr Louise Gorman		Regulation and Governance of Blockchain Technology, MiCA-Compliance, blockchain applications for sustainability reporting across value chains.
Dr Hitesh Tewari		Identity Mgt, eVoting, Privacy, Consensus Mechanisms, Mobile Network Security, IoT Security, V2X Security, Post-Quantum Algorithms, Privacy Preserving Smart Contracts, Cryptocurrencies
Dr Paul Dylan-Ennis	UCD	Bitcoin, Ethereum, Decentralized Autonomous Organizations (DAOs).
Dr Donncha Kavanagh		How blockchain can be used to facilitate decentralised modes of organising
Dr John McCallig	SETU Waterford	Accounting Blockchains for Financial Reporting and Taxation, Enterprise Blockchains

Web3 Partnered and Supportive Events

Webinar October 2023, Ibec
"Web3 and digital fashion" Blockchain Ireland, 2023
https://www.blockchainireland.ie/getting-phygital-with-fashion/

In person event, March 2024, Ibec
"The business of Web3" Blockchain Ireland, 2023
https://www.blockchainireland.ie/the-businesses-of-Web3/

In person event, Dogpatch Labs
"Web3 UX: Opportunities for Growth"
https://www.linkedin.com/posts/blockchain-ireland-startups_web3-ux-opportunities-for-growth-activity-7169285546656129025-oA-o/

In person conference, Trinity Business School
"Blockchain Ireland Week 2024" Blockchain Ireland,
https://www.blockchainireland.ie/blockchain-ireland-week

In person event, Dogpatch Labs
"ETH Dublin Hackathon 2024" ETH Dublin, 2024
https://ethdublin.io/

"Non-Fungible Tokens" Vaults Main Stage, ETH Dublin, 2024
https://ethdublin.io/
Moderator: Jonathan Padden, artist, NFT activist
Irishnftgal (Niamh A), Artist, Web3 Advisor
John Crain, CEO, SuperRare Labs
Frank Poncelet, Co-founder, CTO, Hyperlabs

Acknowledgements

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