Blockchain Skills Submission
Joint Committee on Education, Further and Higher Education, Research, Innovation and Science

Submitted on behalf of:

- Prof. Joyce O'Connor, Chair of the Education, Skills & Innovation WG, Blockchain Ireland.
- Dr. Susan Rea, Education, Skills & Innovation WG, Blockchain Ireland.

Executive Summary

Ireland is in a leading position in many sectors of the economy that can successfully apply Blockchain or other Distributed Ledger Technologies (DLTs) and help create new jobs and up-skill the workforce. This submission highlights Blockchain Skills gaps and the opportunity to create jobs now and in the future. It looks at Blockchain Labour Market Forces, Ireland's Blockchain Eco -System, Skills Requirement and Skills Provisioning. The submission makes three key Recommendations

1. Expand Specialist Education Provision in Emerging Technologies including Blockchain/ Distributed Ledger Technologies (DLTs).
2. Assist Industry - Education Collaboration and Creating Awareness.
3. Establish a National Hub in Emerging Technologies including Blockchain/DLT in the form of a Multi Institutional Centre of Excellence.

Introduction

This submission highlights the potential of Blockchain /DLT Technologies and looks at the future Skills needs to seize these opportunities. It highlights the risk of Skills shortages that will inhibit Ireland becoming an International Blockchain Hub in the context of emerging technologies and harnessing Blockchain technology as a positive force for digital transformation and the creation of jobs now and in the future.

The European Commission has identified Blockchain Technology as one of the key emerging technologies that is shaping Europe's future. Blockchain is accepted internationally as both an emerging technology and emerging skill set. This is reflected in the European Commission's blockchain strategy and the UK's National Blockchain Roadmap.

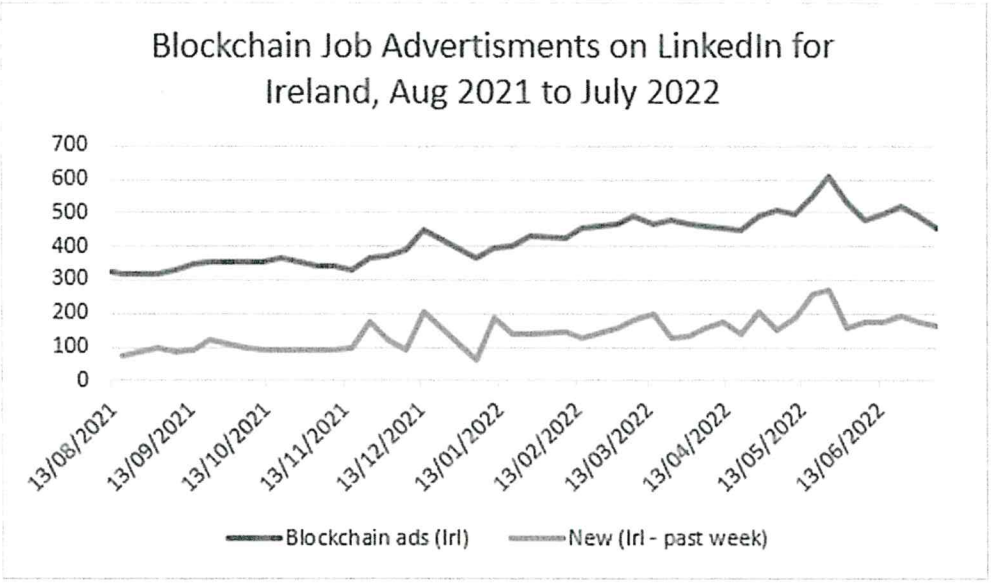
Blockchain is a shared immutable ledger (i.e. a ledger that cannot be changed) that facilities the process of recording transactions and tracking assets in a business network. Such assets can be 'tangible' (house, car, cash, government services, land) or 'intangible' (intellectual property, patents, copyrights, branding). Virtually anything of value can be tracked on a Blockchain network. A simple analogy for understanding this technology is a video of an Excel sheet documenting all changes, to a process or product, by all parties. More formally, it is a system recording transactions which is maintained across several computers linked in a peer-to-peer network. For example, Whiskey is a trillion-dollar industry beset by fraud. Using the key strengths of Blockchain Technology in terms of tracking, tracing, transparency and its capacity to document any change has benefited this industry worldwide.

Blockchain Labour Market Forecasts

The global blockchain market is predicted to grow from 7 billion to over 160 billion by 2029. This emerging technology clearly has the potential to create many new jobs but how can policymakers predict the type of jobs being created and the skills needed for them as blockchain is rapidly adopted and adapted to different uses across different sectors? At present, the number of blockchain vacancies far outstrips the vacancy rate for other jobs. Our research uses a novel methodology to describe the nature of the current employment market in blockchain and provides a basis to forecast future demand and potential skills gaps.

The labour market for blockchain workers in Europe is estimated to produce around 30,000 new jobs over the next five years. Approximately, 50% of these posts will be available to new labour market entrants. In Ireland, the labour market for blockchain workers is estimated to produce around 850 new jobs over the next five years, with approximately 370 of these positions available to new graduates and labour market entrants.

This forecast will be updated annually, as example within in the last year the number of Blockchain advertisements on Linkedin in late 2021 was approximately 350 blockchain jobs advertised in Ireland, but in more recent months, the average is in the region of 500, as shown below based on analysis completed by the Economic and Social Research Institute as part of the EU CHAISE project.



As blockchain technology is still developing from concept to application stage, its labour market impact remains relatively limited. The estimated demand for blockchain workers, expressed as a proportion of all new jobs, remains quite small in Ireland (0.9%) and other EU countries (1.4% on average). However, there is an overarching consensus that this is an area of constant evolution and there is high-growth potential for core and ancillary jobs into the future within the field of Blockchain (Whelan et al., 2021).

Start-ups are currently dominating the scene, but there is an increased number of corporate early adopters. Initially, the main use of blockchain technologies was in the realm of cryptocurrencies. However, the last number of years have seen substantial growth and

expansion in the application of blockchain technologies into other areas. In 2021, the majority of blockchain employers were operating in the ICT, financial services, education, and gaming. It is generally expected that the demand for blockchain skills is likely to grow rapidly as the technology continues to develop and adoption spreads across sectors. For example, blockchain has shown great potential in supply chain management to enable faster and more cost-efficient delivery of products, enhance products' traceability, and improve coordination between partners. Increased investment in blockchain technology has been observed by small- and medium-sized enterprises (SME's) and companies offering the following services: food and agriculture; visual intelligence solutions; decentralised cloud storage; healthcare; insurance; energy and utilities; secure data encryption; digital advertising; research and consulting. There is also a growing interest in the technology by national governments combined with the development of national strategies in the context of emerging technologies.

Ireland is in a leading position in many sectors that can successfully apply Blockchain or other Distributed Technologies (DLTs) across, manufacturing, agriculture, healthcare and education. At the same time the lack of high-level digital skills threatens to hamper and slow down innovation. The importance of creating a talent/skills Roadmap for the future is critical. There is a global talent shortage and global competitive pressures. The mismatch between education, training and the marketplace needs must be addressed. A more flexible approach to skills development is critical. The work of the Irish Universities Association on the Microcredentials Platform is critical to addressing this need.

Ireland's Blockchain Ecosystem

Ireland has a vibrant Blockchain ecosystem of over 150 companies and a number of companies that are recognised internationally as world leaders. These organisations use Blockchain in a range of different areas to provide secure operations or solutions for consumers and societal groups. Examples include, supply chain (Ireland Craft Beverages; Blackwater Distillery; Moyee Coffee;), sport (Equideq), learning credentials (IOB), financial inclusion and digital identity (AID:Tech) and domestic violence (HEHOP).

Skills Requirements

A lack of familiarity with Blockchain and its potential will unduly limit both industry and policy makers appetite for engagement with Blockchain. Blockchain Skills should not be seen as only relevant to Blockchain Developers, Blockchain Architects and Blockchain Managers and experts. Everyone will need some knowledge and understanding of Blockchain and its implications given our increasing move towards a digitalised society. For example the public sector may deploy public services using Blockchain technology and may need to procure or regulate Blockchain systems. Members of the general public need to know how to interact confidently with Blockchain.

The European Commission has identified Blockchain as having enormous potential for the public sector, industry and society. The EU Commission "Communication on the Digital Education Action Plan" outlined the challenges and opportunities for emerging technologies in

education and the future of work, with Blockchain being among these. This communication outlined that "the biggest risk today is of a society ill-prepared for the future". To address this, the key is to furnish citizens with the skills needed to "make the most of the opportunities and meet the challenges of a fast-moving, globalised and interconnected world". To reinforce the need to address the skills gap a European Parliament "Resolution on distributed ledger technologies and blockchains" in 2018 requested that the Commission and Member States develop "digital skills training and upskilling strategies to increase the awareness and understanding of this technology and ensure that nobody is left behind in the digital transformation". This submission highlights what has been set out in the National Digital Strategy a whole of Government Digital Framework which has Skills at its centre. However, at EU level and nationally our Blockchain education and skills offering remains relatively immature.

Overall, employers seek technical competencies combined with transversal skills and business acumen. The most popular technical competencies in blockchain job adverts are coding, solutions design, frontend/backend development, and development of decentralized applications. The most prevalent business skills advertised are use case development, product development, product management, marketing, and finance skills. Finally, the most common transversal skills advertised are co-operation, teamworking, self-determination, self-competence, and communication skills.

Employees in the blockchain sector are typically young, with an average age of under 35, and the possession of a post-graduate qualification is also typical. The vast majority of emerging blockchain jobs (81%) are concentrated in three detailed occupational groups: Software and Applications Developers and Analysts; Information and Communications Technology Services Managers; and Business Services and Administration Managers. As a share of these occupations, Blockchain developers, architects and managers appear to play a significant role. This suggest that the skill requirements for companies engaging in blockchain are heavily concentrated in the areas of ICT and computer science.

Overall, there is a lack of formal education in the field of Blockchain and informal education cannot fully cover the qualifications needed. European forecasts estimate around 15,000 graduates from blockchain specific courses from over 1 million ICT graduates from 2020 to 2026. In Ireland, for the same period, the forecasts produced by the ESRI estimate approximately 390 blockchain-specific graduates from over 60,000 ICT graduates.

The EU forecasts suggests that while there is a gap between the demand for new blockchain graduates and the supply of university graduates, these imbalances are not substantial in the vast majority of countries. The supply of general ICT graduates greatly outweighs the demand for blockchain professionals in most countries examined, suggesting that there will be a sufficient graduate stock from which blockchain companies can recruit. However, there may be training costs associated with blockchain companies recruiting from the general ICT graduate population, and these may act as a constraint on growth. Our research suggests that

there is a need to expand specialist blockchain training courses in most member states, as growth largely relies on the availability of a competent and versatile workforce.

Skills Provisioning

There are a number of challenges in planning skills policy for emerging technologies, such as blockchain: (i) lack of information on the type of jobs across which the skills are being demanded; (ii) the associated jobs have not been linked to the formal occupational framework that is used for forecasting purposes, and (iii) the occupational distribution of the skill area is likely to become quickly outdated as the emerging technology is adopted across an expanding range of sectors and business operations. Our recent research uses novel data scraping methodologies to forecast the demand for blockchain skills and comparing this to educational supply.

In research carried out by the Economic and Social Research Institute, we locate advertised blockchain related jobs within the occupational classification framework and produce forecasts for both total blockchain professionals and newly qualified blockchain graduates for 2020 to 2026 (Whelan et al., 2022a, Whelan et al., 2022b). Data from Eurostat and a survey of CHAISE consortium partners (across EU countries) are used to estimate the supply of both ICT and blockchain-specific graduates for each country for the period. These forecasts can be utilised as a key input into any national, or EU level, skills strategies designed to ensure that the growth of blockchain employment is not restricted as a consequence of skill mismatches. Also, due to the dynamic nature of such emerging technologies the forecasting will be repeated annually in order to capture any changes in the nature of blockchain employment as applications of the technology become more widespread throughout the economy.

The EU Chaise Project highlights the huge potential that Blockchain technologies present and forecasts future Skills. We need to plan ahead so that Ireland is in a position to take the opportunities that this research highlights. This research addresses the issues raised in the National Digital Strategy around the Skills pillar in that it provides a Roadmap for the development of Blockchain Skills in the context of emerging technologies.

Recommendations put forward by: Education, Skills & Innovation WG, Blockchain Ireland.

The Working Group (WG) believes that it is critical to highlight the importance of approaching Blockchain Skills development with an interconnected mindset that includes other emerging technologies like AI, IOT, Robotics and Cybersecurity.

1. **Expand Specialist Education Provision In Emerging Technologies including Blockchain/DLT Technologies:**
    1.1. Fund the further Development of Specialist Programmes in ICT to include Technical, Business and Transversal Skills.
    1.2. Introduce Emerging Technology Programmes in broad areas including but not limited to Medicine, Health Care Professionals, Business, Law, Human Resource Management, the Arts including the Fine Arts and Sports Science.

1.3. Within the Context of the Digital Strategy for Schools 2022-2027 ensure the review of curricula at primary, junior and senior cycle includes consideration of emerging technologies including Blockchain While special attention may be given to STEM subjects all areas of the curricula need to be considered. As the pace of technology change is fast and dynamic all curricula needs to keep pace with technological change (DoE, NCCA, PDST, ICS)

1.4. Using the Young Scientist Framework set up a special Emerging Technologies Night for the Teachers, National Parents Council, Student Union at Second level, Comhairle na NOg Guidance Councillors, The Wheel and other groups to explore emerging technologies with key companies who use this technology to transform their business and society.

1.5. Using the Young Scientist Framework and SFI Discover Programme and other existing initiatives to inform and excite young people and this parents to explore emerging technologies at an early stage , critical to involve young girls and women at this stage . Emerging technologies offer the opportunity to make Transformative change in society , business and the economy .

1.6. Explore the use of Blockchain to support the administration of schools, teaching, learning and assessment, for example the EdQ Institute of Banking (IoB) with Deloitte, AIB and Bank of Ireland.

2. Assist Industry - Education Collaboration and Creating Awareness

2.1. Support the development of a life-long learning wallet taking into account of the EU work on Digital identity and the eIDAS Regulations for the European Digital Identity Wallet (DEPER, DFHERIS) in association with the IOB, IUA, Technological Universities and further education providers

2.2. Support the development of new Apprenticeships in Blockchain and Emerging Technologies in the context of the Unified Third Level Education System policy, see the development of the Apprenticeship in Cybersecurity UL/ MTU and link to honours degree (level 8).

2.3. Make Blockchain micro -credentials – at HE and FET levels – available broadly to both learners and workers across the economy. (HEIs, SOLAS, ETBs, Skillnet, IUA QQI) The Microcredential platform is a helpful development

2.4. Promote a free online Blockchain / Emerging Technology course for citizen (for example to promote a broad understanding of Blockchain and emerging technology). Underpin this with similar online courses on basic digital skills. Link the promotion of this digital literacy courses provided by FET and HE sectors. (SOLAS, eCollege, Skillnet BlockW with IOB, BlockW with ICS). The Chaise project are developing a free 5 semester VET qualification programme to be delivered in 11 EU languages.

2.5. In the context of The Work from Anywhere Movement (Professor Chadhoury, Harvard University Business School) and the "Innovate for Ireland" partnership between the Government and private industry should target talent in emerging technologies including Blockchain in a proactive way through the IDA, Enterprise Ireland, DETE and DFA.

2.6. It would also be helpful to consider an intern scheme for public servants to work in relevant industry sectors so that they have an understanding of these emerging

technologie. They will need to have a broad understanding of Blockchain and emerging technologies and have access to relevant microcredentials programmes.

3. **Establish a National Hub in Emerging Technologies including Blockchain/DLT in the form of a Multi Institutional Centre of Excellence.**
   3.1. Consideration should be given to creating a Public Sector National Stakeholder Map of all departments and ministers with responsibility for the digital agenda. Interdepartmental co-ordination of this Agenda could lead to the establishment of a Public Sector Innovation Hub that would address problems and provide solutions on a co-ordinated basis for Government and public services
   3.2. Co-ordination of Existing Infrastructure and Resources through the creation of a National Multi-Institutional Collaborative Centre of Excellence for emerging technologies including Blockchain. We have All Ireland expertise, bring it together in the context of emerging technologies.

Multi Institutional Centre for Excellence which implements National Level Blockchain Framework with Collaborating Institutions .

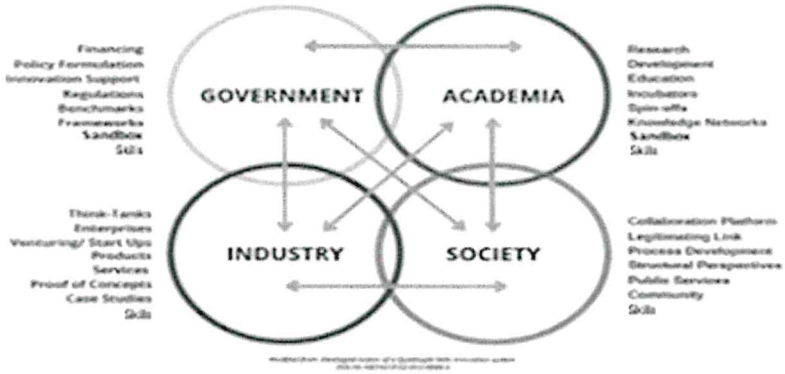


FIGURE 1: QUADRUPLE HELIX

A plan for a National Level Blockchain Framework will enable us to develop and facilitate five levels of participants
1. Confident users of technology --- Developers
2 Provider or operator of Technology Infrastructure and Services
3. Starts-ups , SME's , Enterprise , Business
4. Community / Citizens
5. Technology Stack Builder / Skills & Talent Development
The Multi-Institutional model needs to be created for developing the National Level Blockchain Framework . We will identify organisations / institutions along with their roles and responsibilities.

Conclusion

Ireland has the potential to be an International Hub in the context of Emerging Technologies including Blockchain with opportunities to create jobs for the future. Let's meet that challenge by planning for the future with vision and leadership.

References

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- Whelan et al., 2022a - Whelan, A., McGuinness, S., Redmond, P., & Ciprikis, K. (2022a). Blockchain Skills Forecasting Model. CHAISE Project: Erasmus+ Programme of the European Union. Available at: https://chaise-blockchainskills.eu/wp-content/uploads/2022/06/CHAISE_WP3_D3.1.1-Blockchain-Skills-Forecasting-Model.pdf
- Whelan et al., 2022b - Whelan, A., McGuinness, S., Redmond, P., & Ciprikis, K. (2022b). Annual Blockchain Skills Forecasts - 2022. CHAISE Project: Erasmus+ Programme of the European Union. Available at: https://chaise-blockchainskills.eu/wp-content/uploads/2022/06/CHAISE_WP3_D3.2.1-Annual-Blockchain-Skills-Forecasts_2022.pdf

Acknowledgement

The research is created and supported in association with the Erasmus+ CHAISE Blockchain Skills for Europe, Digital Futures at Work Research Centre (Digit) and Blockchain Ireland's Education, Skills and Innovation Working Group.

The Economic and Social Research Institute (ESRI) is part of the CHAISE Project which is a Sector Skills Alliance financed by the Erasmus+ programme to "design Europe's strategy for blockchain skills". All publications and outputs from this project are available here. The consortium consists of global leaders in blockchain and DLTs, including academic and industry partners, and sectoral organisations and communities.

Appendix - Education, Skills and Innovation Working Group, Blockchain Ireland (Feb. 2021 – May 2022)

The Working Group on Education, Skills and Innovation is chaired by Professor Joyce O'Connor, Co-founder and Chair of BlockW, Chair of the Digital Group of the IIEA, Chair of the IIEA's Europe's Digital Future Think Tank Network, EU Ambassador 4 Women IT, founding President National College of Ireland. The Working Group is representative of industry – including SMEs and multinationals, academia, training bodies, and civil society. The Working Group's approach is to work within the EU and National policy context. Policy makers are briefed in relation to the work of the group on an ongoing basis.

WG Objectives

The overall objectives of the Education, Skills and Innovation Working Group are to:

1. Identify Blockchain Skills needs, gaps and mismatches using an evidence based approach
2. Help create a Skills Roadmap for policy makers, industry, workplace planning, education, training bodies, and civil society that will facilitate the development of a national Blockchain Skills Strategy within the context of emerging technologies
3. Provide research based findings that will help deliver appropriate, flexible, future focused education and training geared to the needs of industry, the economy and society. This will involve exploring the role of micro-credentials in the delivery of education and training to industry.
4. Help create awareness of the potential of Blockchain technology/Digital Ledger Technologies to impact the economy and society through targeted initiatives.

To help achieve these objectives the Working Group worked with partners in a number of areas which will be documented throughout this submission. In particular the Working Group liaised with the Economic and Social Research Institute (ESRI) to introduce their research team to the Blockchain Ecosystem as part of their work on the EU CHAISE Project. This four year project (2021-2024) financed by the European Commission Erasmus Programme addresses the growing demand for Blockchain and distributed ledger technology (DLT) skills across Europe.

The results of the EU CHAISE Project is a series of publications about the following topics:

1. European and National Blockchain Skills Ecosystems
2. A European Blockchain Skills Strategy
3. A forecasting mechanism to anticipate future Blockchain Skills needs
4. A five - semester Blockchain VET Programme
5. Transnational mobility schemes for Blockchain students and professionals
6. The first ever "Blockchain specialist " occupational profile.

which Blockchain skills are a dominant feature and examined the determinants of demand for blockchain skills.

- The other study is Untangled Horizon 2020-2024. The goal of the Untangled project (CORDIS | European Commission, 2022) is to examine the impact of globalisation, technological transformation and demographic change on labour markets in the EU and to recommend policies that will contribute to shared prosperity. Following this, the ESRI will publish a case study on the Blockchain Industry in Ireland.

Opportunities

The EU has identified Blockchain/ DLT technologies as one of the key emerging technologies that is shaping Europe's future. The use of this technology presents a high potential to benefit the economy and society (European Blockchain Strategy — Brochure, 2021). "*Blockchain can help make interventions between citizens, entrepreneurs and public organisations more efficient, reinforce trust and enable each party to maintain control over its data. It will be instrumental in building a citizen-centric sustainable, transparent and inclusive European digital society*" (European Blockchain Strategy — Brochure, 2021). Blockchain will play a valuable role, particularly in combination with other emerging technologies like AI, IoT , Cloud Computing, Cybersecurity and Quantum Computing. Blockchain offers opportunities for digital transformation for the economy and society – specifically for upskilling and new job opportunities. The Working Group believes that Ireland should create a National and International Blockchain Hub. The key to the establishment of such a hub is the identification of blockchain related skills that are in demand now and that will be in the future (Stokes, 2021). Blockchain technology has created new market employment opportunities. The EU Chaise Project (CHAISE Blockchain Skills for Europe) clearly identifies that Blockchain expertise is in high demand. There has been a 300-500% annual increase in the global demand for Blockchain developers. There are currently over 500 Blockchain developer jobs advertised on LinkedIn in Ireland. Over 25,000 Blockchain developer jobs are advertised on LinkedIn globally (WWW. STATISTA. COM: The Global Blockchain Employment Report 2021: Global Blockchain Technology Market Report 2022-2027). This approach for the next phase of Ireland's digital transformation builds on considerable national work which is in line with the EU'S Digital Decade and the EU Digital Compass: Skills Digital Infrastructure, Digital Transformation for Business and the Digitalisation of Public Services. The National Digital Strategy provides a framework to address these issues. This strategy brings a clear focus, targets and work streams covering four pillars Enterprise, Infrastructure, Skills and Government Services (Harnessing Digital : The Digital Ireland Framework 2022) see also Ireland for Finance 2021 action # 21 Pillar 3, (Ireland for Finance, 2021)

Creating Awareness of Blockchain/DLT Technology

A lack of familiarity with Blockchain Technology and its potential has been shown to unduly limit industry's and policy maker's appetite for engagement with Blockchain technology. One of the findings of the EU CHAISE Project is that it is critical for industry, employers and employees to understand and harness the strategic value of Blockchain in business, the economy and society (CHAISE Blockchain Skills for Europe, 2020). As is the case in other emerging technologies such as AI and robotisation (Acemoglu & Restrepo 2020 Clifton et al

2020 : Treiblmaier & Beck (Ed) 2018) successful Blockchain adoption requires acceptance of the technology. Some research studies show that acceptance of this emerging technology depends on a range of contextual factors and can be promoted by various means, such as showing real life applications, telling stories of the positive implications of blockchain (Jansen et al 2020) a broad range of factors over and above the predominantly technology focus of more current work.

Working Group Initiatives

Working Group Members have worked on a number of initiatives to create awareness in academia, industry, employees, professional groups and civil society.

Academia

- Creating Awareness, Understanding and Collaboration: Munster Technological University: Dr Susan Rea has a project to stimulate multidisciplinary Blockchain research, research informed teaching for Blockchain and accelerating Blockchain innovation to enhance external partnerships with HEIs, enterprise, communities, and related stakeholders in the region, nationally and at an EU level with the objective of building sustainable impactful additional capacity at MTU and establishing MTU as leader in Blockchain education, research and innovation.

- New Course Development:

  Bachelor of Science (Honours) in Digital Accounting GMIT
  https://www.gmit.ie/bachelor-of-science-honours-in-digital-accounting
  Developed in collaboration with the CIMA, CAI, ACCA and CPA this Programme is new, future-proofed and the leader in this emerging area. The knowledge, skills and competitiveness of the future graduates of this Programme are identified by industry and employers as critical and in short supply. Dr Trevor Clohessy was a member of an academic team who developed this Programme together with input from the industry. Mr. David Roche was an industry contributor to this Programme. Dr Trevor Clohessy works with Enterprise Ireland companies to inform SME's on Blockchain applications
  Certificate in Emerging Digital Technologies National College of Ireland
  https://www.ncirl.ie/Courses/NCI-Course-Details/course/CEDT
  The National College of Ireland responded to a request from BlockW to develop an online Certificate in Emerging Digital Technologies. BlockW members worked with the academic team in relation to the content and the introduction to the Blockchain Ecosystem. The aim of this Programme is to give employees / employers an understanding of new emerging technologies and how they can be utilised to create opportunities in their industry and develop their career prospects. This Programme is funded by Technology Ireland ICT Skillnet and Engineers Ireland are partners to this Programme. The Programme is targeted at non-Computing professionals who work to understand the latest emerging digital technologies and to integrate them into their

workplace. This programme is also available at Letterkenny Institute of Technology (LYIT).

Training Initiatives at Technology Ireland ICT Skillnet

- Technology Ireland ICT Skillnet is co-funded by Skillnet Ireland and network companies. Skillnet Ireland is funded from the National Training Fund through the Department of Further and Higher Education, Research, Innovation and Science. This enables ICT Skillnet to offer a wide range of courses to companies contracted to education and training organisations. The primary focus is on upskilling workers in employment by providing advanced technical and soft skills programmes. Many of our courses are delivered by Universities and Institutes of Technology and are part-time, primarily online at Bachelor's and Master's level.
- ICT Skillnet also provide a range of short courses in cutting edge and emerging technologies that are usually provided by expert private sector training organisations both face-to-face and online. The network is actively engaged in research and development of new programmes, working directly with industry to meet emerging skills needs in the tech space across industries and has pioneered new initiatives in Cybersecurity, Artificial Intelligence, Cloud Computing, Internet of Things and Blockchain. Enterprises operating in the private sector (including commercial State and Semi-state companies) can access our training programmes.
- MSc in Blockchain – Distributed Ledger Technologies: https://www.ictskillnet.ie/training/msc-in-blockchain/
  This 2-year part-time Masters programme in Blockchain (Distributed Ledger Technologies) is delivered primarily part-time by Dublin City University (DCU) in response to industry demand. Working with Blockchain Ireland, Technology Ireland ICT Skillnet identified skills gaps for software developers with the requisite Blockchain knowledge and development skills needed in industry and as a direct result is co-funding this MSc since 2019 as a direct response to this need.

Industry SME and Multinationals

- Leman Solicitors: Blockchain Technology in Property Practice -Leman Solicitors are developing blockchain applications and they state that: Blockchain applications are being used to revolutionise the cumbersome legal process in the Irish residential new homes space. New technologies such as blockchain has been embraced in the Property Industry to digitise the conveyancing system which has led to drastic improvements in the efficiency, transparency and costs involved in a residential transaction. Through the incorporation of digital signatures, instantaneous stakeholder notifications and electronic payment platforms, the outdated legal process has been transformed. These building blocks have laid the foundations for the incorporation of smart contracts which will automate large strands of real estate transactions and digitise asset ownership.
- Blockchain Learning Training Initiative: Blockdaemon University is a learning and training initiative which has been created to provide a consistent and structured training, development and on-boarding program for new hires and new team members. Blockdaemon University will also act like a digital library for existing staff to up-skill, re-

skill or use as a source of reference. The purpose of the program is to pinpoint the knowledge and skills that all new hires and new team members should have, as well as educate, improve communication and interpersonal skills, enhance productivity, initiate creativity and motivate new hires to do their best, given all the knowledge they gain from Blockdaemon University.

BlockW: Creating Awareness of Blockchain Technology

- BlockW is working with professionals in the financial service industry, information and communication technology professionals in Ireland and industry, academia and civil society.
  BlockW ' s mission is to create awareness about Blockchain and emerging technologies, to increase inclusivity and diversity in its uptake and provide information on pathways to education, training and careers. BlockW interacts with policy makers, industry, academics, research, and citizens to increase their understanding of Blockchain and Emerging Technologies. BlockW has developed partnerships in India, Europe, the US, the UK, Australia, and in Ireland , including with NCI, UCD, TCD, UL, UCC, MTU, and the GMIT Innovation Centre among others.
- BlockW and Institute of Banking: Creating Micro-Learning Modules 2020-present BlockW has developed a series of micro- learning modules for the 34,400 members of IOB. The IOB digital library is available to all members. The purpose of the micro learning modules is to introduce real life applications using blockchain technology that are of benefit to the economy and society. The availability of these micro learning modules offers members the opportunity to explore how blockchain technology can be integrated into aspects of their work and help develop their career.
- BlockW and Irish Computing Society 2020-present: The Irish Computing Society promotes and represents the interests of the ICT professionals in Ireland. There are 15, 000 members and BlockW webinars which are open to non-members and are aimed at an introduction to Blockchain / DLT applications other than bitcoin and cryptocurrency. The webinars are available on the ICS web site as a resource to students and are used as a resource by Third Level Colleges like the National College of Ireland on their Certificate Level 7 Emerging Technologies.
- BlockW and Women's Empower Programme in and North - West -GMIT Innovation Centre: September 2021. The Empower Programme is co-funded by the Irish Government and the European Social Fund to develop female entrepreneurship. BlockW helped develop the content and shape of an introduction to Blockchain technology to women on the Programme and to women led SME's using applications of Blockchain in a business context.
- BlockW and Women4IT 2019-2022. This is an EU funded Programme promoting solutions to the engagement of women in IT working with industry, mentors and community. The Chair Block W received an EU Ambassador Women 4IT Award.
- National College of Ireland and BlockW: Transitioning into a career in Blockchain May 26th 2021. The National College of Ireland ran an event on transitioning into a career in Blockchain. Attended by 120 participants from all over Ireland it provided a platform

for understanding the job and career opportunities available. The webinar also signposted the Education and Training programmes available.

- Webinar Institute of Banking and BlockW Blockchain for Learning Credentials: A First in the world for Ireland. The IOB, the largest professional education body in Ireland have, in partnership with Deloitte, developed an innovative learning credentialing platform called Ed Q.
- The Oireachtas Friends of Science and BlockW Briefing May 12th 2021. This meeting of the Oireachtas Friends of Science (Aidtech, Origin Chain Networks and Ireland Craft Beverages/Killowen Distillery) explored the use of Blockchain applications, sharing examples of how Irish companies use blockchain in supply chain and for digital identity and showing how this transparency and traceability can be used in the distribution of funds and resources by Governments, Banks and NGO's.
- Block and GMIT Student Scholarship: Summer 2021
- A paper was developed and presented at the British Blockchain Association 4th International Scientific Conference ISC2022. Dominic Allen, Trevor Clohessy, Joyce O' Connor. "Developing Educational Awareness of Blockchain: A Student led Blockchain Research Fellowship"

National Infrastructure

- The Working Group's Exploration of a Test Node - The Working Group Initiated, Chaired, provided Secretariat to a Multi stakeholder Group, policy makers, industry, academia, and civil society together with the Slovenian National Blockchain SI-Chain to explore setting up a test node. Lessons were learned for future developments.

International Forums

- Membership of IEEE Committee UK and Ireland Blockchain Group - Dr Susan Rae is a member of this group founded in 2018 to focus on IEEE Blockchain Initiative (BCI) such as pre / standards, education, conferences and events, community development and outreach publications and special project undertaken by the UK and Ireland Section

Micro-credentials

- Micro-credentials offer flexible learning paths to adapt to shifting economic circumstances. There are concerns about standards and their delivery mode, duration, assessment process, validation, accreditation or indeed incorporation into larger credentials, also known as "stack ability". The European Consortium of Innovative Universities (ECIU) describes stack ability of micro-credentials as "certification of learning that can accumulate into a larger credential or degree, be part of a portfolio that demonstrates individuals' proof of learning, or have a value in itself"
  The view of industry, business and community groups is that, compared to conventional degrees and certificates, micro-credentials offer shorter, more targeted and flexible ways to fill the gap between academic programmes and skills required in a fast-changing labour market. A clear definition of micro-credentials that will forge a more common and clearer understanding of the content and quality of these new learning possibilities is needed. Furthermore the development of a life long learning wallet

would be welcome. The Irish Universities Association is working on these issues as are professional groups such as IEEE, however an overall European approach will be very helpful. The Working Group consider the following six areas as crucial for microcredentials:

- A focus on minimum levels of objectivity and standardisation in the skills certified by micro-credentials
- Clear differentiation between traditional degrees and micro-credential certificates delivered upon completion of a learning programme
- Quality assurance, through the establishment of an EU register of trusted issuers open to non-formal education providers, like industry, regardless of their headquarters' location
- Interoperability across learning management systems and promotion of learning content standards
- Financial support to leverage content from various micro-credential providers
- A future-proof European Digital Credentials Infrastructure (EDCI) envisaging badging / recognition of skills validated in professional online networking platforms.

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