Annual Report – Year 2

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Document Information

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Executive Summary

The 2nd Annual Report of BIG focuses on the activities carried out in the first 24 months of the project. Despite the challenges with coordinating an interdisciplinary project, the ERA Chair holder and all of the members of the research team (100% outside of IST, 60% females and 60% international) have been recruited and are currently working onsite and establishing collaborations with different departments at IST. Given the reported limitations of IST as a public institution, in recruiting highly experienced managers, we have proposed an amendment to allow the hiring through a 3rd party agreement with IST-ID, regardless an experienced project manager was recruited by ITI / LARSyS to exclusively support the ERA Chair and her team, while additional administrative support is provided by IST.

The ERA Chair research team and the Co-PIs from ITI/LARSyS and INESC-ID worked together to submit funding applications to European and non-European Funding sources (almost €82M). Four Horizon Europe were funded (DCitizens, SynTechs, LogaCulture and BoSS) with a total of 1 842K€ of European funding aquired for ITI/LARSyS and one PRR Agenda eGames Lab totalling more then 5.8m€ of funding to ITI/LARSyS. We are committed to making IST a national and internationally recognized hub for Blockchain and distributed ledger technologies and design innovation for different application domains. We have started exposing the community of IST students to blockchain problems and topics within undergraduate courses (340 students) and master courses (260 students) including how to apply design innovation techniques for social good. The overall team is co-supervising 31 Master students, one of our Co-PIs, Dr. Augusto Esteves, Co-PI, in the context of his sabbatical, visited the [Center for Cryptocurrency & Blockchain Research](#) which resulted in two master theses.

We have organized the following conferences as well:

- Bauhaus of the Seas Co-Design Event, Lisbon, MAAT, 20 May 2021, https://bauhaus-seas.eu/conference/lisboa-maat-20-may-2021/
- Bauhaus of the Seas Co-Design Event, Venice, 20-21 Sept. 2021, https://bauhaus-seas.eu/conference/venice-arsenale-20-21-sep-2021/
- Nuno J. Nunes, Valentina Nisi, Pedro Campos, Create Funchal: Inovação, tecnologia e criatividade, Presentation of the eGames Lab PRR Agenda, 27 May 2022. https://create.funchal.pt

And the Roundtables:

- Digitalization at the Service of People and the Environment, Nuno Nunes, Bernhard Lenger, Frederike Manders, Hessel van Oorschot, Cultuur Eindhoven, 22 Sept. 2021, Chairs: Tanja Mlaker and Oscar Kocken;
- Worldbuilding a more-than-human future: Exploring and envisioning new narratives with the seas, Roundtable Discussion at the Bauhaus of the Seas, 20 May 2021, Chair: Nik Baerten;

- Transformative Economies: Ecosocial Wellbeing and the Politics of Participation, Roundtable Discussion at the Bauhaus of the Seas, 20 May 2021, Chair: Ann Light;

- Circular Economy for Coastal Regions: A sea of opportunities, 20 May 2021, Chair: Paulo Ferrão;

- Tech in Sustainable Development: Digital & Other Technologies for social good, 20 May 2021, Chair: Catherine Mulligan;

- Design Education: How to evolve design education for a NEB, 20 May 2021, Chair: James Auger;

- Technological Dreams and Post-Petroleum Futures, James Auger, IST, 20 May 2022

Furthermore, we have 3 PhD and Master level exchanges. For summer 2023, we are planning a Doctoral Summer School programme in distributed ledger and blockchain technologies. We continue to work on the development and deployment of the BIG Lab. We have not only defined our strategy for Knowledge Transfer, characterised our research Infrastructure, and planned our industry affiliation model. We started meetings with users to scope their needs. Lastly, we have disseminated the project at several venues, organised events, and workshops, and committed to raising the BIG project profile on social media.

1. Introduction

The overall goal of BIG is to expand the research and innovation potential of Técnico-Lisbon, contributing to foster a digital ecosystem taking advantage of Blockchain technologies and design Innovation for social Good through the hiring of an ERA Chair and the associated team. BIG aims to develop a critical mass of interdisciplinary research in deploying and testing Blockchain technologies in strategic application domains aligned with Portugal and Lisbon's smart specialisation strategy (S^3). The BIG ERA Chair activity aims to unlock the full potential of interdisciplinary research while strengthening innovation and knowledge transfer activities in close collaboration with local and global industrial partners. The BIG ERA Chair will therefore contribute to the smart specialisation strategy of the Lisbon Region by stimulating the upcoming ecosystem of digital startups and their economic impact.

BIG is particularly well suited to assist Lisbon to leapfrog and become a European high-tech hub for the data economy. The BIG ERA Chair on Blockchain technologies and design Innovation for social Good is pursuing the following strategic objectives:

- **Upgrade the existing research and technological development capabilities** by expanding the human potential and fostering a critical mass of researchers with interdisciplinary expertise in Blockchain and related technologies (distributed computing, security and applied cryptography, AI, machine learning, big data, and cloud computing) as well as design thinking. BIG is looking at new ways to boost the potential of these emerging technologies in application areas such as health, energy, digital citizenship, transport, and creative industries and their economic impacts. BIG will provide resources to design and other creativity-enhancing practices to explore innovative solutions for Blockchain and distributed ledger technologies via design studios. By developing unanticipated uses of technology, testing unusual application domain solutions, and working on social innovation/acceptance, BIG will investigate and support novel methods of examining and communicating the potential of blockchain technologies and guide and evaluate their impacts on critical societal challenges.

- **Improve the innovation potential and impact** of Lisbon and Portugal as an ideal platform in the Euro-Atlantic region of the EU through design-driven innovation for the data economy. By unravelling the implications of open innovation in Blockchain technologies on advanced training and knowledge transfer and expanding the human capital and the creative research capabilities of individuals and organisations with the ultimate goal of materialising opportunities offered by Blockchain and distributed ledger technologies. Examples include investing in creating testbeds for decentralised, trusted, transparent, user-centric digital services and stimulating new and improved business models that promote decentralised social innovations. These testbeds will enable the industry stakeholders to test and market solutions

in Strategic application areas aligned with the smart specialisation strategy, for instance, tourism, transportation, mobility and logistics, creative industries, and the blue economy.

- **Raise international awareness** about the research institutes (LARSyS and INESC-ID) and connect Técnico – Lisbon and its industry affiliates to the global knowledge networks: work with mentoring institutes based at prestigious universities in Europe (CNRS, EPFL, Polimi, and Soton), which have agreed to serve as advisors to the project by sharing their knowledge and promoting the exchange of key personnel; BIG will continue to deepen the strong partnerships established with Carnegie Mellon University (CMU) and Massachusetts Institute of Technology (MIT), which include joint research and advanced training programs and help position BIG and Lisbon as a brokering platform in the Euro- Atlantic region for the data economy. The BIG ERA Chair project will generate long-term opportunities for economic development by enabling the Lisbon digital ecosystem to undertake a vital role within the Euro-Atlantic region and strengthen its competitive position.

BIG aims to deploy a campus-wide initiative in blockchain, distributed ledger technologies and design innovation to better integrate Técnico – Lisbon with the European Research Area (ERA) through the following objectives revised from the original GA:

O1. To reinforce the position of Técnico - Lisbon as an active player in the ERA by building an experienced partnering network of EU centers**.** These will assist Técnico's research capacity in blockchain and distributed ledger technologies and design innovation through synergies, know-how exchanges, infrastructure setup, EU funding access and talent retention, fostering excellent research and internationalisation.

O2. To focus the research strategy of Técnico's main ICT research labs (LARSyS and INESC-ID) on core distributed ledger technologies with strong ties to application areas corresponding to the needs of industry affiliated from the Lisbon ecosystem and internationally.

O3. To assist Técnico - Lisbon to reach distinctive and critical human capital in blockchain and distributed ledger technologies and design thinking, by overcoming the fragmentation of competences, which is currently straining the existing human resources of LARSyS and INESC-ID.

O4. To overcome the brain-drain and increase the competitiveness of Técnico - Lisbon by recruiting high quality experienced researchers and established scientists capable of driving structural changes in the school, and promoting free exchange of knowledge and people within and across the partner network.

O5. To improve the innovation performance by creating a unique research infrastructure (Blockchain Design Studio) that acts as a platform for collaborative impact, based on an open innovation model. This platform will leverage Lisbon as an international living lab for testing

innovative applications and services based on blockchain and DLTs, and impact EU societal challenges and S^3.

O6. To enhance the generation of advanced knowledge and, in a complementary way, the use of that knowledge through an effective strategy for managing intellectual property.

O7. To boost the potential of Técnico - Lisbon to generate innovative ideas that can be turned into new marketable and usable data intensive systems and services through the increased collaboration with industry and the generation of startups and spin-offs in the upcoming Lisbon digital ecosystem.

O8. To substantially improve the RTD indicators of Técnico – Lisbon, resulting in an expected two-fold gain in the number of funded projects in these topics.

We have called this initiative "DCentral". By doing so, BIG will lead to better integration of Instituto Superior Técnico in the European Research Area (ERA) and improve the associated ICT research Labs, LARSyS, and INESC-ID engagement Horizon Europe and ESIF programs.

2. Objectives of the period

The BIG project team had set clear objectives for the first 24 months of the project, mainly the hiring of the ERA Chair Holder and team, establishing the quality procedures of the project and developing the communication plan.

The BIG project had a successful kick-off of the project in September 2020, which allowed us to establish the management structure of BIG, namely the ERA Chair Board and the Search Committee. The Search Committee was a quintessential part of the scouting and hiring process of the ERA Chair holder. The ERA Chair Holder, Catherine Mulligan, was hired on month 8 (May 2021) of the project. After Catherine Mulligan was hired, we started the scouting process for the ERA Chair team. During Year 2, we completed the Research Infrastructure, Industry Affiliation Model, the Periodic Report 18 Month Report, Knowledge Transfer Plan and Contracts of Era Chair Team. We are committed to taking a continuous improvement approach to those.

Regarding the development of research capacities, some team members have attended Horizon 2020 training courses to help raise the competitiveness when applying for Horizon2020 projects. Links have also been established internally with the Pre-Award Officer, Marta Candeias, and externally with João Ribau, the National Representative & Contact Point for Horizon Europe – Industry & European Innovation Council (EIC) at the Portuguese Innovation Agency (ANI) and Rui Munhá, National Contact Point at the Portuguese Science and Technology Foundation (FCT).

We built the project's website and created social media accounts, such as, Instagram, Twitter and Youtube for BIG and DCentral concerning the communication and dissemination activities. The website and social media were mainly used to promote hiring the ERA Chair holder and its team.

3. Tasks for the period

The table below determines all the tasks from each work package set to be accomplished in the project's first year and the tasks whose planning and work should start during this period.

Task	Execution Period
Task 1.1. Activity Planning and Reporting to the Commission.	M1- M60
Task 1.2. ERA Chair Board and Institutional Coordination.	M1- M60
Task 2.1. Recruitment of the ERA Chair	M1 – M12
Task 2.2. Recruitment of ERA Chair research team	M7- M27
Task 2.3. Recruitment of ERA Chair Support Team	M6 – M27
Task 3.1. Acquiring Horizon 2020 funding development expertise	M6-M24
Task 3.2. Exchange of Know-how with Potential EU Partner	M6 – M36
Task 3.3: Secondments of doctoral students and junior researchers	M1 – M36
Task 4.1: Building the BIGLab	M10 – M21
Task 4.4: Industrial Affiliates Program	M10 – M60
Task 4.5: Knowledge transfer planning	M10 – M60
Task 5.1 Project Communication and Dissemination Plan	M4 – M60
Task 5.2: Newsletters, Website and social media	M4 – M60

4. Work progress during the period

WP1 – Project Management

Objectives

The objective of this work package is to perform the global project coordination and support tasks, the project management in general, the monitoring of project development and budget spending, the coordination of the interactions among partners, and the communication with the European Commission. The activities performed in this Work Package will provide the basis for administrative, technical and financial project management and ensure the technical and economic features of the project are correctly conducted.

Task 1.1. Activity Planning and Reporting to the Commission

Over the last 24 months we have ensured the project management of the BIG ERA chair project, by organising, planning, monitoring and coordinating to plan and deliver a number of activities such as:

- Budget control
- Procurement processes – purchase of goods and services
- HR procedures – open and recruit vacancies for the ERA Chair´s team
- Supporting the ERA Chair team in project applications and submission
- Set the strategy for the effectively delivery of the project
- Collate KPI and other results
- Monitor, coordinate, write and submit deliverables to the European Commission.

We have submitted to the European Commission 5 deliverables on Year 2: Research Infrastructure V.1.1 (D4.1, on the 12th of April 2022) - This document outlines the Research Infrastructure (RI) for the BIG project, the current state of development, the plans and the weaknesses, challenges and opportunities that exist to successful execution of the plan; Industry Affiliation Model V.1.1 (D4.2, on the 13th of April 2022) - The aim of this report is to explain how our industry model works in practice and how it informs our strategic vision for industry cooperation within Portugal and with EU partners; Periodic Report V4 18 Month Report (D1.5, 28th of April 2022); Knowledge Transfer Plan V1.1 (D4.3, 06th of September 2022) - The knowledge transfer plan aims to foster the transfer of knowledge generated by **BIG** to wider society; Contracts of Era Chair Team V1.0 (D2.2, 08th of September 2022) - This deliverable describes the recruitment process the strategic decision and reports on the contracts of the ERAChair research team and the senior project manager(s) hired through ITI/LARSyS.

With the ERA Chair team and a BIG Senior Research Manager in place, responsibilities shifted towards the ERA Chair team, with the support of LARSyS and INESC-ID. Since then, the project management

team was established, currently integrated by the ERA Chair Holder (Prof. Catherine Mulligan), the
BIG ERA Chair Senior Project Manager (Andreia Cavaco), the Project Coordinator (Prof. Nuno Nunes)
and ITI/LARSyS Senior Project Manager (Alexandra Mendes). This team meets once a week to solve
day to day contingencies and support the BIG ERA Chair. Separately, the two Senior Research
Managers also meet weekly to operationalize the work to be delivered, as well as to organise and
monitor the project implementation, collating the project results, KPIs and relevant indicators.

The Project Management team through the RMU liaises with the relevant departments at Instituto
Superior Técnico, such as the pre award office, which supports researchers in funding applications, and
the department of international projects, which validates the budgets. It will also collate and provide
relevant information for the researchers on finding new calls for project proposals. The RMU also
focused on on a detailed Strategic Plan and coordinating transnational cooperation (with the Partnering
Organisations and beyond), as well as the task distribution, management, support and coordination
procedures at regional level (distribution of tasks and actions, allocation of resources, communication
and diffusion plan and risk and contingency plan. Furthermore, the RMU works in collaboration with
the financial department at Instituto Superior Técnico to purchase goods and services, as well as to
submit the financial reports to the European Commission.

The ERA Chair team (ERA Chair, Prof. Catherine Mulligan, ERA Chair Researchers (Dr. Kevin
Gallagher, Dr. Mariana Pestana, Dr. Teresa Almeida and Dr. David Matos) and the Senior Research
Manager (SRM, Andreia Cavaco)), meet weekly to plan the work, define and deliver the project
objectives and build capacity in blockchain amongst the DCentral team. The team is also focused on
sharing the current and future supervision of Master students in blockchain related topics including
international students, defining a doctoral summer school in 2023. Moreover, the team is focused on
identifying gaps in funding applications for EU projects, to identify funding opportunities and potential
collaborations at regional, national and international levels.

Task 1.2. ERA Chair Board and Institutional Coordination

As per the previous report, the ERA Chair Board was appointed to the project kick-off meeting on
September 29, 2020. The ERAChair Board changed since Prof. Rodrigo Rodrigues decided to leave the
project and also appointed Prof. Ana Póvoa as representative of the SC of IST. The ERAChair Board
is currently composed of the following members:

- Prof. Nuno Nunes – Project Coordinator (Head)
- Prof. Catherine Mulligan – ERAChair Holder
- Prof. Inês Lynce – President of INESC-ID
- Prof. José Santos Victor – Coordinator of LARSyS
- Prof. Ana Póvoa - Representative of the SC of IST

The following members have been requested to the ERAChair holder and are awaiting her decision:

- External EU Expert
- Representative of the Industry Affiliates

The aim of the ERA Chair Board is to ensure supervision of the strategy of the project, monitor the quality of the work and ensure coordination with other scientific bodies involved in the organisational structure of Técnico – Lisbon, LARSyS and INESC-ID. This ERAChair Board is planned to meet once a year and a meeting was scheduled for May 2022 but the ERAChair holder refused to attend the meeting until the review report was delivered and a new plan for the project was proposed.

As of the writing of this report the Coordinator plans to schedule a meeting of the ERAChair Board prior to the submission of the answer to the report and the full revised deliverables.

WP2 – Recruitment of ERA Chair, Research and Support Team

Objectives

This WP aims to recruit the ERA Chair holder, the research team, and the support team, including three researchers, one research manager, and one TTDO. The staff should support the work of the Chair holder, providing the blend of complementary expertise and skills needed to promote the excellence of research and the activities of fundraising, advanced training, knowledge transfer, and public dissemination.

Task 2.1. Recruitment of the ERA Chair

The main goal of BIG was to hire an experienced researcher able to build critical mass and widen the fields of expertise of Técnico-Lisbon, LARSyS and INESC-ID, and we have now crossed that hurdle. The recruitment process was reported in Year 1 as well as on the 18Month Report.
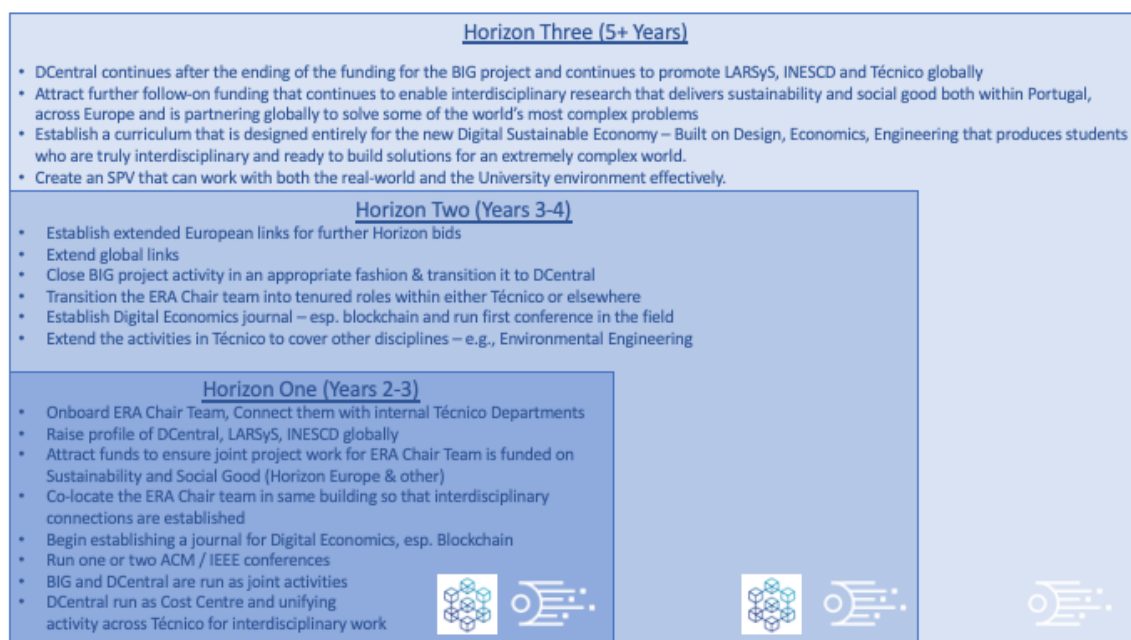
Figure 1 - Overview of the strategy outlined for BIG's longevity

Task 2.2. Recruitment of ERA Chair research team

As mentioned on the 12-month report, offers were made to five faculty to join the ERAChair research team. Starting dates have been defined and completes as follows: Two researvhers (Kevin Gallagher and Mariana Pestana) started in October 2021, two in February 2022 (Teresa Almeida and Alfio Puglisi), and one (David Matos) joined the team on the 1st of July 2022. The wide range of skills of these researchers will enable us to not only deliver the BIG activity, but also to ensure its longevity for both Portugal and Técnico.

We strongly believe that the most effective strategy to ensure sustainability of the project, whilst promoting long term institutional change, is creating a virtuous cycle where we move the ERA Chair research team to tenure track over the course of the ERA Chair project, whilst ensuring that they are still actively involved in the project. The ERA Chair (Cathy Mulligan) will continue to oversee the overall project and team until the end of the project, irrespective of whether she achieves tenure or is successful in landing other grants.

Task 2.3. Recruitment of ERA Chair Support Team

As highlighted in the original proposal, this task is essential for building the research management capacity for the ERA Chair, the BIG project and in the longer term at IST. On our original grant proposal, we had envisaged that the senior research manager and the Technology Transfer and Dissemination Officer (TTDO) will oversee knowledge transfer actions to promote and manage innovation activities with the public administration and private business corporations. Particular attention will be devoted to establishing an Industry Affiliates Program (WP 4). Furthermore, a lab technician would run the BIG Lab. This technician will work in close collaboration with technical staff already working at the facilities of LARSyS and INESC-ID, but he/she will focus on the implementation of the specialised techniques required for the deployment of blockchain infrastructures.

As per our communication with the Project Officer of 25th of February, we sought a Linked third party for IST-ID for the recruitment of the Senior Research Manager and the Technician, as through this process, the recruitment of support and management staff is more agile and positions can be advertised at higher grades to recruit more experienced people.

Despite not having a Linked third party with IST-ID, as mentioned in the 12-month report, a senior research manager was recruited (Maria Laranjeiro). However, due to unforeseen circumstances, she had to leave her employment prematurely. Nevertheless, on the 1st of February, we recruited a Senior Research Manager (Andreia Cavaco), a programme manager with over 16 years international experience, including research management, fully dedicated to the BIG Project working at ITI/LARSyS. In addition, the ERA Chair project is supported on financial and management and other logistic matters by staff from IST from the central international project office and senior support staff from ITI/LARSyS (Alexandra Mendes).

Regarding the recruitment of the TTDO, as highlighted on the email submitted to the Project Officer on Friday the 25th of February 2022, we are committed to creating structural and cultural changes at IST and to ensure the sustainability of a critical mass of interdisciplinary research, whilst tying in with the current structure and strategy of IST. Therefore, we sought to create synergies building on existing resources: INESC-ID´s Innovation Management Coordinator and IST´s technology transfer office that

has an oversight of the university's technology transfer, as well as the know-how on how to operate in Portugal.

As per our proposal, we are still on track to recruit the lab technician in month 24 of the project. However, having the Linked third-party agreement with IST-ID, this would mean not only that we could be more agile on the recruitment, recruit at higher grade and be able to recruit a lab technician with 36 months rather than a 12 month contract.

WP3 – Development of Research Capacities to Participate in the ERA

Objectives

To strengthen the research capacity of Técnico – Lisbon, LARSyS and INESC-ID and to promote its long-term sustainability by providing support to foster the project management, networking and fundraising capabilities of its researchers. Specifically, the WP aims to: (i) provide LARYS and INESC-ID researchers with training on the technical and practical skills needed for preparing successful applications to H2020 and to gain project management skills; (ii) build relationships with key international organisations and networks in the environmental area; (iii) consolidate and expand the network of partners through regular, bi-directional exchange of researchers and students; (iv) foster the establishment of long-term partnerships with leading research institutions; and (v) promote the preparation of applications to H2020 calls.

Both BIG and DCentral are aimed directly at ensuring the associated activities enable Técnico to participate in the ERA. The aims of the refreshed ERA are to:

- Strengthen mobility of researchers and the flow of knowledge
- Incentivise investing in research and innovation
- Promote gender equality and diversity in science
- Enhance cooperation among universities, business and other research and innovation actors and it has four strategic aims:

    1. Prioritise investments and reforms in research and innovation, to support the digital and green transition and Europe's recovery
    2. Improve access to excellent research and innovation for researchers across the EU
    3. Translate results into the economy to ensure market uptake of research output and Europe's competitive leadership in technology
    4. Make progress on the free circulation of knowledge, researchers and technology through stronger cooperation with EU countries

In order to ensure that BIG and DCentral are fully aligned to the ERA strategic aims, we have developed an initial plan along the following lines that ensure the Tasks in this work package provide a unified effort to deliver towards the ERA and enable our full participation.

Firstly, we ensure an interdisciplinary approach in order to enable us to align to strategic objective 1) through ensuring we take an environmental, economic and social perspective into account for any engineering solution we propose (Figure 2) - this will ensure that we are able to contribute research and ideas that directly link to the digital and green transition, in particular as it relates to Europe's recovery:
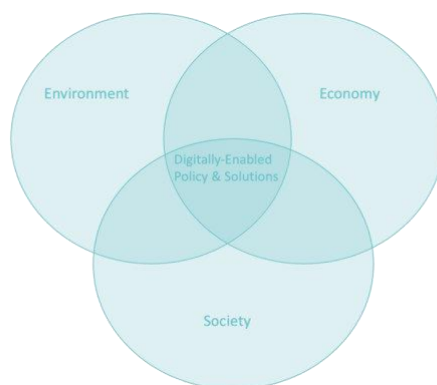
Figure 2 - Our approach to engineering solutions.

Our unifying research question is therefore:

> *"How can decentralised technologies help society build a sustainable future and deliver Social Good?"*

In order to deliver on the rest of the ERA strategic objectives, we apply an "innovation garage" approach (Figure 3) to 1) managing our research inputs and 2) developing our research outcomes. This is illustrated below:
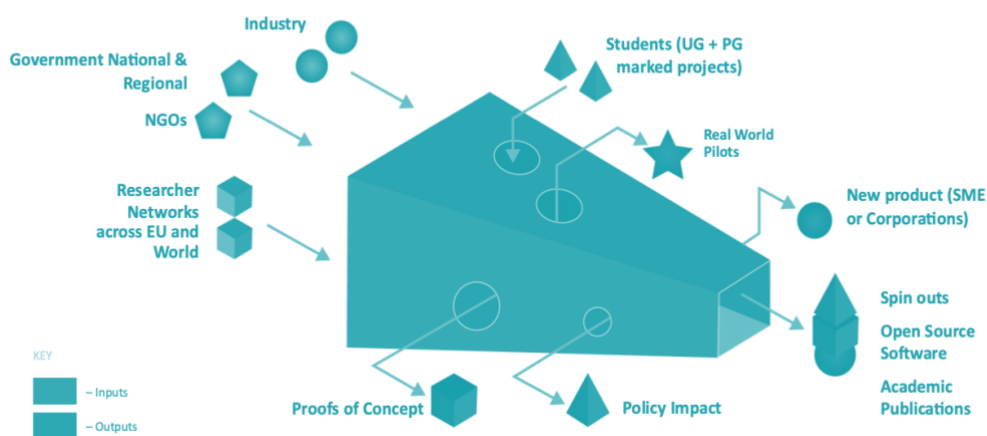
Figure 3 -"Innovation garage"approach

Firstly, our inputs to developing our appropriate research agenda come from various sources – including discussions with other researchers across the EU and globally, but also across different governments, both regional (EU) and national (Portugal), as well as industries and non-governmental agencies such as the United Nations, charities and others. Our Innovation Garage approach works to ensure that as we collate these inputs, we are generating *research activities* that are directly related to solving the issues identified. Through this we work towards strategic aim 3 by focusing research activity on

problems identified across industry and broader society. We then focus our outputs on several items in order to fully deliver towards strategic aims 2 and 4:

- **Academic Publications**: As an academic activity, our main aim is to produce research excellence and this will be a core driver of our activities. This will be aimed at Computer Science, Design, Economics and Innovation Policy. In some instances, we will also push the boundaries of academia to create new journals for the new Digital Economy that is becoming a foundation of the EU.

- **Policy Impact**: We will ensure that the relevant Innovation, Economics and Policy insights are delivered into the correct policy forums locally and globally to better connect the academic outputs with the real-world.

- **Technical Outputs:** Another output of our work is a series of technical outputs and artefacts that can be:

  o **Proofs of Concept**: We will trigger uptake of our ideas through the development of PoCs that can form both the foundation of academic publications as well as useful ways to engage with industrial partners around initial topics

  o **New Products:** We will work directly with industrial partners to provide research input into their product developments to further embed the research activities in the industrial landscape of Portugal

  o **Spin Outs**: In particular, we will work with our students to develop their ideas and concepts into viable spin-outs – developing an innovative and flourishing start-up economy in Portugal. A key aspect of Dcentral will be to develop and cultivate not just the student projects, but also the connections to Venture Capital, Angel Investors and government agencies to ensure that good ideas for spin-outs are well-handled to give our students the best opportunities possible for success.

  o **OSS –** from a broader societal perspective, all of our software will be made available via Open-Source Software, allowing uptake of our research outputs and generating further research excellence across the EU through exchange of ideas and software components.

- **Cultural Impacts:** When dealing with a new form of money or value exchange such as cryptocurrencies that fundamentally challenge the social contract that has formed the basis of our society for over 150 years, it is important to conceptualise, research and provide insight into the cultural impacts of the technologies. Dcentral will also address these research concerns from a variety of angles.

We will also work with both undergraduate and postgraduate students to deliver the next generation of academic and industrial talent in this space.

Finally, DCentral will start as a collaboration between several departments, but over time will enable interdisciplinary activity across all of Técnico as illustrated below (Figure 4):
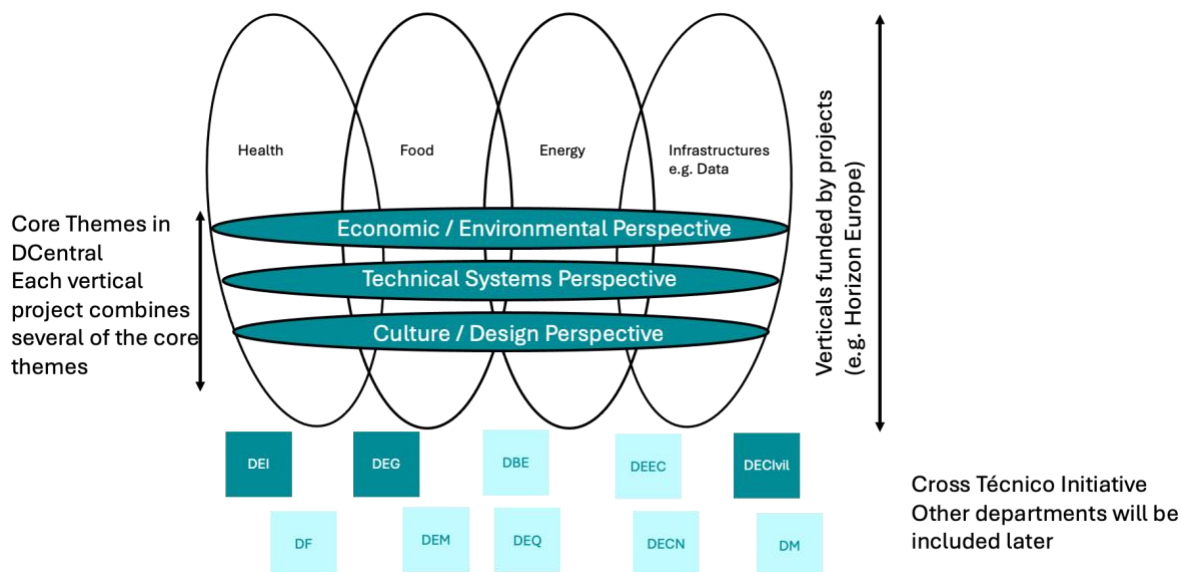

Figure 4 - Cross Técnico Initiative

Through these activities, BIG will initially build competence in Técnico and across Lisbon and Portugal. Through the longer-lasting DCentral activity, we will engage fully with the world and aim to interact both across the EU and at a global level: firstly, promoting the research excellence of both LARSyS and INESC-D, secondly developing new research excellence within blockchain and associated technologies and finally by creating a vehicle for long-term engagement both internally and externally to Técnico (DCentral).

Task 3.1. Acquiring Horizon 2020 funding development expertise

In this first year of the project, the staff and faculty acquired H2020 expertise through local training and online webinars lectured by the European Commission. One member of the support team from LARSyS, Alexandra Mendes, attended the training course "Horizon Europa and the preparation of applications for European projects" organised in the scope of the Horizon2020 project – FORWARD. The training course focused on the Pillars and topics of the Horizon Europa Program. The first session addressed the Participant Portal and all the information inherent and necessary to submit a proposal. On the second day, the theme was Pillar I and the types of projects and proposals for the Marie Skłodowska-Curie Actions. In the third session, the focus was on Pillar II- Widening and filling out the sections of the forms. In the fourth and final training, Pillar III was addressed and its types of projects and the European Innovation Council (EIC).

ITI/LARSyS (Alexandra Mendes, Senior Research Manager) support staff also participated in a meeting organised by Instituto Superior Técnico on June 16, 2021, to discuss the financial, administrative and technical aspects of HE applications, specifically for the thematic Collaborative

Pillar 2 projects and for the Pathfinder Challenges (closing dates September/October/November), so that we can advise and support researchers in preparing their applications. Furthermore, Alexandra Mendes attended the Financial Management of Horizon 2020/EUROPE Projects, delivered by the European Fund Management Consulting (EFMC), specifically designed for project managers, finance services, EU post-award offices, which took place from the 19th-21st of February 2022 in Vienna (Austria).

Catherine Mulligan and Alexandra Mendes participated in the European Research and Innovation Days event, organised by the European Commission on June 23 and 24, 2021. This event covered topics such as Horizon Europe, the European Research Area, the European Innovation Ecosystems.

On the 24th of June 2021, we delivered deliverable 3.1 (Organization of Horizon training events), through an info session on the new Horizon Europe program for LARSyS and DCentral researchers, focused specifically on the upcoming project funding opportunities, delivered by IST´s Pre-award officer (Marta Candeias). Building on the success of the session, the information and calls under the new Horizon Europe program, and with the ERA Chair research team now in place, we have arranged a new meeting with IST´s Pre-award officer on the 5th of May 2022. This meeting aims to inform the ERA Chair Research team on the Horizon Europe funding opportunities, potential partners search, and identify the gaps of knowledge on the ERA Chair Research team to support with further training.

Furthermore, we are liaising with other Portuguese organisations supporting EU funding application, such as the national representatives and contact points at for example the Agência Nacional de Inovação (ANI, National Innovation Agency, João Ribau) and Fundação para a Ciência e a Tecnologia (FCT, Science and Technology Foundation, Rui Munhá). We will map the interests of the ERA Chair Research Team, LARSyS and INESC-ID to understand the gaps and organise sessions to support the researchers, in close collaboration with IST´s Pre-award officer, Marta Candeias.

At European level, we have recruited a UK company with expertise in successfully obtaining EU funding, Make Time Count, to support our ERA Chair on funding applications. We are also considering further support from other companies such as EUMasterclass, expert consultant for EU funding projects, to train the ERA Chair on successfully applying for EU funding. We expect to deliver this training by September 2022, as per the grant agreement (deliverable 3.2).

Task 3.2. Exchange of Know-how with Potential EU Partners

The exchange of Know-how with Potential EU partners is essential to the BIG project. Therefore a number of efforts have and continue to take place to establish a number of connections and discussions for example for different Horizon bids – including:

- Italy - Sant'Anna, Pisa & Istituto Italiano di Tecnologia
- Germany - Weisensee school of art and design & Humboldt university

- Spain - Centre Blockchain de Catalunya
- UK - University College London, Imperial College, University of Exeter & MiFarm
- Sweden - KTH & Umeå University

For example, on the 18th of December 2020, we organised the first event connected to the BIG ERA Chair project, Demystifying Blockchain, bringing together world-know Blockchain experts and Academics: Dr Catherine Mulligan (then at Fujitsu; University College London; Imperial College London, UK), Professor Chris Speed (Institute for Design Informatics, University of Edinburgh, UK) and Professor Allen Clement (DFINITY – Zurich, Switzerland).

As per our email to the Project Officer on the 25th of February, we will also like to expand our collaborations beyond the ones named on the bid. For example, over the last months, the ERA Chair Research team have started to develop long term collaborations with:

- *Florida University*: On Digital Justice, particularly assessing the role of blockchain / DAOs in the delivery of social justice;
- *Exeter University and French Competition Authority*: On Emergent Digital Economies: AI and DeFi – what are the emergent attributes of the digital economy?
- *Ericsson:* On Telecommunications and Blockchain – solutions and opportunities for 6G;
- *Imperial College London.* On Designing Resilient Food Systems – specifically Food DAO, Prof. Catherine Mulligan is also working on WaterDAO and EnergyDAO);
- *European University Institute*, Florence. Responsible Innovation and Regulation in FinTech.;
- *Newcastle University*, Newcastle, UK. Cybersecurity Group, working on topics of AI, trust, decentralisation and differential privacy in FemTech.
- *Umeå University*, Umeå, Sweden. Design Informatics Group, working on topics of decentralisation and social justice;
- Manicómio, Art project and gallery based in Lisboa. Early discussions on working on topics of women's and mental health;
- Industry Partners: Zharta, Anchorage, Feedzai, Ericsson, Energy Unlocked, KLH sustainability, IoT Tribe, Climate Connect, EIT Food, Digital Economist, Mesh Net, eWater, World Economic Forum, Sudden Compass, Vodafone;
- *New York University*, New York, United States, *Purdue University*, Indiana, United States and *American University of Paris,* Paris, France. Working on theory and application of decentralised access control;
- *New York University*, New York, United States. Working on improving Tor, the decentralised anonymity system.

We have also collaborated with other partners to secure European Union Funding (table 1) as well as other sources of funding. In total, we have submitted applications for almost €16M (€15,794,260.00) from which 42% (€6,671,733.50) were on funding applications for European Union Funding.

Principal Investigador	Proposal title	Reference (call name)	Budget requested	Result
Hugo Nicolau	DCitizens: Fostering Digital Civics Research and Innovation in Lisbon	Twinning – Widening	€ 552 000.00 / € 1 430 000	Funded
Valentina Nisi, Nuno Nunes	LOGACULTURE: Locative Games for Cultural Heritage (Coordinator)	HORIZON-CL2-2022-HERITAGE-01-09	€ 454,636.25	Funded
Nuno Nunes, Paulo Ferrão	SYNTECS - SustainablY aNd digiTally driven hiErarchical laser texturing for Complex Surfaces	HORIZON-CL4-2022-TWIN-TRANSITION-01-02	€ 225,125	Funded
Nuno Nunes, Mariana Pestana	Bauhaus of the Seas Sails – BoSS (Coordinator)	HORIZON-MISS-2021-NEB-01	€ 609,875 / € 4,999,975.0	Funded
Valentina Nisi, Nuno Nunes	CULTURE CHAIN - Cultural BlockChain and Artificial Intelligence for the Protection and Preservation of Digital Cultural Heritage	HORIZON-CL2-2021-HERITAGE-01	€ 626,312.5	Not funded (12.5/15, threshold 10)
Teresa Almeida	iNtima: Enabling New Relationships with Intimate Data	ERC Starting Grant	€ 1 500 000.0	Not Funded
Nuno Nunes	Proactive Self-aware Personal Companions for Sustainable Quality of Life	HORIZON-EIC-2021-PATHFINDERCHALLENGES-01	€ 579 031.25	
Valentina Nisi, Nuno Nunes	LEAPCulture - Locative Engagement, Access, and Preservation of Cultural Heritage	HORIZON-CL2-2021-HERITAGE-01, HORIZON-RIA	€ 545 613.75	Not Funded
Valentina Nisi	WILD – Into the Wild	H2020-FETPROACT-2020-2, RIA	861 627.5€	Not funded within threshold (Total score: 12.50/15.0 Threshold: 10)
Valentina Nisi, Nuno Nunes	3D CULT Design and Digital manufacturing for the Diffused Mediterranean	HORIZON-CL2-2022-HERITAGE-01	€ 260 297.5	Not funded, 9.0 (Threshold: 10)
Miguel Correia	TRUSTyFOOD: Stakeholders-driven pathways for blockchain implementation in the agri-food sector	HORIZON-CL6-2021-FARM2FORK-01-07	€238,793.00	Not Funded
Augusto Esteves	DRAIS - Designing Responsible Human-Centred AI Systems	COST Action - OC-2021-1-25513		
Nuno Nunes	BauMar ERAChair: aligning the research and innovation potential of Técnico with the New European Bauhaus through the Bauhaus of the Seas	HORIZON-WIDERA-2022-TALENTS-01	€ 2 454 745	Not funded, 9.5 threshold 10

Valentina Nisi, Nuno Nunes	GLAMURE - A Glocal, IncLusive, DigitAl ecosysteM for the crafts of the fUtuRE	HORIZON-CL2-2022-HERITAGE-01-04	€ 321,250	Not funded, 12.0 threshold 10.0

Table 1 - European Union funding applications from the ERA Chair and Co-PIs team

The remaining 58% (Table 2) was for non-Horizon funding sources such as the Algorand Foundation (€7.1M, which unfortunately has not been successful). Moreover, we have passed to the second stage of funding application with a large consortio of Portuguese partners (companies and Universities) on the Plano de Recuperação e Resiliência (PRR, Portuguese for Recuperation and Resilience Plan, funds from the EU to support dealing with the effects of the Covid19 pandemic). We have collaborated with two companies (Anchorage and Zharta) to work on Digital Asset Management (budget of €1.9M).

Researcher	Reference	Budget requested	Result
Catherine Mulligan	Algorand	€7,180,521	Not funded
Catherine Mulligan	PRR	€1,942,005	Not funded
Pedro Campos / Nuno Nunes	eGamesLab	€ 5 848 401	PRR

Table 2 - Non- European Union funding applications from the ERA Chair and Co-PIs team

Task 3.3: Secondments of doctoral students and junior researchers

During the Covid-19 pandemic, and for safety reasons, our doctoral students and junior researchers weren't invited or advised to spend time abroad on the partner institutions. As the Covid-19 measures started to lift, we made plans for secondments of students and researchers.

For example, Dr. Augusto Esteves, Co-PI of the BIG project, in the context of his sabbatical, visited the [Center for Cryptocurrency & Blockchain Research](#) (CCBR in South Korea, from July 2021 to February 2022) was partially supported by the DCentral laboratory via the BIG ERA Chair project. The center actively conducts research and development related to cryptocurrency, furthermore, provides on-campus lectures, MOOCs, and holds blockchain seminars and conferences. This research exchange resulted in two ideas that have already matured into two MSc student theses currently taking place at Instituto Superior Técnico in Portugal.

The first thesis focuses on Leveraging Non-Fungible Tokens (NFTs) for Asset Attribution in the Metaverse. The recent announcement of Meta's (previously Facebook) vision for the Metaverse has made one thing clear: mixed or virtual reality (MR/VR) is here to stay. This first thesis is focusing on the assets that will enable the Metaverse, from the buildings to the objects users will be able to interact with. It is easy to imagine that various artists, architects, and modelers will apply the expertise and craft they have developed in the real-world to developing the building blocks of the Metaverse. The goal of this thesis is to explore and articulate a decentralized alternative to closed markets or stores to the Metaverse.

The second thesis focuses on the Validation of Self or At-Home COVID-19 Tests via a Blockchain-based Application. The COVID-19 virus and its mutations are not going away anytime soon. Different strategies have been put in place to mitigate its spread and allow us to return to our normal practices and everyday life. These range from vaccination efforts to carrying valid PCR or antigen tests, which are not only costly for the end user (between 20 and 100 euros) and the government, but also time consuming for everyone involved. And while self or at-home tests are recommended for the early-detection and containment of the virus, they are not deemed acceptable in various situations such as when attending large cultural events or bars (as per the latest government measures). Part of the issue is that there is no simple way to verify that a person has indeed carried out a valid test at home. As such, in this thesis we will interact with relevant stakeholders to come up with a system design and implementation that can potentially be adopted by the government to accept self or at-home COVID-19 tests.

We are hosting three students at Técnico-Lisboa: A PhD student Linnea Öhlund from the Department of Informatics at Umeå University (Sweden, Mar-May 2022), working on topics of HCI, decentralisation and social justice; a Masters student, Stefan Kwant from Innovation Sciences at Eindhoven University of Technology (The Netherlands, Mar-May 2022), working on blockchain,

sustainability and agriculture; and Meander van der Weijst, a Master student from Technische Universiteit Eindhoven (The Netherlands, Feb-July 2022), working on DAOs and nature.

At Técnico-Lisboa, we are strongly committed to reinforce blockchain in our courses: Co-PIs of the BIG ERA chair project have included blockchain topics in two courses, reaching a total of 480 students: In the BSc course which includes a Human-Computer Interaction discipline there was a module on [Cryptocurrency Wallet Interface](#) and in the MSc course which includes a User-Centered Design discipline, students worked on a project regarding [Crypto Cities](#).

Moreover, the ERA Chair Research team and the Co-PIs have supervised 19 master students (from which three were paid internships, Sara Sol, Nikoletta Matsur and Catarina Ribeiro) and one PhD student. The Masters students were part of DCentral and more information on their research topics for their respective theses can be found [here](#) under the students' section.

The ERA Chair Research team, led by Dr Kevin Gallagher and Dr David Matos with courses and teaching from Catherine Mulligan, Alfio Puglisi, and Teresa Almeida will enable a Doctoral Summer School programme in distributed ledger and blockchain technologies, which will be launched at IST during the summer of 2023. It is designed to be an interdisciplinary summer school - so it will cover technical subjects, economics, management, environmental and design topics. So far, Co-PIs have supervised PhD students while the Co-PIs and the ERA Chair team have supervised masters students at Técnico around the issues of Blockchain, DeFi and Cryptocurrencies applied to for example Green Economic Growth for small to medium enterprises, Service Design for Blockchain, and the Environmental impact of cryptocurrencies.

WP4 – Deployment of BIGLab, Test Beds and Living Lab

Objectives

This work package focuses on offering the ERA Chair and the LARSySand INESC-ID research team the opportunity to enhance the existing research labs with new equipment for world class blockchain and distributed ledger technologies and design innovation research. This equipment will be used to develop test beds that can be used not only by LARSyS and INESC-ID members but also by European and local industry partners. These test beds will play a key role in raising the visibility of the research teams and increasing their competitiveness in the Horizon 2020 programme. This work package will address the current lack of in-house and large-scale deployments and help further to aggregate and retain the critical mass. The development of a Lisbon digital living lab infrastructure is a key action of BIG to support the further development of the research capacity of LARSyS and INESC-ID under the strategic direction of the ERA Chair holder in several key application areas. The acquisition of state-of-the-art equipment will make Técnico - Lisbon more competitive and a convenient partner due to the uniqueness of the BIGLab design studio. The foreseen focus for the BIGLab serves as a shared cross-domain platform (for the smart specialisation strategy application domains) that will foster interdisciplinary approaches and the exploitation of synergies among research members and collaborators.

Hence, the living lab will serve to unlock our research potential allowing for innovative and novel creative approaches in the S3 application areas. Therefore, the equipment and the resulting cutting-edge research are key elements to position strategically LARSyS and INESC-ID to be competitive in ERA and beyond the project scope

Task 4.1: The BIGLab

The original aims outlined for the BIG Lab are ambitious and require concerted effort to deliver the outcomes. We have therefore outlined a structured, phased plan to ensure that we can deliver the aims over the course of the project. Here we focus on the two main concepts – testing of smart contracts and our data curation projects for research and policy.

Our main aims with the BIG Lab are to:

1) Provide the technical infrastructure required to support the Design Lab outlined in the Research Infrastructure deliverable

2) Create a flourishing ecosystem of researchers across Técnico – and where appropriate across the University of Lisbon

3) Develop independent policy input required for the European Commission and national governments around the role of DeFi in the European economy – what are the appropriate

4)   Contribute to a flourishing ecosystem of blockchain and cryptocurrency / DeFi in Lisbon and where possible across Europe and enable the creation of products that companies may pay us for and secure a long-term funding stream for BIG and the DCentral

Our design process has been outlined in our Research Infrastructure deliverable. The following section outlines the underlying technical and data infrastructure that is required.

Data Curation for Research and Policy

A key aspect of the BIG Lab is the creation of data sets from cryptocurrency, blockchain, DeFI and Web 3.0 spaces that enable economic, social and policy impact studies to be performed. These are critical data sets that are currently missing from both European and global policy discussions. We believe that the DCentral Lab through the BIG project can deliver highly needed data sets to provide an independent policy, economic and social science research across the EU. We outline two possible phases for our data curation – firstly collection and curation and - if time allows - secondly a machine learning assessment engine to identify as yet unknown influences occurring in the DeFi space – as well as any possible systemic risk between DeFi and the traditional financial system.

Open Data Access

Open Data is an important component to facilitate knowledge sharing and creation across academia, government, industry and civil society. A practical example of the focus for DCentral Lab is how the three ESAs (European Banking Authority, European Securities and Markets Authority, European Pension Authority) could use our data tools for monitoring financial innovation. This will also complement their work started on Big data.

https://esas-joint-committee.europa.eu/Publications/Reports/Final%20Report%20on%20Big%20Data.pdf

The Data collection platform gathers data from firms, consumers available online on the Blockchain and from industry-based surveys.
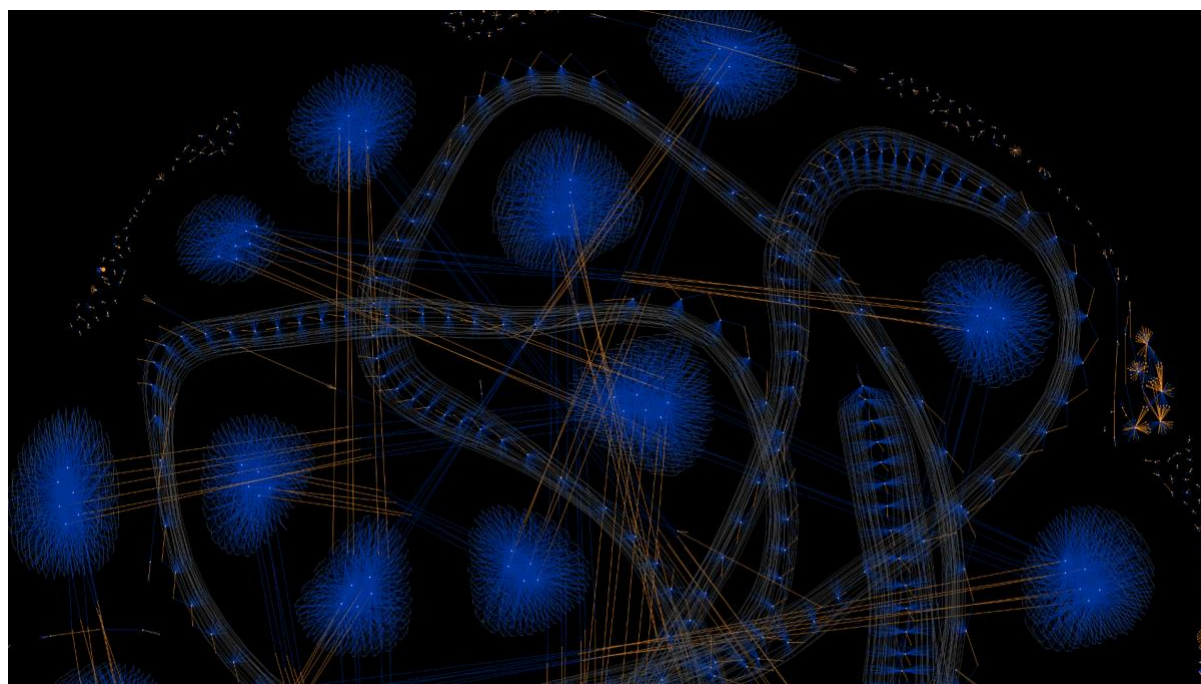
Phase 1: Data Collection and Curation

We have identified a number of different types of data that we will need to work on collecting – some of them based on surveys, while other data sets will be harnessed from the DeFi and traditional finance industry itself.

Online Data Collection	Survey Based Data Collection
Business data	Gather data on regulatory frameworks for digital payments
International flows of monetary transactions	Size & Growth of the Decentralised Finance Market
Monetary Value	Market Share of Decentralised Finance by Region
Wallet analysis of the users Operational risk of transactions	Global Volume by Key Models of Defi (payments, loans, investments)
Liquidity risk of transactions	Small business benefiting from/using Defi
Mortgage lending	Access to finance from Defi

Data Visualisation Tools:

Data necessitates efficient ways of analysing these large datasets, especially for policy purposes. We aim to address dimensionality reduction of data, scalability and readability and interactivity of the data tool.

An example of the illustrative benefits in the Cryptocurrency space are highlighted below – an illustration of the Bitcoin network that captured the first 51% attack on the Bitcoin network:

Source: Cathy Mulligan, 2012

Data Collection and Curation Architecture

Phase 1:

Our first phase of data collection and curation will focus on a traditional architecture that enables us to store the data in a structured and secure format while enabling us to make those datasets publicly available for research and policy across the European Union. Through this, we will attract new research partners and increase the awareness of the DCentral Lab and the broader BIG project across Técnico.
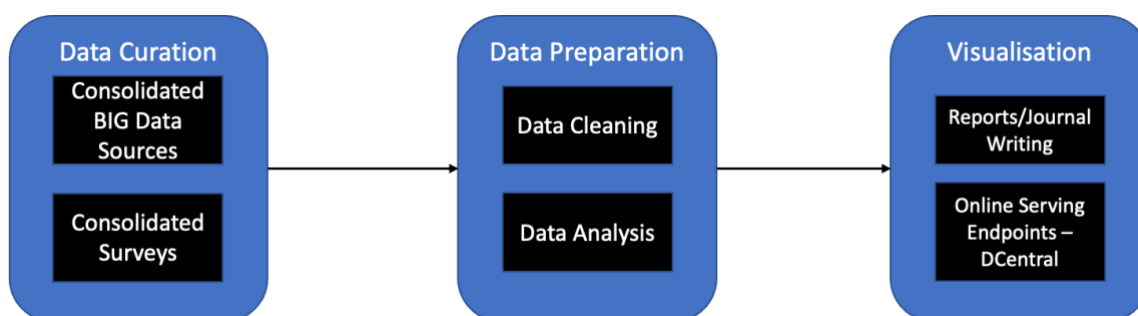
Phase 2:

If phase one of the BIG project and DCentral delivery mechanism are successful, we will work to create a Machine Learning interface that enables us to push our understanding of DeFi and Web 3.0 and blockchain further than is possible today. If possible, this phase will enable DCentral Lab and the BIG project to deliver social good on several levels.
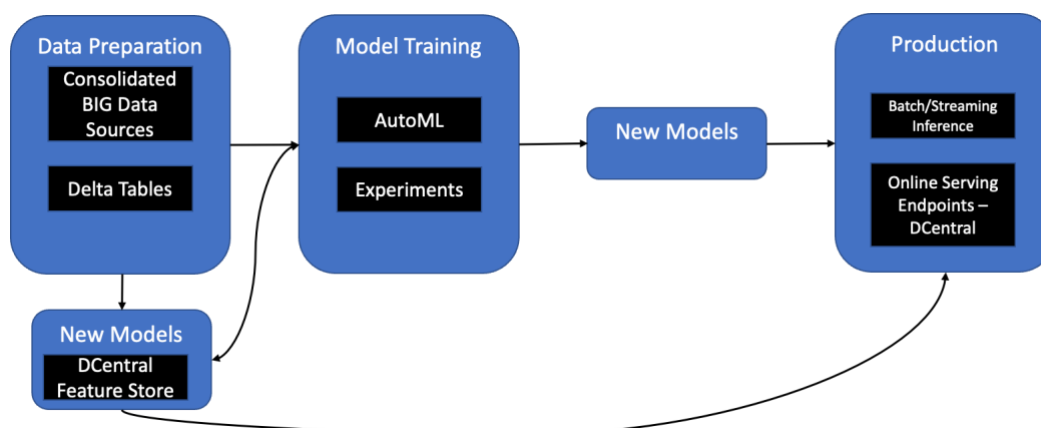
Testing Smart Contracts

Within the emerging DeFi products and services space – also known as Web 3.0 – the vulnerabilities associated with smart contracts is a key area that is creating issues around trust. As a simple example, one of the most famous hacks associated with cryptocurrency – called "The DAO hack" was enabled by a small error in the coding of the smart contract. In order to assist companies, we aim to provide an

independent testing service for smart contracts. We aim for this to be an automated service – a high level overview is provided in the figure below.

Phase 1:

- Companies will submit a request for testing of the smart contract with information regarding the type of blockchain that they wish to test on and also a set of use cases. A series of static-tests will be run on the smart contracts and a report sent back to the company in question.

- Research / Teaching Impacts: This phase of testing will enable us to create an assessment of the type of common errors in smart contracts to improve teaching and create research questions. In addition, this may form the basis of a white paper of recommendations for the broader DeFi / web 3.0 community.

Phase 2:

Phase 2 depends on a set of research that we will commence over the 2022/2023 academic year; the dynamic testing of smart contracts. In this instance, companies will perform the same process as in Phase 1 but will also receive a report related to the running of dynamic tests.
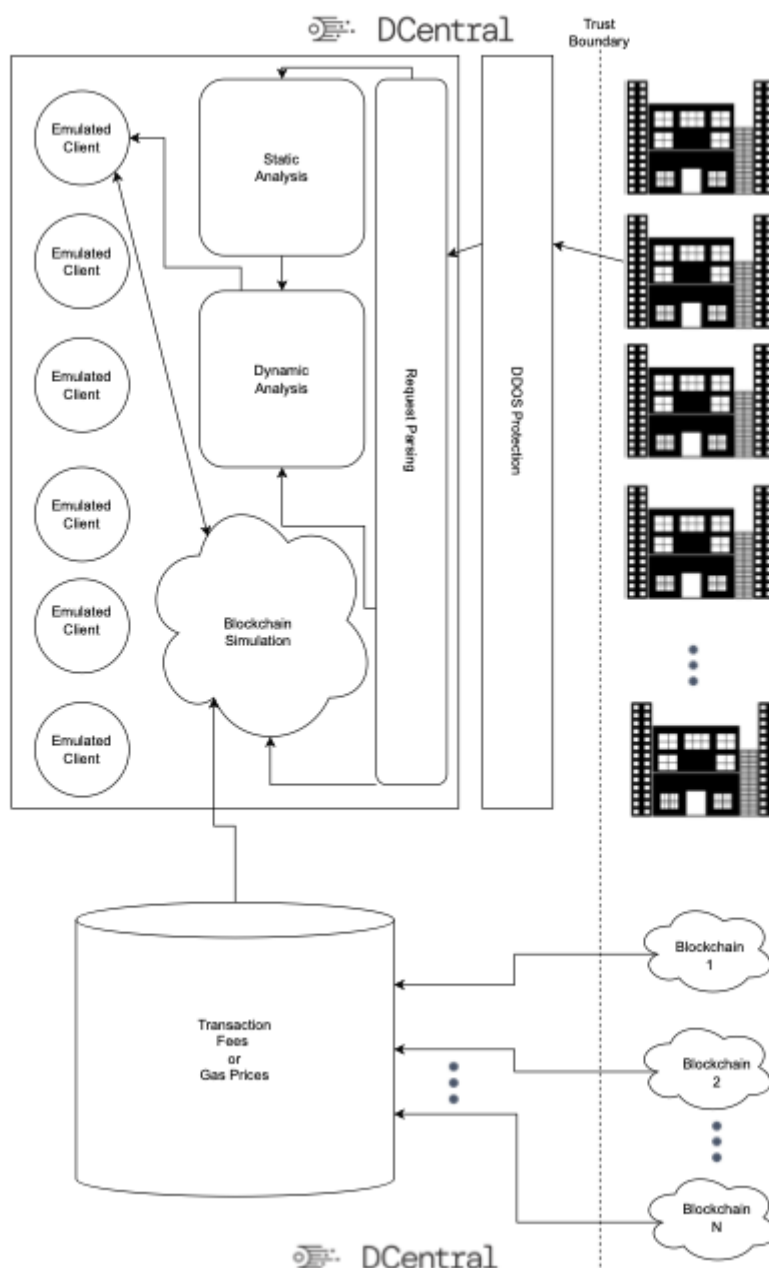
In terms of deliverables, in this work package we have delivered the D4.1: The Characterization of Research Infrastructure, D4.2 : The Industry Affiliation Model and D4.3 : Knowledge Transfer Plan, in April 2022.

The BIG ERA Chair team has been actively seeking out stakeholders and potential users for our Living Lab infrastructure. Throughout the past 5 months the BIG ERA Chair team has been discussing use cases for the living lab with established companies, think tanks, and the entrepreneur community to design a Living Lab that fits their needs, and the needs of the Portuguese Blockchain community at large.

On February 15th, 2022, the BIG ERA Chair and one other member of the BIG ERA Chair team met with the President of Instituto New Economy, a think tank focused on Blockchain for public good. The

meeting occurred at the restaurant *Sem Vergonha* in Lisbon. The purpose of this meeting was to discuss what functionality was required from the BIG ERA Chair's Living Lab to maximally fit the needs for the Blockchain community. Using the knowledge gained by his experience working with members of the Portuguese Blockchain community, the representative of Instituto New Economy provided us a list of open problems that the community did not have time or resources to solve. Among these open problems was a platform for testing smart contract security.

Also on February 15th, 2022, in the morning, the BIG ERA Chair met with a representative from Anchorage Digital, a digital assets bank in her office at Instituto Superior Técnico. During this meeting the BIG ERA Chair discussed with the representative open problems that Anchorage faced that could be resolved with open infrastructure hosted, maintained, and made available by the BIG ERA Chair team at Instituto Superior Técnico. Among the problems mentioned was the accurate estimation of gas fees for smart contracts.

Based on the insight gained at the above-mentioned meetings the BIG ERA Chair team designed a first draft architecture that addresses Smart Contract security through automatic static, dynamic, and concolic analysis, as well as estimates the gas fees for a given submitted smart contract. Throughout the month of March the BIG ERA Chair team also met virtually via ZOOM with representatives from Zharta, a Portuguese company that provides loans using NFTs as collateral. During our discussions with Zharta, among other topics, we discussed the BIG ERA Chair team's plans for the living lab. Zharta's representatives confirmed that this would indeed be useful.

To solicit further feedback on the Living Lab design, as well as to include opinions from larger amounts of smaller Blockchain organisations and smaller startup companies, members of the BIG

ERA Chair attended a Blockchain meetup in Lisbon on the 1st of April, 2022. There the team spoke with representatives from three smaller Blockchain related organisations, two Decentralised

Autonomous Organisations (DAOs) and one Non-fungible Token (NFT) and Cryptocurrency based startup (which was scheduled to soon launch a DAO). After describing the architecture to these representatives, the BIG ERA Chair team was met with overwhelmingly positive feedback from these smaller organisations, who stated that they do not have the time, infrastructure, knowledge, or labour to verify the security of their smart contracts. Thus, we are moving forward with this design.

In addition, the ERA Chair, with the ERA Chair team where possible, has had multiple discussions with the following as Commercial (Com), Academic (A), End-User Communities (EUC) and government partners (G) for *input* regarding what the Living Lab needs to provide to make it an exciting, dynamic and responsive infrastructure for the needs of Lisbon, Portugal and the European Commission - given the chance, this activity can provide a critical base for the European Community to create depth of insight into decentralised technologies that other countries can currently not yet match - our ambition is therefore to enable Portugal to leap-frog other nations in this regard. The next steps will be - as

discussed in the Research Infrastructure deliverable - to get buy-in for further developing the Living Lab with paying customers.

- Faculdade de Direito (AC) - Legal and organisational challenges for blockchain technology with regards to DAOs
- Nova University (AC) - Blockchain club
- Wharton University (AC) - Legal Implications of DAO technology
- WaterDAO (EUC) - start-up in the Gambia working on water infrastructure
- Combient Pure (EUC) - consortium of 34 companies across Scandinavia with 180 Billion Euros in revenue
- Zharta (Com)
- Anchorage (Com)
- Bank of International Settlements (G)
- Comissão do Mercado de Valores Mobiliários (Securities Commission in Portugal) (G)
- Ericsson (Com)
- Vodafone (Com)
- Swiss Federal Department of Foreign Affairs FDFA (G)
- Government Office for Science (GO Science) (G)
- FCDO SIN Network (G)
- Bank of International Settlements (BIS)
- Portuguese Blockchain Alliance (EUC)

Our next steps are to iterate our Living Lab architecture, with a view to launching it at the end of 2022 (late Q4).

WP5 – Communication, Dissemination and Exploitation

Objectives

This work package focuses on maximising the impact of the ERA Chair, and more generally that of BIG, at the regional, national and international levels, including activities for dissemination of knowledge, networking, and raising global awareness of the research and innovation potential and achievements in the scope of the project.

Task 5.1 Project Communication and Dissemination Plan

The Communication and Dissemination Plan has been developed for the past 12 months and determines how the activities and outcomes of BIG should be disseminated. The staff will communicate and disseminate the project in close collaboration with Técnico's communication team, ITI/LARSyS and INESC-ID.

The approval of the project was communicated in the national media: https://www.dnoticias.pt/pais/investigadores-do-tecnico-conquistam-25-milhoes-de-euros-para-projecto-que-combina-tecnologias-digitais-com-os-grandes-desafios-societais-ED6027134

Master students working on Blockchain-related topics

- Trustable blockchain interoperability: incentivizing public escrow parties, by Catarina Pedreira. Supervisor: Miguel Matos (2021)
- Correct Smart Contract Speculation By Design, by Leonor Loureiro. Supervisor: Miguel Matos (2021)
- TBO: Total Byzantine Order - Scalable epidemic probabilistic total order resilient to Byzantine faults, by Nuno Anselmo. Supervisor: Miguel Matos (2021)
- Building More Decentralized Blockchains Using Secure Virtual Coordinates, by Marco Filipe Guerreiro da Silva. Supervisor: Rodrigo Rodrigues (2021)
- SCALEET: A Scalable and Performant Permissionless Blockchain, by João Paulo da Costa Campos. Supervisor: Rodrigo Rodrigues (2021)
- Separating Agreement from Execution to Improve the Scalability of Blockchains, by Diogo Peres Monteiro de Faria Fernandes. Supervisor: Rodrigo Rodrigues (2021)
- Using Randomized Byzantine Consensus to Improve Blockchain Resilience under Attack, by Afonso Garcia Louro do Nascimento e Oliveira. Supervisor: Rodrigo Rodrigues (2021)
- CryptoCities - tokenising the city, by João Duarte. Supervisors: Nuno J. Nunes and Catherine Mulligan 2021, (ongoing)

- AI Energy Sensor interface for Google Home/Assistant, by Francisco Fialho. Supervisor:Nuno J. Nunes, 2021 (ongoing)

- Tiago Silva, Blockchain and Digital Tools for Inclusion, Supervisor: Valentina Nisi with Catherine Mulligan

- Catarina Ribeiro, Decentralised Technologies and Small Farmers services, Supervisor: Valentina Nisi with Catherine Mulligan

- Sistema de Gestão Blockchain de Comunidades de Energia, by João Dinis. Supervisor: Nuno J. Nunes, 2021 (ongoing)

- Federated AI in Financial Services, by Francisco Santos. Supervisors: Nuno J. Nunes and Catherine Mulligan, 2021 (ongoing)

- Cryptocurrencies and the environmental future of finance, by Sara Sol. Supervisors: Nuno J. Nunes and Catherine Mulligan, 2021 (ongoing)

- Visualising the Decentralised Finance (DeFi and Cryptocurrencies) World, by Ricardo Gueifão. Supervisors: Nuno J. Nunes and Catherine Mulligan, 2021 (ongoing)

- Blockchain-Based Decentralised Autonomous Organisations, by Félix Saraiva. Supervisor: Miguel Pupo Correia, 2021 (ongoing)

- Scalable Multi-Blockchain, by João Pedro Martins. Supervisor: Miguel Pupo Correia, 2021 (ongoing)

- Blockchain Forensic Analytics, by André Martinez. Supervisor: Miguel Pupo Correia, 2021 (ongoing)

- Blockchain replication, by José Miranda. Supervisor: Miguel Pupo Correia, 2021 (ongoing)

PhD students working on Blockchain-related topics

- Blockchain Interoperability, by Rafael Belchior. Supervisor: Miguel Pupo Correia (ongoing)

- Trusted Execution Environment Migration, by Daniel Andrade. Supervisor: Miguel Pupo Correia (ongoing)

- A fault model for data centers, by Daniel Porto. Supervisor: Rodrigo Rodrigues (ongoing)

- Scalable and Resilient Byzantine Fault Tolerant Consensus, by Ray Neiheiser. Supervisors: Miguel Matos and Carlos Montez (2022)

- Efficiency and security in permissionless blockchains, by João Martinho. Supervisor: Miguel Matos (ongoing)

- Blockchain sharding, by Francisco Rola. Supervisor: Miguel Matos (ongoing)

- Consistency and correctness guarantees in permissionless blockchains, by Paulo Silva. Supervisor: Miguel Matos (ongoing)

Funded projects

- Bauhaus of the Seas Sails:

- **Qualichain**: Decentralised Qualifications' Verification and Management for Learner Empowerment, Education, Reengineering and Public Sector Transformation (EU H2020 grant agreement No 822404.), Total funding: 400K€. INESC-ID funding: 469K€. PI: Miguel Correia

  QualiChain targets the creation, piloting and evaluation of a decentralised platform for storing, sharing and verifying education and employment qualifications and focuses on the assessment of the potential of blockchain technology, algorithmic techniques and computational intelligence for disrupting the domain of public education, as well as its interfaces with private education, the labour market, public sector administrative procedures and the wider socio-economic developments. The project focuses more specifically on the assessment of the implications (technical, political, socio- economic, legal and cultural) as well as the impact - in terms of benefits and risks - of the prescribed solution's utilisation, whose disruptive potential lies both in the exploitation of the innovative features of the aforementioned individual technologies, as well as in their unique combination in a new territory for the provision of a set of baseline services (Awards'/ Qualifications' Archiving; Awards'/ Qualifications' Verification; Qualifications' Portfolio Management) and a number of value- adding services (Career Counselling and Intelligent Profiling and Competency Management including Recruitment; Competencies' Evaluation and Development; Consulting and Decision Support). The proposed solution will be piloted through four representative scenarios, including: (i) cross-university degree equivalence verification; (ii) smart curriculum design; (iii) staffing the public sector; (iv) providing HR consultancy and competency management services.

- **LOGACULTURE**: Locative Games for Cultural Heritage, ITI/LARSyS, Consortium: U. Southampton, Bournemouth U., Trinity College, CMFunchal, IPNatureza, National Trust, Total Funding 3m€, ITI/LARSYS 604K€, PI: Valentina Nisi, co-PI Nuno Nunes (HORIZON-CL2-2022-HERITAGE-01-09)

  Locative Games are in the process of entering the mainstream, in cultural heritage they can improve access by offering alternative experiences and widening audiences, they can aid in preservation by managing footfall and focusing digital assets, and they can increase engagement and allow visitors to see their heritage in new ways. However, existing design approaches and infrastructures for locative heritage are bespoke and poorly integrated with existing visitor structures. There is also a lack of guidelines on what is ethically desirable in these digitally mediated spaces, and how designers might mitigate against unintended consequences or abuses. This is a barrier to the widespread adoption of locative heritage applications and means that more complex experiences are currently not sustainable in the

wider sector. LoGaCulture will change this by bringing together the leaders in digital locative games, in collaboration with some of Europe's most significant cultural institutions, to enable a new generation of locative cultural heritage games through proposals for design guidance, validated ethical frameworks, and an open, extensible, and reusable set of technologies. Through a set of five interlinked case studies across four countries the project will: gather evidence from the heritage design space for interactivity, narratives, and play; look at how augmented reality and soundscapes can affect visitors' immersion; explore the place of locative heritage in the wider visitor journey through transmedia and social visiting; and explore how the barrier to authoring and deploying such systems might be lowered. The goal is to create a step change in knowledge in how to design, deploy, and maintain locative heritage games, and lay the groundwork for their mass adoption by cultural institutions by allowing them to treat locative experiences that offer new forms of access and engagement as an integrated part of their existing cultural heritage work.

- **eGamesLab**: A Game Changer, Budget: 50m€, ITI/LARSyS 5.5m€. PRR - Agendas Mobilizadoras, PI: Pedro Campos, co-PIs: Nuno Nunes, Valentina Nisi, Hugo Nicolau, Augusto Esteves

   The eGames Lab is a unique egames development and creative industries cluster in Portugal, bringing together 14 companies, R&D centres and public & private entities in order to leverage the competitiveness of the sector and positioning itself globally. The eGames Lab is a national cluster established in Portugal (Madeira, Azores, Lisbon, and Évora) with close ties and cooperation with Carnegie-Mellon University in Pittsburgh (USA), and AmazonWebServices (AWS) GameTech in London (UK) as well as with industry players and consultants from games hub in Copenhagen (Denmark). The consortium has formal support from major industry leaders, such as Sony Playstation, Dell's Alienware and Singapore's EnjinStarter Launchpad. The consortium will also work with the prestigious University of Canterbury (New Zealand) and the famous HitLab (one of the best Virtual Reality in the world labs).

- **DCitizens**: Fostering Digital Civics Research and Innovation in Lisbon, Consortium: ITI/LARSyS, IIT, U. Siegen, U. Northumbria, Budget. 1,430k€, ITI/LARSyS, 552K€, PI: Hugo Nicolau, co-PIs: Nuno Nunes, Valentina Nisi

   While governments act as transactional providers of uniform and static services, the challenges of contemporary society require different models of service design and delivery that are built on long-term engagement, participation, and co-creation with local communities and citizens. Digital Civics posits the use of technology in the provision of relational models of public services by empowering citizens and non-state actors to co- create, take an active role in shaping agendas, making decisions about service provision, and making such provisions sustainable and

resilient. DCitizens builds on those principles to achieve 5 main objectives: O1) Enhance ITI research profile and innovation competence in Digital Civics; O2) Provide training to Staff and Early Stage Researchers to build critical mass at the interface of research, local government, and the private/third sectors; O3) Establish a leading pole of excellence in Digital Civics; O4) Strengthen and expand the collaborative network between the Twinning partners; and O5) Establish a Digital Civics Research and Innovation Agenda in line with the SMART Specialization Strategy for Lisbon. We identified four interconnected Strategic Areas in Digital Civics to be strengthened with the Twinning partners' support that provide solid ground to establish the methodology and action plan to reach these objectives. The Strategic Areas are: 1) Community-based Research Methods, 2) Emerging Technologies, 3) Design Justice, and 4) Civics, Policy, and Economic Models. Based on these areas, the project's work plan includes a staff-exchange programme, organisation of joint scientific/training events, activities to enhance the profile of young researchers, training of research management staff, and a small citizen-led research project. The consortium includes partners from one widening country (ITI - Portugal), and three leading institutions in the field: IIT (Italy), University of Siegen (Germany), and University of Northumbria (UK).

- **BoSS**: Bauhaus of the Seas Sails, Consortium: ITI/LARSyS, Magellan, TBA21–Academy, Ca' Foscari University of Venice, University of Malmø, Genoa Municipality, Het Nieuwe Instituut, Delft University of Technology, Marine Education Center / Naturum Öresund, North Adriatic Sea Port Authority, Venice Municipality, IUAV University, Fondazione Istituto Italiano di Tecnologia, Gulbenkian Foundation, Oeiras Municipality, Lisbon Municipality, EGTS Linieland van Waas en Hulst, The New Institute, Budget. 5m€, ITI/LARSyS, 609,875K€, PI: Nuno Nunes, co-PIs: Mariana Pestana, Paulo Ferrão.

The vision of the BoSS project is to demonstrate and archive solutions for climate neutrality with a particular focus on coastal cities as an interface to healthy seas, ocean and water bodies envisioning a new triangle of sustainability, inclusion, and design focused on the most important global natural space. The BoS will offer opportunities to engage with communities for an environmentally sustainable, socially fair, and aesthetically appealing transition. Seven lighthouse demonstrators, located in four different regions and aquatic ecosystems in Portugal (estuary), Italy (lagoon and gulf), Sweden/Germany (strait / north sea / river), and the Netherlands/Belgium (delta) will showcase the transformational and uptake impact at the EU level serving as lighthouse pilots for the implementation of Horizon Europe mission objectives and showcase innovative solutions. The seven pilots will all provide tangible examples of mission-oriented approaches that are impactful, measurable, and targeted. The action plan includes the deployment of "drops" in all pilots designed to generate "ripple" effects at the local (demonstrator) level but then also at the city/region levels (demonstrating effects of scale) and

at a broader level (demonstrating the replication. The BoSS, therefore, introduces an ecocentric narrative both cosmopolitan and rooted in nature-based solutions, plural, and testimonial, proposing to apply a design approach to complex socio- technical-ecological and more-than-anthropocentric problems. An agenda that moves from fixing to caring, from growth to nurture, from certainty to contingency, will enable designers, architects, and engineers to think about assemblages instead of systems and change the outcome from extinction to precarious flourishing. The design of these interactions generates the emergence of new aesthetics and, most decisively, a critical awareness of the history, contemporary, and future: designing beyond humans as a way to sustain our future.

Projects not funded

- **TRUSTyFOOD**: Stakeholders-driven pathways for blockchain implementation in the agri-food sector, Consortium: Tecnoalimenti, Ethniko, Fraunhofer, U. Koblenz, INESC-ID, Stitching, Udruga, Compellio, OMDA, Budget: 3m€, INESC-ID: 321K€, PI: Miguel Correia

  13 participants from 7 EU and 1 third countries join forces for supporting the Strategic Research Agenda of the future joint research program on the subject of Blockchain by sheding light on the current partial and fragmented picture of BCT applications in the agri- food domain and by clarifying the benefits and opportunities which BCT can concretely to stakeholders throughout the food chain offer. The project intends to prepare the way for R&I activities for the decade to come, basing its assumptions on systematic monitoring and reviews of national, European and international R&I pilots/use cases, experiences and best practices and on consolidated and balanced stakeholder views. The active involvement of users is required from the very beginning for the identification of needs and use cases, which will be subsequently translated into operational requirements for services. The goal of the proposal is to understand why communities, i.e. users, accept/reject blockchain-based projects, the mistakes done by others for not repeating them, the best and innovative practices in blockchain development in agri-food sector (considering its complexity) for arriving to shape different possible futures for BC application. The project will investigate and discuss both technical aspects as well as non-technical barriers to BCTs deployment, but also other issues fostering BCTs deployment, such as interoperability, innovative business models, standardisation and regulatory issues and will be at the base of White Papers addressed to EC. At the same time, the proposal intends to provide to users some a framework of services (and guidelines) for empowering them in future BC technology implementation.

- **CULTURECHAIN**: Cultural BlockChain and Artificial Intelligence for the Protection and Preservation of Digital Cultural Heritag, Consortium: IIT, ITI/LARSyS, EY, U. Surrey, Noho,

ECCOM, KEA, Withers LLP, Artivite, Muzej, IMVF, Total Funding 4m€, ITI/LARyS budget: 626K€, PI: Valentina Nisi, co-PI Nuno Nunes (Call: HORIZON-CL2-2021-HERITAGE-01)

CULTURE CHAIN promotes the preservation of digital tangible and intangible cultural heritage by providing tools for the re-use of assets enabling traceability, acknowledgement, licensing, endorsement, and access. The driving principle of the project is to co-design with relevant stakeholders groundbreaking BlockChain (BC) and Artificial Intelligence (AI) technology that protect CH digital assets, while being invisible to the users, with the aim to safely ease and democratise access to culture. To bring technology tailored to the stakeholders, the project implements new actions for user-centered design to: understand the NEEDS of artists and creators, and co-design interfaces to suit their needs; DEVELOP the audience through participation strategies; during and after the current pandemic crisis. The fruition of this will be achieved through novel ICT tools to handle ACKnowledgment through (semi-) automatic referencing methods by identifying where and how a piece has been influenced or derived from prior art; PROTECT using Blockchain and embed Non-Fungible Tokens (NFT) support by a Knowledge Graph to handle authenticity, the endorsement of use and the remuneration; ACCESS to create a general-purpose platform for smooth deployment of content using polyvocal storytelling, AR and VR visualization of digital CH and Art. CULTURE CHAIN will be deployed and demonstrated on three pilots with unique stakeholders and case studies. First, a community of AR Artists, which need greater safe access to digital content and new methods for remuneration. Secondly, managing digital exhibitions in small-medium size museums promoting the re-use of digital assets across Europe with a limited budget. Finally, CULTURE CHAIN will expose polyvocal stories of the inhabitants of Lisbon intermixing tangible and intangible heritage and assets of the locals into guided tours through the city.

- **LEAPCULTURE**: Locative Engagement, Access, and Preservation of Cultural Heritage, Consortium: U. Southampton, Bournemouth U., ITI/LARSyS, Trinity College, CMFunchal, IPNatureza, National Trust, Total Funding 3,5m€, ITI/LARSYS 604K€, PI: Valentina Nisi, co-PI Nuno Nunes (HORIZON-CL2-2021-HERITAGE-01)

Locative Narratives and Games are in the process of entering the mainstream, in cultural heritage they can improve access by offering alternative experiences and widening audiences, they can aid in preservation by managing footfall and focusing digital assets, and they can increase engagement and allow visitors to see their heritage in new ways. However, existing design approaches and infrastructures for locative heritage are bespoke and poorly integrated with existing visitor structures. There is also a lack of guidelines on what is ethically desirable in these digitally mediated spaces, and how designers might mitigate against unintended consequences or abuses. This is a barrier to the widespread adoption of locative heritage applications and means that more complex experiences are currently not sustainable in the

wider sector. LEAPCulture will change this by bringing together the leaders in digital locative experiences, in collaboration with some of Europe's most significant cultural institutions, to enable a new generation of locative cultural heritage applications through widely drawn design guidance, validated ethical frameworks, and an open, extensible, and reusable set of technologies. Through a set of five interlinked case studies across four countries the project will: explore the heritage design space for interactivity, narratives, and play; look at how augmented reality and soundscapes can affect visitors' immersion; explore the place of locative heritage in the wider visitor journey through transmedia and social visiting; and explore how the barrier to authoring and deploying such systems might be lowered. The goal is to create a step change in knowledge in how to design, deploy, and maintain locative heritage applications, and lay the groundwork for their mass adoption by cultural institutions by allowing them to treat locative experiences that offer new forms of access and engagement as an integrated part of their existing cultural heritage work.

- **PROSPER-CO**: Proactive Self-aware Personal Companions for Sustainable Quality of Life, Consortium: U. Lodzka, Charlmers U, ITI/LARSyS, U. Utrecht, UCL, Total funding; 3,53m€, ITI/LARSyS; 579K€, PI: Nuno Nunes, co-PI: Valentina Nisi (HORIZON-EIC-2021-PATHFINDERCHALLENGES-01-01)

While the technical perspective of artificial consciousness is approaching, we still do not understand what benefits such systems could offer to human society. This project proposes to leverage the potential of artificial consciousness to improve everyday quality of life. We propose the concept of extended consciousness. Extended consciousness gives users the ability to delegate parts of their daily experiences to proactive self- aware companions. Such companions are services which can help us make decisions in everyday life based on extended consciousness. We will research and demonstrate how artificial consciousness applications can address such needs within three areas of use: health, sustainability, and work. We will design and implement prototypes for each of these and conduct studies to understand what makes users perceive them as conscious and how best to effectively interact with them. The findings arising from our user studies will inform the development of an interaction framework together with engineering toolkits which can be used to facilitate the creation of future self-aware systems. Our project PROSPER-CO will contribute to new concepts of consciousness by studying the theoretical and empirical foundation of extended consciousness and showing its applicability in an interaction framework. The aim of the project is to demonstrate the added value of awareness inside by showing benefits in user experience and quality of life across three application areas. The main contribution is an integrative approach to awareness engineering through developing theoretical frameworks, algorithms, and software tools which will form a

foundation for future systems. We will also investigate the range of social and ethical aspects of self-aware systems.

- **DRAIS** - Designing Responsible Human-Centred AI Systems, PI: Augusto Esteves. COST Action - OC-2021-1-25513.

Computing is impacting everyday live. Work environments are complex pervasive computing systems. Mobile computing technologies are intertwined with our personal lives. Communication and entertainment is computer mediated. We expect that over the next decade many of these computing systems, that are ubiquitous in our lives, are engineered to become intelligent systems. With artificial intelligence (Al) and machine learning we can add new qualities to computing systems, bringing benefits to the individual as well as to our society as a whole. With advances in machine learning (ML) systems can perceive their environment (e.g. computer vision for vehicles) and make decisions. There is a growing understanding of the potential benefits and risks of this type of technology. Expected advantages of using Al is to create systems that can perform tasks and actions with little human involving, making systems easier to use, more efficient, and requiring less attention. In our project we investigate how to put the human at the centered of the development of intelligent systems. They key aspect is to understand and develop processes and tools for designing and developing responsible human centered Al system. Methodologies, techniques, and tools, able to support system designers to build responsible human-centered Al, are still lacking. The main goal of this proposal is to create a group of discussions in Europe, to advance the field of Human-Centered Al by promoting research that can overcome the current lacks.

- **BauMar ERAChair**: aligning the research and innovation potential of Técnico with the New European Bauhaus through the Bauhaus of the Seas, ITI/LARSyS, Budget; 2,5m€, PI: Nuno Nunes (HORIZON-WIDERA-2022-TALENTS-01)

The "New European Bauhaus" (NEB) aims at raising a movement towards implementing the Green Deal based on sustainability, social inclusion, and beauty. This means realising regenerative approaches inspired by nature that enrich our experiences through creativity, art, and culture, embracing diversity to promote inclusive, accessible spaces where the dialogue between diverse cultures, disciplines, genders, ethnicities, and ages becomes an opportunity to imagine a better future for all. The climate crisis is a global, complex hyperobject emerging from human exceptionalism of generations schooled in the dichotomy of humans vs nature. Only an interdisciplinary, movement that addresses the sheer complexity and scale of the problem will allow us to enact meaningful change. In response to this challenge, through the Bauhaus of the Seas, Técnico – Lisbon is leading a NEB mobilisation around the most definitive global natural space and the most critical shared space in the EU and the world: seas, ocean and

water bodies and the coastal areas. The overall goal of this proposal is to seek funding in order to expand the research and innovation potential of Técnico – Lisbon contributing to foster the vision of the Bauhaus of the Seas through the hiring of an ERA Chair aiming at developing a critical mass of interdisciplinary research in deploying and testing solutions that promote BauMar literally the "the sea as a space for creation and entrepreneurship". The BauMar ERA Chair aims at unlocking the full potential of interdisciplinary research in the leading engineering and architecture school of Portugal, while strengthening innovation and knowledge transfer activities in close collaboration with local and global industrial partners and contributing to the smart specialization strategy of the Lisbon Region in stimulating the uptake of the NEB towards implementing the Green Deal based on the triangle of sustainability, social inclusion and beauty.

- **3D CULT**. Design and Digital manufacturing for the Diffused mediterranean CULTural heritage, Consortium: U. Sapienza, ECCOM, Laba, Noho, ITI/LARSyS, U. Cat. Valparadiso, D6 Culture EU, KRITI, Budget: 2.98m€, ITI/LARSyS: 260K€, PI: Valentina Nisi, co-PI: Nuno Nunes (HORIZON-CL2-2022-HERITAGE-01-02)

The combination of creativity, art, design and technology offers enormous possibilities for the discovery, representation and interpretation of heritage. New technologies have greatly enhanced the different ways of accessing and experiencing cultural heritage: the user is no longer a passive subject, but rather interacts with technology to discover and construct meanings through numerous sensory and cognitive modalities. 3D CULT seeks to explore the potential of 3D printing, combined with rapidly growing innovative technologies, arts and creativity, to contribute to the preservation, reproduction, promotion and creative re-interpretation of European cultural heritage (CH) and values, as well as a deeper comprehension of the environmental risks threatening cultural and natural heritage and of the possible solutions to mitigate them. Bringing together partners from technological, social and cultural sectors, the project aims at engaging creatives and artists, together with technology - savvy partners, in the production of new scenarios, ideas and concepts through Rapid Manufacturing models and prototypes, including 3D printing technologies. The concepts will be inspired around five sites of natural and cultural relevance situated along the coast of the Mediterranean, in an endangered status due to lack of preservation and climate change-related issues. In a second stage, the Rapid Manufactured models resulting from the artists and creatives participation will be re-interpreted in connection with local communities through the use of digital technologies such as Digital storytelling, Augmented and Extended realities. This re-interpretation of the models will result in new artworks connecting the sites and communities that live closely in and with it, extending the reach of CH and providing new meanings and critical points of view of the legacy that such sites stand for.

- **GLAMURE** - A Glocal, IncLusive, DigitAl ecosysteM for the crafts of the fUtuRE, Budget: 3,26K€, ITI/LARSyS: 321K€, Consortium: U. Torino, U. Roma, ITI/LARSyS, Martel, Masterbuga, Fratelli Piacenza, Megla Rozsa, Earthster, IADA, ACROSSLIMITS, FINCONS, PI: Valentina Nisi, co-PI: Nuno Nunes (HORIZON-CL2-2022-HERITAGE-01-04)

Local artisans and SMEs are valued as they keep alive their heritage know-how, inscribe manufacturing in our history and our culture, and involve a human dimension in products. It is then important to protect and enhance local production and craftsmanship by empowering people with making and permitting emerging ideas to become real and valuable for the market. These goals underline some challenges: - How will local designers and manufacturers manage contributions in co-production environments? - will work environments deal with environmental-related and process sustainability issues? - How will traditional craftsmanship, part of European and Global heritage and cultural identity be preserved and revived for future markets? - How will artisans and SME's of the future compete with major digital platforms, able to turn data and interaction from users into trends ? - How will local production raise awareness to obtain impact at the global level? GLAMURE aims to face these challenges with the creation of an ecosystem where a community of artisans, designers, entrepreneurs, researchers work together mediated by an innovative, highly integrated AI-driven platform comprising an inspirational component, to foster creative thought, a sustainable processes component, to make production processes in line with sustainability and green manufacturing, a co-working space, that is, an environment to e-meet collaborators where each contributor to a project is formally acknowledged, a glocal marketplace, i.e., a global window to showcase local heritage-based crafts, and an inclusive e-learning space to support anyone interested in preservation and enhancement of heritage crafts and techniques. GLAMURE will validate results by means of two pilots in two domains, Textile/Fashion and Food, with a perspective, from the scientific and technological point of view as well the economical and societal directions, of future upscaling in other fields.

- ECOMIND: Support Solutions and Digital Tools with Eco-Accounting for Sustainable Manufacturing Industry, Total funding: 4,998,997€, INESC-ID funding: 571,375€
- Descentralizar Portugal com Blockchain, Projetos mobilizadores de agendas de inovação (PRR), Total funding: 72 907 241 €.

Task 5.2: Newsletters, Website and social media

BIG's website was launched in October 2020. Since its creation and until August 2022   , the website has received 4725 visits (Figure 5). BIG's website gives its visitors an overview of the project objectives,

its team and organisation, and the workplan. There are also two sections that target the recruitment calls and media & Events.
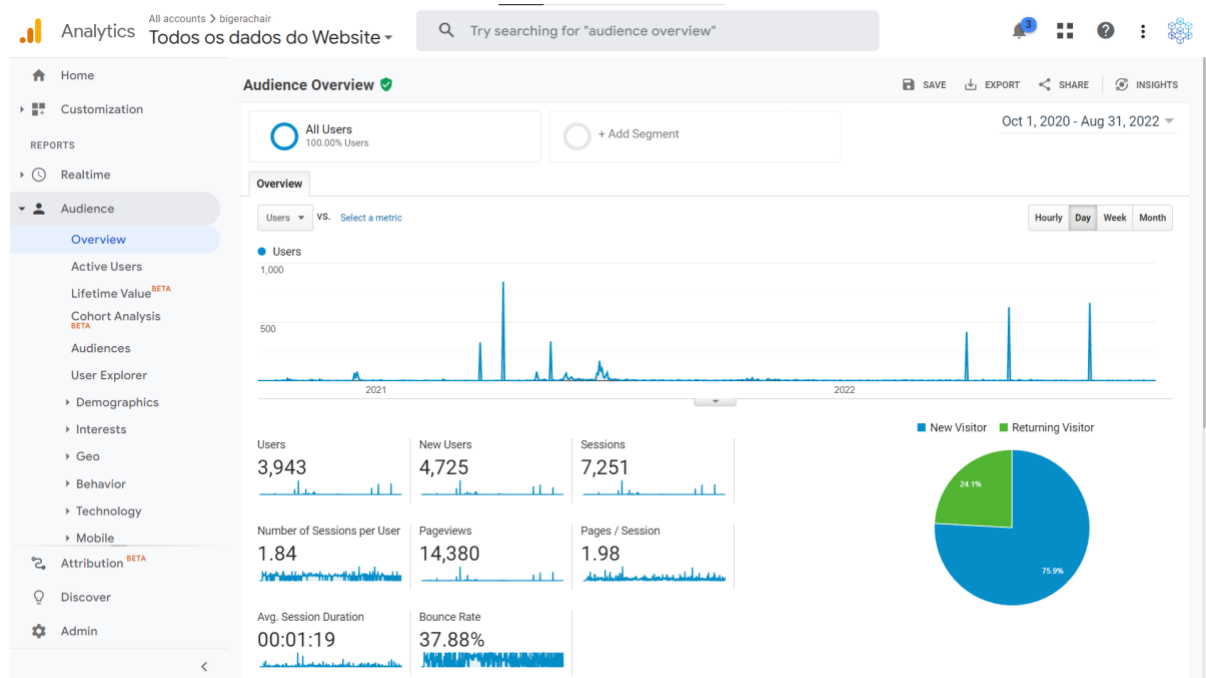

Figure 5. Statistics from https://bigerachair.tecnico.ulisboa.pt/

Regarding social media, we created an Instagram (*@big_tecnico)* and a Twitter (*@big_tecnico)* account for the project. We chose these two social media because Instagram is one of the most popular social networks and engages with a wider non-technical audience. On the other hand, the Twitter (*@big_tecnico)* public is middle aged and tends to have more literacy than in other social media which makes it an excellent resource to promote our research.

BIG's Instagram account was created in April 2021 and had 62 followers.

The more recent Twitter account was created in July 2021, and we already count with 21 followers.

Task 5.3 Participation in Workshops and Conferences

Prof. Catherine Mulligan:

- European Regions Summit for Smart Communities, 3rd-9th May 2021
- Data for Policy: https://dataforpolicy.org/ (UCL/Cambridge)
- IEEE ICTE, 2021
- Robert Bosch Stiftung Fellows - Workshops and Conferences 2021 (6)
- Institute of Directors "Sustainability Greenwashing Roundtable", 2021
- CreaTech Workshop, 2021
- IORMA Roundtable, 1st July 2021

- WEF Pathways to Digital Justice Workshops (4)
- D4A Pulse Blockchain Education Workshop
- IET / ONS - Measuring the Digital Economy Workshop 23rd June 2021
- IET Digital Panel Meetings - 22 June 2021
- Ascend 2021, 7th July 2021
- Extension of ICT Verticals and Horizontals for Blockchain Standardisation (3)
- MEMEX 2 Brainstorming workshop
- PepsiCo Virtual Roundtable - Women in Technology 13th May
- Global Blockchain Business Council, 5th May

6. List of Deliverables

Deliverables			
WP No.	Del. No	Title	Status
WP1	D1	Minutes of Kick-off meeting	Submitted, accepted
WP1	D2	Quality Plan	Submitted, in revision
WP1	D3	Data Management Plan	Submitted, in revision
WP1	D4	Annual Report 1	Submitted, in revision
WP1	D5	Annual Report 2	in Submission
WP1	D6	Annual Report 3	Pending
WP1	D7	Annual Report 4	Pending
WP1	D8	Publications in high impact journals in the relevant research fields before the start date of the project	Submitted, accepted
WP2	D9	Contract of ERA Chair holder	Submitted, in revision
WP2	D10	Contracts of ERA Chair Team	in Submission
WP3	D11	Organisation of Horizon 2020 training events v1	Submitted, in revision
WP3	D12	Organisation of Horizon 2020 training events v2	in Submission
WP3	D13	Researcher Exchange Reports	Pending
WP3	D14	Strategic plan for long lasting collaborations	Pending
WP3	D15	Open Research Data Pilot	Pending
WP4	D16	Characterisation of Research Infrastructure	Submitted, in revision
WP4	D17	Industry Affiliation Model	Submitted, in revision
WP4	D18	Knowledge Transfer Plan	Submitted, in revision
WP4	D19	Report on Knowledge Transfer and the Industry Affiliates 1	Pending
WP4	D20	Report on Knowledge Transfer and the Industry Affiliates 2	Pending
WP5	D21	Communication & Dissemination Plan – v1	Submitted, in revision
WP5	D22	Communication & Dissemination Plan – v2	Pending
WP5	D23	Knowledge Management System	Pending
WP6	D24	Report of the Independent Evaluation Panel	Pending

7. List of Publications

Academic Publications

- Sabrina Scuri, Marta Ferreira, Nuno Jardim Nunes, Valentina Nisi, and Cathy Mulligan. 2022. Hitting the Triple Bottom Line: Widening the HCI Approach to Sustainability. In Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems (CHI '22). Association for Computing Machinery, New York, NY, USA, Article 332, 1–19. https://doi.org/10.1145/3491102.3517518

- Afonso Oliveira, Henrique Moniz, Rodrigo Rodrigues: Alea-BFT: Practical Asynchronous Byzantine Fault Tolerance. CoRR abs/2202.02071 (2022)

- Mulligan, C., Elaluf-Calderwood, S. 2021, AI ethics: A framework for measuring embodied carbon in AI systems. *AI Ethics* (2021). https://doi.org/10.1007/s43681-021-00071-2

- Mulligan, C., Kelly, F., 2021, Digital Entrepreneurship: Ensuring True Compliance with Sustainable Development Goals (SDGs) – 2021 IEEE ICTE (accepted, upcoming August 2021) - Winner of the Best Presentation at IEEE ICTE 2021

- Mulligan, C., 2021, Data for Common Purpose Initiative, Data for Policy 2021, accepted & upcoming September 2021

- Rafael Belchior, Sérgio Guerreiro, André Vasconcelos, Miguel Correia. A Survey on Business Process View Integration: Past, Present, and Future Applications to Blockchain. Business Process Management Journal, Vol. 54, Issue 8, November 2022

- Rafael Belchior, André Vasconcelos, Sérgio Guerreiro, Miguel Correia. A Survey on Blockchain Interoperability: Past, Present, and Future Trends. ACM Computing Surveys, Vol. 54, Issue 8, November 2022

- Rafael Belchior, André Vasconcelos, Miguel Correia, Thomas Hardjono. Hermes: Fault-tolerant middleware for blockchain interoperability. Future Generation Computer Systems. Volume 129, Pages 236-251, April 2022.

- Sérgio Guerreiro, Diogo Silva, Tiago Rosado, André Vasconcelos, Miguel Correia, Pedro Sousa. Decentralized Business Process Control using Blockchain - An experience report from two applications: Food Supply Chain and Car Registration. Enterprise Modelling and Information Systems Architectures, Volume 15, 2020

- Mara Caldeira and Miguel Correia. Blockchain Address Transparency with DNS. In Proceedings of the 26th IEEE Symposium on Computers and Communications, September 2021

- Rafael Belchior, André Vasconcelos, Miguel Correia, Thomas Hardjono. Enabling Cross-Jurisdiction Digital Asset Transfer. In Proceedings of the 2021 IEEE International Conference on Services Computing, September 2021

- Kauri: Scalable BFT Consensus with Pipelined Tree-Based Dissemination and Aggregation. R. Neiheiser, M. Matos, and L. Rodrigues. Proceedings of the 28th ACM Symposium on Operating Systems Principles (SOSP), Online, October, 2021.

Non-Academic Publications

- Mulligan, Cathy, 2021, Data-driven Economies: Foundations for Our Common Future, World Economic Forum White Paper

8. List of Public Presentations and Activities

- Bauhaus of the Seas Co-Design Event, Venice, 20-21 Sept. 2021, https://bauhaus-seas.eu/conference/venice-arsenale-20-21-sep-2021/. Main organizers: Tiziana Lippiello (Ca' Foscari University of Venice), Paola Mar (Municipality of Venice), Fabio Pittarello (Ca' Foscari University of Venice), Maria Del Valle Ojeda (Ca' Foscari University of Venice), Nuno Jardim Nunes (Técnico – ITI/LARSyS), Mariana Pestana (IST, U. Lisbon), Markus Reynman (TBA Academy).

- Nuno J. Nunes, Valentina Nisi, Pedro Campos, Create Funchal: Inovação, tecnologia e criatividade, Presentation of the eGames Lab PRR Agenda, 27 May 2022. https://create.funchal.pt

- Mulligan, C, 2021, September 8th 2021, Data for Policy Conference, Standard Track 2.C: Data Technologies and Analytics for Policy and Governance

- Digitalization at the Service of People and the Environment, Nuno Nunes, Bernhard Lenger, Frederike Manders, Hessel van Oorschot, Cultuur Eindhoven, 22 Sept. 2021, Chairs: Tanja Mlaker and Oscar Kocken

- Nuno J. Nunes, Redes Descentralizadas na Perspectiva Mediática da Cultura da Cidadania e Informação, XVI Semic Jovem, U. Fereral de Goias, Brasil, 24 August, 2022.

- Nuno J. Nunes, Valentina Nisi, Ecocentric Interaction: for the rebalance of the relationship between humans and nature, EIT Digital Summer School, Como, July 2022.

- Nuno J. Nunes, Interação Eco-centrica: o papel da tecnologia para (re)equilibrar os humanos e a natureza, Hub Internacional Sustentável, U. Campinas, Brasil, 8 Junho 2022.

- Nuno J. Nunes, The Bauhaus of the Seas Vision, Sonar+D and ART+S talk, Lisbon, 8 April 2022, https://sonarlisboa.pt/pt/2022/artists/sonar-d-nuno-nunes

- Nuno J. Nunes, Critical development of technologies of participatory culture, Cultuur Eindhoven, 22 Sept. 2021, https://www.cultuureindhoven.nl/blog/afsluiting-programma-creatieve-industrie-digitaal-samen-leven-22-september/

- Miguel Correia, Blockchain: O impacto dos NFT na economia e nas empresas, Técnico+ / Católica Lisbon webminar, March 9, 2022.

- Miguel Correia, From Intrusion Tolerance to Trust and Recovery: A Research Overview, Resilient Computing and Cybersecurity Center, KAUST, Dec. 2021

- Miguel Correia, Blockchain Cross-Borders: The European Blockchain Services Infrastructure, IEEE EMEA Blockchain Seminar, Sep. 8th 2021

- Miguel Correia, Digital Assets: How they work and can we trust them? Keynote at International Conference in Accounting and Finance Innovation, Aveiro, Portugal, July 1, 2021.

- Technological Dreams and Post-Petroleum Futures, James Auger, IST, 20 May 2022.

Prof. Mulligan has also become an Associate Editor for the first ACM journal for Blockchain (Distributed Ledger Technologies: Research and Practice), chief editors Raymond Choo and Mohammad Hammoudeh: https://dl.acm.org/journal/dlt/editorial-board

Subjects and short courses

- Human-Computer Interaction, 340 students - Nuno Nunes, Augusto Esteves, Hugo Nicolau

- Highly Dependable Systems, 126 students – Miguel Correia, Paolo Romano

- Human-Centered Design and Evaluation, 130 students – Valentina Nisi, Nuno Nunes

- Design Studio, 70 students – Hugo Nicolau, Valentina Nisi

- Service Design, 60 students – Valentina Nisi

- Blockchain e Smartcontracts (Técnico+ e Católica Lisbon) – Miguel Correia
    - 3rd edition - sep. 2021
    - 4th edition - mar. 2022
- Tech4Law - Technology Bootcamp for Layer (Técnico, Católica) - Miguel Correia
    - Blockchain session