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Co-designing for Resilience in Rural Development through Peer-to-peer Learning Networks and STEAM Place-based Learning Interventions

Authors: Anita McKeown, Lucy Hunt, James Murphy, Eleanor Turner and Rebecca White

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Rialtas na hÉireann
Government of Ireland

ENVIRONMENTAL PROTECTION AGENCY

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- the contained use and controlled release of Genetically Modified Organisms *(GMOs)*;
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- Office of Environmental Enforcement
- Office of Evidence and Assessment
- Office of Radiation Protection and Environmental Monitoring
- Office of Communications and Corporate Services

The EPA is assisted by an Advisory Committee of twelve members who meet regularly to discuss issues of concern and provide advice to the Board.

EPA RESEARCH PROGRAMME 2021–2030

Co-designing for Resilience in Rural Development through Peer-to-peer Learning Networks and STEAM Place-based Learning Interventions

(2017-SE-MS-6)

EPA Research Report

Prepared for the Environmental Protection Agency by

University College Dublin

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The EPA Research Programme addresses the need for research in Ireland to inform policymakers and other stakeholders on a range of questions in relation to environmental protection. These reports are intended as contributions to the necessary debate on the protection of the environment.

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Executive Summary

The climate crisis is the defining challenge of our time (DT, 2020). There is no easy answer: neither technology nor geoengineering will solve everything. The economy, social inclusion and environmental protection must be attended to as parts of an interdependent system. Effective messaging and models of practice that support all citizens to take action, rather than overwhelm citizens into inaction, will be key to effective behavioural change.

"Co-designing for Resilience in Rural Development through Peer-to-peer Learning Networks and STEAM Place-based Learning Interventions" (called CoDesRes in this report) was one of five EPA-funded projects exploring novel approaches to implementing the United Nations 17 Sustainable Development Goals (SDGs). The principal aim of this study was to transfer an existing culturally situated co-design placemaking methodology, the permaCultural resilience (pCr) praxis[1], to education and self-organised community contexts as an approach to localising the SDGs.

As a suite of tools, the pCr praxis reframes problems and imagines and works towards better solutions in a socially, economic and environmentally equitable way to effect changes in behaviours towards meeting the SDGs. CoDesRes embedded an interdisciplinary research team on the Iveragh Peninsula, south Kerry, Ireland, using a disruptive arts-led approach to encourage self-organisation to reimagine local possibilities and explore a "beyond-compliance" engagement with the SDGs through nine distinct actions:

1. seven proof-of-concept[2] interventions and step-by-step plans for community projects;
2. a series of formal and informal education interventions to localise the SDGs;
3. producing open-source SDG resources for educators and communities, available at www.codesres.ie/resources;
4. Caherdaniel River Restoration project natural and cultural heritage strategy and implementation plan and pilot project;
5. securing Muinín Catalyst legacy programme funding to build and trial the education SDG toolkit;
6. a successful Rural Regeneration Development Fund bid in partnership with Kerry County Council to develop "shovel-ready" feasibility for place-based STEAM (science, technology, engineering, the arts and mathematics) education and a placemaking research, development and innovation centre of excellence in Cahersiveen;
7. the development and transfer of the project's circular economy focus and co-design through the EPA-funded sister project MARplas, addressing marine plastic waste in coastal communities through innovation and local sustainable enterprise and continuing to contribute to six part-time employment positions and additional learning resources;
8. embedding an upskilled research team within the local context, with economic impacts demonstrated through employment positions and new professional collaborations;
9. establishing an educational development spin-out company, Future Focus21c.

Given the unpredictability of the global context and all this entails, collaborations that bridge field specificity and engage all abilities and knowledge available should be considered a necessary and logical response. Over the lifetime of the project, CoDesRes delivered 183 activities; had direct engagement with 4599 people (at an average cost of €36 per person); raised an additional €359,100 for post-funding legacy projects and €41,200 in-kind, which brought a total investment of €565,000 into the region; multiplied

1 A critical praxis integrates a process of action and reflection (self-reflection, reflective action and collective reflective action) that is applied to theory and practice to effect behavioural change.

2 A proof of concept is used to demonstrate feasibility, and the research considered how the pCr methodology would perform and how it could be developed for delivery on localising the SDGs and new ways of contributing to their targets.

the initial investment by approximately 2.25; and contributed to the employment of 10 people, eight of whom were local residents.

CoDesRes provides proof of concept for an approach to localising the SDGs[3] and investing in locally embedded interdisciplinary research teams to support building local capacity. The report recommends a national beta-testing programme of the educational resources in Transition Year to address the senior cycle's systemic deficits in education for sustainable development. It also recommends embedding trained teams within all local authorities' Creative Ireland teams, linked to localised quadruple helix (government, academic, industry and civil society) networks, focused on systemic approaches and capturing project data from the public participation networks to contribute to the National SDG Implementation Plan. The report concludes that culturally situated disruptive approaches, in combination with embedded expertise focused on local strategic actions, would be a cost-effective solution towards a Just Transition, not least in the face of Ireland's predicted fiscal penalties for climate inaction.

3 Owing to the constraints of the report format, journal papers, a book chapter and an online supplementary document (OSD) providing granular details of the project and its execution, evaluation and findings can be accessed at www.codesres.ie/publications (accessed 18 November 2021). The OSD is referenced, with relevant page references, throughout the report.

1 Introduction

In 2016, at the World Economic Forum at Davos, delegates discussed the United Nations 2030 Agenda for Sustainable Development (United Nations, 2016) and it was internationally recognised that it can no longer be "business as usual", given the projected 14 years remaining to achieve the transformative change necessary for the wellbeing of humankind (Møller, 2016). The global challenges we face demand alternative systemic approaches (Gawande, 2014), with a commitment to making equitable change at the local and global levels. This will require international top-level political collaboration and the collective effort of all actors at all levels. Developing a multi-stakeholder approach will be critical for Ireland to progress innovative systemic and generative[4] responses. Long-term actions will require cross-sectoral and consensus-dependent ownership and capacity (Møller, 2016).

In recognition of this, **CoDesRes – Co-Designing for Resilience in Rural Development through Peer-to-peer Learning Networks and STEAM Place-based Learning Interventions** – was supported under the EPA Strive project-based awards, Sustainability: Theme 4: Socio-Economic Aspects of a Sustainable Environment, novel methodologies for delivery on the Sustainable Development Goals (SDGs).

Ireland's national implementation plan for delivery on the SDGs (see Figure 1.1) was launched in April 2018 by Minister Denis Naughten, Department of Communication, Climate Action and Environment (DCCAE, 2018a). The national implementation plan focused on four strategic priorities: (1) raising awareness of the SDGs among the general public; (2) providing stakeholders with opportunities to engage with and contribute to national implementation of the SDGs; (3) supporting communities and organisations to make their own contributions towards achieving the SDGs; and (4) supporting the alignment of national policies with the SDGs.

Figure 1.1. The 17 Sustainable Development Goals. Source: https://www.un.org/sustainabledevelopment/news/communications-material/

4 Generative approaches set up foundations and build capacity for legacy and ongoing work or actions, whereas development is often a "one and done" approach.

The research proposed that rural areas have a crucial role to play in Ireland's delivery on the SDGs through their potential to alleviate many of the challenges cities are facing by developing viable alternatives to urban dwelling. We maintain that, as resources become scarce and the climate increasingly changes, it will be important to draw on the power and knowledge held within local communities to ensure the equitable sharing of benefits and resources, and access to basic infrastructure and services. Furthermore, civic engagement with the SDGs for those in rural areas could enhance their management of their own social, economic and environmental objectives.

To this end, CoDesRes explored the transferability of an existing arts-led critical praxis, the permaCultural resilience (pCr) praxis[5] (McKeown, 2015). A critical praxis integrates theory and practice for application within a set of circumstances or situation(s) and seeks to effect change and encourage action within that context. Previous use of the pCr praxis (McKeown, 2015) was found to contribute to a concept of sustainability while simultaneously integrating social, environmental and economic priorities, an aspect that has potential benefit for the delivery of the SDG goals, owing to their interconnected nature. Section 2.2.1 provides further details of the CoDesRes methodology and the unique suite of tools that form the basis of the principal outputs of CoDesRes: open-source educational resources for Transition Year and community development within placemaking.

In using this praxis, CoDesRes sought to explore its efficacy and transferability to contribute to localised engagement with Ireland's SDG National Implementation Plan, specifically SDG 4 – Quality Education (SDG 4), SDG 11 – Sustainable Cities and Communities (SDG 11), SDG 14 – Life Below Water (SDG 14) and SDG 15 – Life on Land (SDG 15). The research had three key questions:

1. How can we use the existing pCr methodology to raise awareness of and engage rural communities with the SDGs?
2. How do we transfer the pCr methodology to those communities in an accessible way to facilitate building on local networks and existing resources as contributions to localising the SDGs?
3. How might this contribute to and support local and national resilience?

As a systemic approach, the pCr praxis has been shown in earlier studies by the principal author in London, New Mexico and Dublin (McKeown, 2015) to contribute to the concept of sustainability while simultaneously integrating social, environmental and economic priorities. The research focused on the use and transfer of a novel methodology for contributions towards future socioeconomic and environmental challenges to provide increased sustainability within a rural area. The research aimed to go beyond citizen inclusion in governance and decision-making towards active engagement with problem-finding and -solving, delivered through education (formal and informal) within youth and community contexts.

The planned project outputs, principally beta-resources (www.codesres.ie/resources), were designed to give citizens the tools to begin to read and analyse their local system and develop opportunities for localising the SDGs. The resources facilitate a confident systemic approach to making change on a local scale (McKeown, 2015, 2020) and use policy to facilitate locally responsive actions that contribute to the national 2030 Agenda through shared aims. The project's dissemination strategy was two-fold: social media enabled CoDesRes to build relationships with the local audience, project participants and partners, while local activities raised awareness of the SDGs. This was undertaken in tandem with engaging with academic peers and key stakeholders within institutions through more formal channels, including conferences and journal papers (see www.codesres.ie/publications).

Following this introduction the report includes a contextualising chapter, including the research design. This is followed by three consecutive chapters outlining the work packages (WPs) and an overview of their evaluation. Chapter 6 presents the project's impact, with Chapter 7 concluding by summarising the outcomes and recommendations both for local action

5 The pCr praxis was developed and trialled over 6 years in three distinct geopolitical contexts, London, Dublin and New Mexico, and built on 25 years of socially engaged arts practice and best practice within culture-arts-led regeneration.

and emerging indicators and for directions of potential opportunities for delivery on Ireland's SDG National Implementation Plan. Additional details regarding the project can be found on the accompanying website (www.codesres.ie/), including access to the resources and a supplementary document providing the granular detail of the projects and their full evaluation, with a copy of this report.

2 CoDesRes – A Situated Embedded Approach

CoDesRes was, first, situated[6] within a complex problem landscape; second, geographically positioned within a rural Irish coastal context; and, third, placed in the local and global context of Agenda 2030 and the evolving climate crisis. This chapter presents the research context: the local, national and global situation in which CoDesRes was undertaken. Section 2.1 outlines these aspects through the lens of the CoDesRes project and its situated research approach. Section 2.2 presents the research design, including the methodology and its underpinning rationale, and introduces the suite of tools used. Section 2.3 outlines the rationale for embedding local residents as researchers.

2.1 Positioning the CoDesRes Research Project

CoDesRes explored the transfer of an existing methodology and how effectively it could contribute to the strategic objectives of Ireland's National Implementation Plan. The outputs of a situated research project evolve out of the context and situation in which the research was undertaken. The research sought to create accessible resources that communities can use to enhance the work they are doing and teachers can use to augment their teaching and the national curriculum, particularly within Transition Year. Section 2.1 positions the research problem within the following three areas: section 2.1.1, considering sustainable development within a rural community; section 2.1.2, place-based STEAM (science, technology, engineering, the arts and mathematics) 21st century skills for sustainable development; and section 2.1.3, self-organised activities and interventions on a localised scale.

2.1.1 Considering sustainable development within a rural community

There remains less than 9 years to achieve the transformative change necessary for the wellbeing of humankind (Møller, 2016), and, even if all pledges within the Paris Agreement were implemented, there is still a predicted average 3°C increase in global warming by 2100 (IPCC, 2019). Climate crisis (possibly, collapse) is the overarching context in which the SDGs now sit. In May 2019, a climate and biodiversity crisis was declared in the Dáil in light of the fact that:

> The window of opportunity to act is fast closing, but Ireland is way off course. Successful climate action will require profound societal transformation. This will not be possible without citizen engagement at its core. (DCCAE, 2019, p. 8)

Moving the SDGs from a theoretical set of goals to localised tangible action within the framework of Ireland's National SDG Implementation Plan requires confronting a number of challenges. Despite Ireland's rapid societal progress in recent years, its understanding of itself as a developed nation is facing the reality that "business as usual" is no longer tenable. The complex and interconnected global climate challenges demand systemic strategies and a reconsideration of what sustainable development means within a finite system. The present system is unstable (Meadows, 1997) and is collapsing with the unsustainable "too big to fail" approach further perpetuating the crises and the barriers to sustainability (Morgan, 2015). There is a need for robust understanding of both the existing system and our planetary boundaries (Rokström *et al*., 2009) within the context of the climate crisis. Ironically, when we are in crisis, we are least disposed to make changes (Meadows *et al*., 1972; Meadows, 1997), yet this is precisely when we need different approaches.

World city population is expected to reach 6.7 billion by 2050 (UNDESA, 2019). This will necessitate accelerated action on SDG 11 – Sustainable Cities and Communities to support links between the urban,

6 A situated approach is an immersive approach within a community of learners and practice that acknowledges the capacity that emerges from multiple experiences and backgrounds.

suburban and rural areas. The rural context has a role to play within the development of sustainable communities and cities by considering viable realistic alternatives to urban dwelling. Situating the project in the Iveragh Peninsula, County Kerry (Figure 2.1), facilitated an exploration of the potential of the rural context to redress the imbalance of the unprecedented global growth in urbanisation and the resulting challenges this brings to ecosystems.

Kerry is one of the most sparsely populated counties in Ireland, with low birth rates, high death rates, an older population and high levels of emigration further creating a population contraction (KCC, 2015a), which in turn has an impact on the region's sustainability. Population decline is most prevalent in the Iveragh Peninsula: the Iveragh Gaeltacht has the highest levels of compound socioeconomic disadvantage (Ó Caoimh, 2021), with three-quarters of south Kerry "characterised by weak accessibility and dispersed rural living" (Ó Caoimh, 2015, p. 5). The Iveragh Peninsula was defined in the *National Spatial Strategy for Ireland 2002–2020* (DECLG, 2002) as Rural Area 5, marginal and highly diversified, representing an almost post-agricultural rural economy with areas of high natural amenity, attracting high levels of tourism, recreational usage and, in some cases, non-farming residents, e.g. retirees or second homeowners who have migrated to Kerry.

Kerry County Council's (KCC) local development plan (KCC, 2015b) and the West Iveragh local area plan (KCC, 2019a) both seek to build on traditional sectoral strengths while diversifying the economy. Diverse industries with job-creating potential, e.g. experiential tourism, diversification in farming and the food and drinks sector, have all been earmarked for development, underpinned by Kerry's blue (sea) and green (land) ecosystems. CoDesRes also sat within the context of the Atlantic Economic Corridor (AEC), the "linear network along the Western seaboard, Kerry to Donegal", which is considered a "key enabler for the regional growth objectives" in Project Ireland 2040 (DPER, 2018, p. 43).

The research focused on four specific goals (SDG 4 – Quality Education; SDG 11 – Sustainable Cities and Communities; SDG 14 – Life Below Water; and SDG 15 – Life on Land), as these goals are especially pertinent to the rural coastal context of a small island nation. With almost 50% of Ireland's population living within 5 km from the coast, the research has the potential to have an impact not only on the local context, but also on national concerns. In addition, by choosing this area we also anticipated that the methods would be transferable to other "post-economy" areas and small island nations through the lens of degrowth and redistribution, as well as Ireland's blue and green economies. To date, the concept of

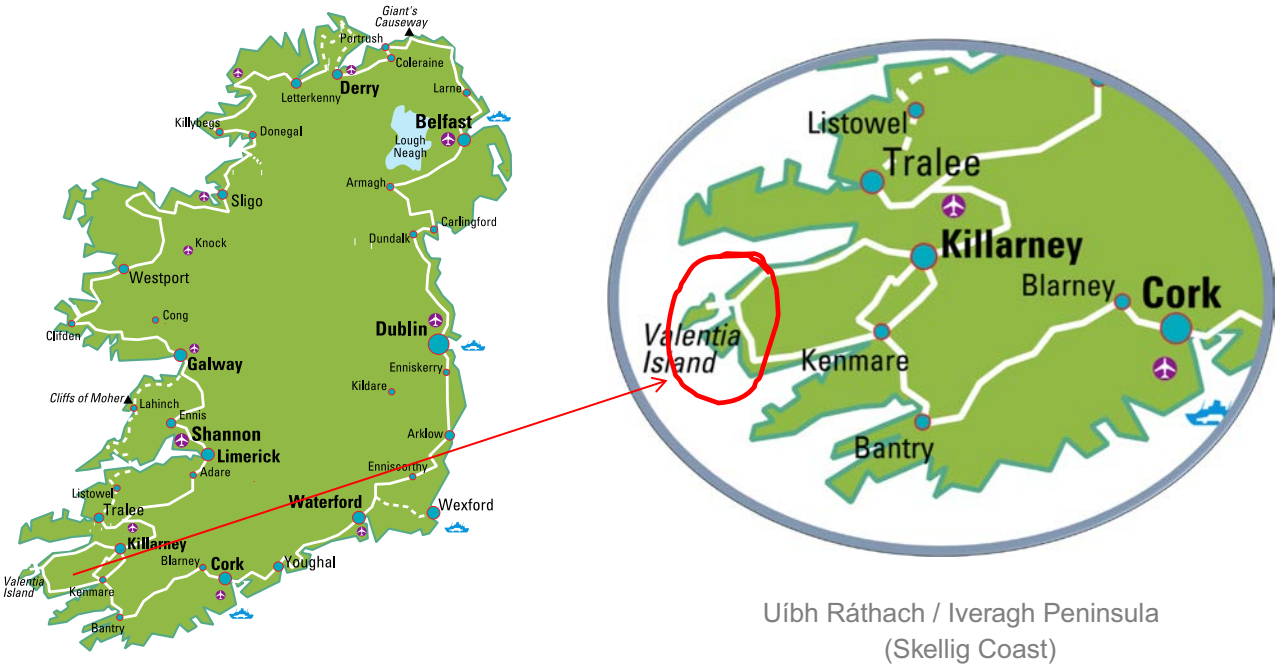

Figure 2.1. Iveragh Peninsula, south Kerry – the research location. Source: Tourism Ireland (2018).

degrowth and the realities of the impact of the climate crisis are only nascently addressed within local development plans. This has a ripple effect by further affecting awareness-raising of the impending climate crisis, localising the SDGs and aligning citizen's input.

To this end, we argue that the Iveragh Peninsula is a prime location to explore and develop the use of novel methods for localising the SDGs and contributing towards socioeconomic and environmental challenges. There is an urgent need to "increase public awareness and understanding of the rapidly changing, interdependent and unequal world in which we live" (Irish Aid, 2017, p. 6). The coronavirus disease (COVID-19) pandemic has provided a tangible example of an unprecedented global crisis, and the rapid change to business as usual that occurred as a result. This highlighted the need for agile and equitable responses, simultaneously managed on local and global scales. Thus, the research explored the efficacy of a systemic approach that uses a novel methodology, integrating social, environmental and economic aspects equitably, to contribute to a localised concept of sustainable development.

2.1.2 Place-based STEAM – 21st century skills for sustainable development

The employment sectors in Ireland identified as least at risk from artificial intelligence or robotics are education, research and development, information and communications technology (ICT), green technology, and environmental and culture-led sectors (Crowley and Doran, 2019). Smart economies, advanced manufacturing [three-dimensional (3D) printing/additive manufacturing and rapid prototyping], aqua and agritech, and the Internet of Things have also been identified as developing sectors (DECLG, 2002; DES, 2015). Broadening students' and communities' understandings of STEAM opportunities with an entrepreneurial approach could offer increased sustainability for rural communities, if the infrastructure (e.g. broadband) is present. This is a perspective also supported in KCC's recently commissioned Cahersiveen Socio-Economic plan (Prescience, 2019).

It is clear, then, that education, formal and informal, has a role to play in Ireland achieving its SDG targets, if it is used more effectively for raising awareness and embedding skills and values that contribute to increased SDG action. The Department of Education and Skills' *'Education for Sustainability': The National Strategy on Education for Sustainable Development in Ireland 2014–2020* (DES, 2014) aims to:

> ensure that education contributes to sustainable development by equipping learners with the relevant knowledge, skills and values (the 'why') that will motivate and empower them throughout their lives to become informed active citizens who take action for a more sustainable future. (DES, 2014, p. 3)

Recognition of the relationship between creativity and innovation and the implications for attracting the brightest minds to research fields and contemporary problem solving is long-standing (Kuhn, 1962; Getzels and Czikszentmihalyi, 1991). STEAM does not simply add art to science, technology, engineering and mathematics (STEM) education or use the arts as a vehicle to teach STEM; rather, it expands STEM to include the creative risk-taking and exploratory processes inherent in art and design training and disciplines within the STEM fields. STEAM places value on the arts for their creative methodologies, ways of knowing the world and tangible modes of knowledge production (McKeown, 2018). Within STEAM education, learning occurs at the intersections of the five disciplines, transforming how we know and investigate the world. As a pedagogical innovation,[7] the STEAM agenda offers an approach to teaching and learning that poses different questions based on knowledge exchange and insights from different ways of understanding and exploring the world.

This contributes to new ways of thinking and, in combination with enquiry-based learning,[8] provides students with learning opportunities that strike a balance between subject-specific knowledge and a wider range of skills and thinking abilities. STEAM

7 STEAM emerged from a 2-day National Science Foundation-funded Rhode Island School of Design workshop entitled "Bridging STEM to STEAM: Developing New Frameworks for Art-Science-Design Pedagogy".

8 Enquiry-based learning is an active learning approach based around a challenge, posing problems, or other forms of questioning. It has five phases: orientation, conceptualisation, investigation, conclusion and discussion.

pedagogy integrates the 21st century skills, broadly speaking the skills required for future-ready students such as critical thinking, creativity, collaboration, communication, information, media, technology literacies and flexibility, leadership, social skills and initiative. "Scaffolded" learning incrementally develops students' skill, competence and confidence to analyse and define local and global concerns rather than simply learn facts. When applied within the context of the SDGs, CoDesRes's place-based STEAM approach supports students to intervene and consider their actions from an integrated perspective: social, environmental and economic.

Within the context of the research, teaching and learning in this way facilitated students' processes of questioning or investigating the application of knowledge within physical or practical processes. This offered a foundation for theory and/or knowledge becoming action and, as such, the CoDesRes resources sought to encourage the ability to apply knowledge to a problem or within a specific context. In this instance, problem-based learning was organised around SDG 11 – Sustainable Cities and Communities, SDG – 14 Life Below Water and SDG – 15 Life on Land, and was geared towards exploring solutions to environmental challenges and delivering on the SDGs. CoDesRes's educational and local approach initially provoked participants to "question and restructure their notion of complex causality" (Grotzer, 2012), proposing to engage citizens (youth and community) in a learning process that initiated awareness of and action on the project's four SDGs and their relevance for the local context and for national and international concerns.

2.1.3 Self-organised action on a localised scale for sustainable development

Maurice Strong, the Secretary General of the United Nations Conference on Environment and Development in Rio, stated that local government should lead the way in tackling sustainability challenges through "manageable, tangible scales of governance more readily identifiable by citizens" (UNCED, 1992). This idea was quickly enshrined in Local Agenda 21 frameworks and is reminiscent of early "think globally, act locally" (Dubos, 1977) initiatives and numerous research studies (Atkinson *et al*., 2007; Beatley and Manning, 2013; UNDP, 2014). The United Nations Commission on Sustainable Development has since found that inhabitants' perceptions of a location's resilience and sustainability have been shown to be positive when stakeholder engagement is "anchored to local government commitments to urban sustainability" (UNCSD, 2012, p. 513).

Therefore, if Ireland is to adopt a "beyond-compliance"[9] culture, then culturally situated local approaches that include multiple worldviews and a systemic design thinking[10] perspective, which itself integrates science and technology (McKeown, 2018), offer a fertile research opportunity. However, tackling (local) governmental responsibility around sustainability issues is complex. Kirsty Hobson has identified the "governance trap", where citizens expect their elected officials to act, yet simultaneously have no trust in the government's messaging regarding an accurate ecological position or its ability to follow through with suitable action (Hobson, 2010). Understanding upcoming challenges is further complicated, as the challenges are often both spatially and temporally removed, distancing individuals from the impact and consequences of their actions.

Several policy initiatives in Ireland[11] have provided increased opportunities for the inclusion of citizens in local governance, yet within the research context the CoDesRes team found engagement in local governance to be limited. To develop a more sustained and direct involvement with governance that contributes to societal change, we will need to evolve peer-to-peer and self-organising networks to support citizens' ability to set agendas and have an impact on policy outcomes. CoDesRes explored transferring an existing methodology with efficacy to develop solutions that, on a local scale and if scaled up, could contribute to addressing national- and global-scale issues.

9 Beyond compliance moves beyond minimum regulatory legislation and includes an ethical imperative.

10 Design thinking (Brown, 2008) is a five-stage, design-led, problem-solving process embedding cognitive, strategic and practical processes by which design concepts are developed.

11 Including *Better Local Government Programme for Change* (DOE, 1996); Local Government Act (ISB, 2011); Local Government Reform Act (ISB, 2014); and *Our Communities: A Framework Policy for Local and Community Development in Ireland* (Government of Ireland, 2015).

CoDesRes supports a commons-based[12] self-organised approach to societal change through its underpinning methodology, the pCr praxis, which has been shown to contribute to sustainability and resilience through disruptive thinking and collaborative self-organisation. The pCr praxis is a bespoke approach to local concerns that facilitates self-organisation and develops innovative solutions collaboratively and systemically. This enabled a focus on iterating the existing praxis, an evidence-based approach (McKeown, 2015) for tangible resilient placemaking within a specific context, the Iveragh Peninsula. The praxis embeds an adaptive change model[13] (Heifitz *et al*., 2009), which uses creativity, innovation and practical processes to develop home-grown solutions to global concerns from the inside-out (McKeown, 2015). The pCr praxis, through a series of formal and informal learnings, grounds activity in tangible, practical action to cultivate the creation of conditions towards a healthy and resilient eco-socio-cultural system through exploring and co-creating innovative solutions collaboratively and systemically.

2.2 A Culturally Situated Critical Praxis for Rural Sustainable Development

In this section we outline the research methodology and its underpinning rationale, the suite of tools used and iterated within the project, and the embedded WPs, deemed necessary to develop the best practice guidelines, including training and resources to contribute to education and community practices for SDGs 4, 11, 14 and 15. Section 2.2.1 introduces the pCr praxis, and the suite of tools forming the praxis, which were used within the research and evolved to form the basis of the project's resources (see section 2.2.2). Section 2.2.3 develops the rationale for an arts-led approach to resilience and section 2.2.3 outlines the CoDesRes embedded research model, central to the CoDesRes research design.

2.2.1 Introducing the pCr praxis

The existing CoDesRes methodology, pCr praxis, was devised and trialled for creative placemaking over 6 years in three geopolitical contexts: London, Dublin and Taos, New Mexico (2008–2014). Placemaking, as both process and philosophy (PPS, 1995), is the planning, design and management of public space through community-led change. The pCr praxis has proven to be effective in creating locally relevant and non-formulaic placemaking projects that encourage participation and self-organisation (McKeown, 2015, 2018). Within a placemaking context, the pCr praxis supports a culturally situated approach to local SDG challenges, whereby solutions emerge from the situation in which embedded practitioners (in this instance, the researchers) find themselves. The praxis facilitates the nuanced reading of a high-context culture (HCC) (Hall, 1976), in which a high value is placed on interpersonal relationships, local knowledge and histories, within which knowledge is often implicit.

Informed by permaculture, the principal author's prior research shifted the focus from designing ecological landscapes for food production towards broader eco-social and cultural relationships to develop a generative, dynamic and sustaining process for placemaking. By integrating the theory from the four fields that are outlined below and shown in Figure 2.2 into an artistic practice that uses the systemic approaches of permaculture, the pCr's suite of tools was originally devised to facilitate place-based behavioural change (McKeown, 2015) within the context of the climate crisis. The CoDesRes project sought to contribute to a circular economic approach to knowledge production for addressing local concerns within the broader context of the SDGs – a variation on the theme of "think global, act local".

CoDesRes's underpinning praxis is a suite of tools and a theoretical framework, which were developed by distilling information from four distinct fields of knowledge and expertise: systems thinking; open-source culture; tactical creative placemaking;

12 Historically, "the Commons" were cultural and natural resources shared by members of society. The term was updated by political scientist Elinor Ostrom, Nobel Prize-winning economist, as a reaction to neoliberalism, in the 1980s.

13 An adaptive change model involves the planning, design and management of disrupting events or actions that have the potential to encourage systemic change for better outcomes.

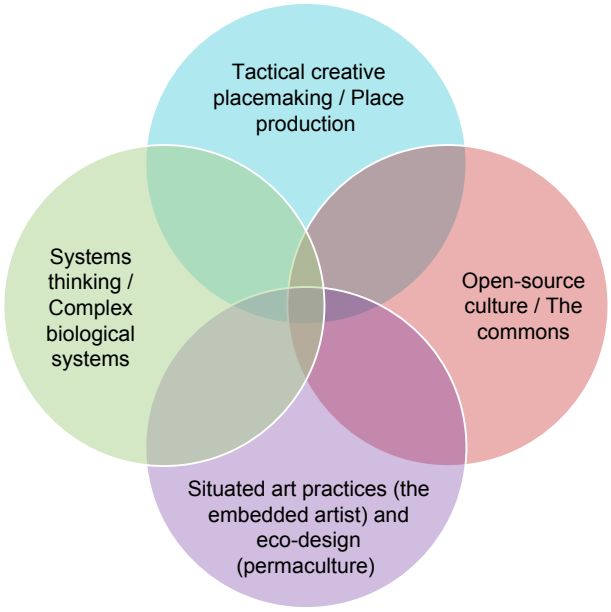

Figure 2.2. The pCr fields of knowledge. Source: McKeown (2015).

and situated art practices including eco-design–permaculture practices (Figure 2.2).

Within the "century of the system", when no single individual can change or be expected to change whole systems, their policies or procedures (Gawande, 2014), the praxis's tools develop capacity building for citizen input (McKeown, 2015, 2018). Increasing participatory civic governance will require outlining the levels of responsibility of citizens and government which, in line with 2030 Agenda, will need to embrace societal changes "in a manner that is fair, efficient and timely" (Desmond, 2016, p. 33). Such activity necessitates reconfiguring current systems, which will inevitably require upskilling. To this end, CoDesRes sought to investigate the transfer of an existing methodology to make it accessible by developing resources for youth and community through formal and informal education. Through a practical iterative exploration of the pCr praxis within a specific context, CoDesRes aimed to contribute to SDGs 4, 11, 14 and 15 by encouraging public participation, creativity and innovation using the pCr praxis tools.

Introducing the ROLE stages of the pCr praxis

Section 2.2.1 introduces the pCr praxis, which was purpose built to facilitate emergent processes by exploring new ways of doing, relating and working. Through this exploration, new structures, new connections, and new ways of being and doing emerge and the local system can begin to evolve. The pCr praxis facilitates exploratory processes: it is a systemic agile method that integrates feedback while allowing for unpredictability and, importantly, manages the risk of change. Through creating new connections, this can lead to interconnectedness and interdependence, which support local resilience (section 2.2.2). The pCr's suite of tools can be summarised by the acronym ROLE (relationships, OBREDIM, life cycle analysis, evaluation) (Figure 2.3). The ROLE of the pCr praxis shows a series of phases and includes specific tools that were designed as part of a cyclic process and can be enacted and iterated a number of times, as necessary.

As an operating system, the ROLE of the pCr praxis is an open-source,[14] locally resilient approach to

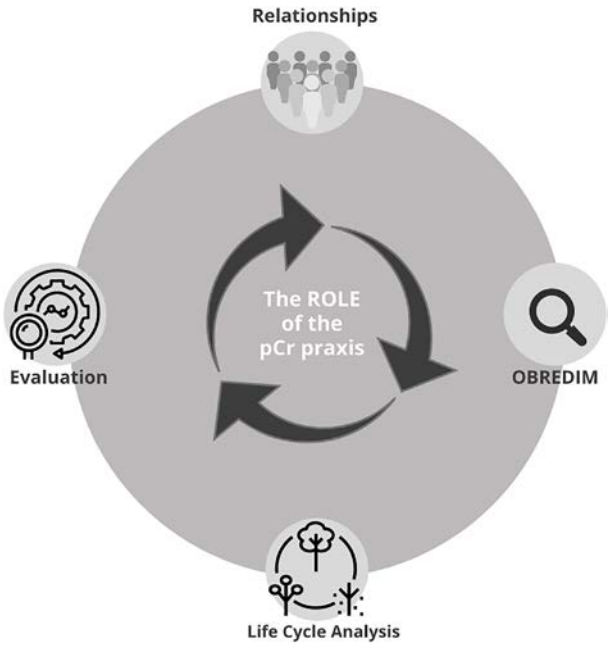

Figure 2.3. The ROLE of the pCr praxis. Source: McKeown (2015, 2018).

14 Open source originally referred to non-proprietary software developed to enable a decentralised, collaborative approach to peer review and community production. It is now a movement that seeks to embed similar decentralised production models to find new ways to solve problems in communities and industries.

design and it encourages a triad of capitals – social, environmental and economic – within community activities. Activity is grounded in tangible practical action, which cultivates the creation of conditions for a healthy and resilient eco-socio-cultural system through a series of formal and informal learning opportunities. As a proven approach for contributing to local resilience within a complex system (McKeown, 2018, 2015), the ROLE framework is at the heart of the CoDesRes project, both as the project's methodology and as the backbone of the resources created as the principal outputs of the CoDesRes project. An overview of the phases/tools is as follows.

R – Relationships. Using an intensive audit tool to map cultural, economic, socio-political and environmental dynamics, the pCr praxis reveals relationships, resources and opportunities to help reconfigure and reimagine an understanding of place. Stakeholder consultation is the first stage in the process and asks "What's at stake?" as a guiding question to redefine stakeholders. The mapping and construction of flexible micro-ecologies (relationships, contextual data, organisations, resources of a bio-psycho-social context) aid the revelation of multiple knowledge cultures and entities (McKeown, 2015, 2018). The pCr praxis proved that integrating local place-based knowledge and relationships has value for its potential to contribute to a local resilience (McKeown, 2015).

O – The OBREDIM audit log (see Figure A1.1) is a three-phase tool that deepens the pCr audit undertaken in advance of developing any project or intervention:

- Phase 1:
  - **O**bservation – survey the landscape.
  - **B**oundaries – find the edges and crossovers.
  - **R**esources – audit the social, environmental and economic resources.
- Phase 2:
  - **E**valuation – consider the situation.
  - **D**esign – consider the logistics and plan the design.
- Phase 3:
  - **I**mplementation – put the audit into action.
  - **M**aintenance – sustain the process and work towards legacies).

The log shows the three phases and examples of the information that the pCr audit can capture, depending on the challenge to be addressed or the problem to be considered. This facilitates the deep mapping required within HCCs and develops the "reading" of the localised system, its strengths and weaknesses, gaps and ultimately opportunities that can be built upon. Only then can appropriate interventions be created, partnerships brokered and projects developed, seeding, adapting and iterating the praxis.

L – Life cycle analysis. The framework offers a simple visual tool that embeds an eco-social commitment by addressing the full life cycle of a project and beyond. By plotting the position of the inputs, processes and outputs across relational zones 0–5 of a project [see the online supporting document (OSD), p. 13], an initial assessment of all production processes and consequences can be considered. Completely adaptive, the zones are defined in response to the project, whether geolocation, actors or another project input. Zone 0 is the core of the project and the other five zones are positioned in relation to this zone.

E – Evaluation. The pCr toolkit includes an evaluation matrix, the vital signs matrix (VSM), which is based on the concept of, and contributes to, the vital signs of a project (McKeown, 2015). The vital signs are four foundational characteristics developed through prior research (McKeown, 2015) to indicate healthy human and non-human systems, integrated with three other key factors – Earth care, people care and fair share – ensuring social, environmental and economic justice. From a systemic perspective, VSM offers a viable method to develop an evaluation matrix appropriate to the CoDesRes process. As an ecological approach, the evaluative methods aid the observation of a system's deterioration (Holden, 2015), as a means to determine what is necessary for a healthy generative eco-social cultural ecology. The pCr VSM is also used as a collaborative project development tool to address short-, medium- and long-term social and environmental equity within a project. The pCr praxis also uses an extended concept of the Doran (1981) SMART goals, known as SMARTER (McKeown, 2015):

- S – socio-culturally specific, simple and sincere.
- M – meaningful, as well as manageable and measurable.
- A – appropriate, achievable, aspirational and ambitious.
- R – relevant, responsive, reviewed and revised.

- T – timely and time specific.
- E – eco-considerate and ethical.
- R – resilient, resistant, resourceful and far-reaching.

As an expanded concept, SMARTER instils additional values to effect necessary change for the 21st century, e.g. sincere, meaningful, ambitious, responsive, eco-considerate, resilient and far-reaching, and more relevant for current and future contexts.

A final evaluation indicator draws from inclusive fitness theory (Hamilton, 1964) and offers a useful metric to gauge project impact beyond the project's lifetime. Through the "web of relations" (McKeown, 2015) of working practices and practitioners, the pCr ethos can be mapped for its contribution to longer-term behavioural change within other organisations. The pCr praxis is a proven arts-led approach that reframes problems, ideates solutions and iterates towards better answers through design thinking with an interdisciplinary team, combining their expertise with participants' insights for adaptation (McKeown 2015, 2018).

As with all methodologies, there are limitations that should be considered. The pCr praxis was originally developed by the principal investigator (McKeown, 2015) for applied qualitative research and built on extensive professional practice, including disruptive interventions, project management, participation and engagement. This experience could be drawn on to address issues that occurred within the research as a result of working in a complex "messy" real-world situation. The praxis was designed to be agile and transferable, with easy-to-use methods from the outset. The core tools have been embedded in the resources, which were developed to be used by communities without input from specific experts. However, to transfer CoDesRes to other locations within professional contexts should require training, regular mentorship and careful consideration of team selection, depending on the local context and the aims and requirements of the specific challenge.

2.2.2 Arts-led approaches for locally relevant and resilient practices

Section 2.2.2 introduces the role of arts-led approaches for resilient and locally relevant practices. Human responses to the volatility, uncertainty, complexity and ambiguity (VUCA) (Bennis and Nanus, 1985) of the world we now live in will require new forms and processes of leadership. Although science and other fields may mitigate many of the symptomatic factors, "fundamental transformations in all aspects of society — how we grow food, use land, transport goods, and power our economies" (United Nations, 2015, point 9) will be required. The climate crisis, the context in which the SDGs now sit, is driven by behavioural issues. Without behaviour change, our ability to scale action on the SDGs will be limited. As a behavioural issue, the psychosocial aspects of human behaviour will also need to be addressed. Low-risk opportunities, using agile and adaptive processes for experimental and exploratory actions, provide opportunities to learn and develop resilient solutions to complexity.

Approaching situations systemically, with easy-to-use tools in advance of a crisis, begins to identify leverage points (Meadows, 1997, 2008) for changing behaviour and encouraging more locally relevant, resilient and sustainable development. COVID-19 has highlighted the importance of inclusive recovery strategies that support community needs and require both social interaction and community resilience. With the climate crisis presenting an entirely new, unprecedented and high order category of trauma (Woodbury, 2019), the ability to respond effectively poses new concerns. Indeed, our student cohort was already experiencing eco-anxiety, a clinically legitimate diagnosis (Clayton *et al*., 2017) – see Chapter 3.

Woodbury (2019) posits that the dissociation and related symptomatic effects of trauma could be a perspective from which to approach our current condition regarding inaction. If we are to achieve the SDGs, developing individual and community resilience to existential and physical threats will be critical. Case studies considering the influence of community on mental health show that the communities that fare better under existential and disaster threats are those that not only have resources but can demonstrate community cohesion and support (Cutter *et al*., 2008a,b; Berry *et al*., 2018) or a sense of agency. Managing future scenarios, including shock events (natural disasters, financial crises, pandemics or armed conflicts), is a core aspect of the SDGs, with building resilience (physical, social and emotional) a core component of a number of them. Localising action on the SDGs while dealing with a VUCA context increases the need for focus and development within locally scaled contexts.

CoDesRes's underpinning methodology, the pCr praxis, was designed to build resilience within communities (McKeown, 2015). The praxis facilitates disruptive innovation towards the creation of proofs of concept (safe spaces) to try something new and manage risk. Transferring the methodology to education and self-organised community contexts as an approach to localising the SDGs is the principal aim of this study. The recognition of systemic interdependence underpinning resilience thinking acknowledges the need for the distribution of knowledge, diverse experience, values and cultures as the means to building capacity for resisting shocks or change (Fleming, 2009; Moberg and Simonsen, 2013).

Increasingly, developing resilient thinking and practices is the subject of discussion, yet the skills and tools to do so are nascent; they are excluded from education and are not specifically used in general community development. Research on the subject of the visual arts for resilience (Winter *et al*., 2012) identified the visual arts as an ideal field to support the effort to promote resilience in young people by helping them to develop a sense of belonging; to develop an ability to cope; to learn artistic skills and gain confidence; and to develop a sense of identity, self-awareness and self-esteem. Arts-based sessions in classrooms have been shown to help students develop coping skills, improving psychosocial wellbeing and creating a stable and understanding environment for all.

Human qualities considered inherent in artistic practice and training, for example, creativity, innovation, practical processes and design competencies (DETE, 2020), will play an increasingly important role in surviving unprecedented scenarios and are at the core of CoDesRes. Within eco-psychosocial interventions, such as CoDesRes, the arts (beyond studio practices) are engaged in collaborative, creative problem solving. Such eco-psychosocial practices (McKeown, 2015; Fitzgerald, 2018) have a heritage of over half a century, which has developed models of practice and methodologies that contribute to best practice in the social realm. Using these arts practices offers an opportunity to contribute to an understanding of being agents in survival, through activities that build on collaborative and socially equitable practical actions and through creativity and imagination.

Locally scaled and integrating the concept of "oikos" [from the ancient Greek word for home, a crafting of home, from the "house territory to town cosmos" (Bateson, 1994, p. 187)] into placemaking, the process encourages a more sustained and direct involvement with civil society and governance. Connections to concrete actions and their feedback into the system effecting change, both positively and negatively, become perceptible. The potential to make and re-make "oikos", the ethical management of resources and equity of multiple capitals, uses existing and emerging peer-to-peer networks and self-organising methods by extending into commons-based approaches for societal change. The pCr praxis has been shown to develop resilience that is locally scaled (McKeown, 2015, 2018) by supporting resilient thinking and activities.

By initiating and facilitating locally scaled self-organisation towards potential solutions grown from the inside out, the pCr praxis integrates strategy and tactics, to move beyond top-down or bottom-up approaches. By bringing a systemic, arts-led, situated, generative and cultural approach to the strategic objectives of the SDGs national implementation plan, CoDesRes explored reimagining possibilities for localising the SDGs.

2.2.3 Embedded research and work package design

CoDesRes sought to demonstrate the feasibility, transferability and sustainability of the pCr methodology for place-based rural development and for delivering the SDGs at the local scale. As well as the standard WPs, namely Project Management (WP1) and Dissemination (WP5), CoDesRes's core activity was a series of three interlinked WPs (Appendix 1, Table A1.1) designed to investigate two things: (1) the transfer of a proven methodology within the context of sustainable development for education and community and in the context of SDG 11 and (2) what happens when researcher-residents are embedded within a locale. Although beyond the scope of this report, as a proof of concept for a place-based, practice-led, co-designed approach to research, the CoDesRes project has much to share.

All but one of the research assistants were full-time south Kerry residents; three had not yet completed their PhDs and two were not involved in research prior to CoDesRes. The interdisciplinary team included an artist-scholar and educator, two marine biologists,

one of whom focused on coastal communities, an engineer, a media artist and a curriculum developer. This ensured a diverse range of knowledge, informed the process of expanding the methodology, as it was refocused towards localising the SDGs, and challenged our own practices and assumptions. Owing to additional generated revenue and in-kind funding from Community Social Enterprise, the research greatly benefited from the inclusion (for 1 day per week) of Mr Seán O'Laoghaire,[15] a local resident, artist and seanchaí (storyteller). As an embedded research project, the team's implicit and explicit knowledge was realised within the project through the linked WPs and their design.

The ratio of the project's core team in the arts, science and media roles self-identifying as female to male was 80:20. This was beneficial to many of the female students the project engaged with, as many had little contact with women in these roles due to the Kerry diaspora.[16] The team undertook Epigeum Research Integrity[17] training, and a full University College Dublin (UCD) ethics application covered the diverse participants: community groups, mature minors and vulnerable people. The team were also Garda vetted by Kerry Education Training Board (ETB), KCC and UCD and received TUSLA (Child and Family Agency) child protection training.

As informed by the concept of "oikos", CoDesRes considered under-utilised knowledge and resources as waste and its methods sought to encourage circular economy principles applied to services and concepts, rather than simply products, as part of its response to sustainable development. As an embedded research project in an HCC, the CoDesRes WPs were designed to focus on SDGs 4, 11, 14 and 15, as they are considered to be the most pertinent to the rural coastal context and its concerns about building resilience, while effectively harnessing existing local knowledge and resources, an important aspect of the pCr ethos. As a small island, the exchange and relationships that occur between land and sea affect Ireland on a daily basis, and the Iveragh Peninsula, a coastal context, must also contend with this exchange.

Within the context of sustainable development, the climate crisis and its impacts, the exploration of developing practical solutions becomes a necessity. Both youth and community transition WPs were designed to explore the following issues from the outset: sustainable communities, waste as resource, and land and ecosystem health, including freshwater and marine ecologies. Each WP had distinct aims and objectives to contribute to the development of the principal deliverables, namely the educational and community resources. In addition, the WPs were also interlinked by design and sought to integrate the interdisciplinary skills of the whole team across all the WPs. Chapters 3–5 focus on the core WPs that were designed to develop and iterate the resources in education and community contexts as part of producing resources that would enable the accessible transfer of the pCr process and tools. Each WP is summarised and followed by the pCr VSM evaluation and the key learning from the VSM evaluation criteria.

15 https://seananseanchai.com/ (accessed 19 November 2021).

16 Kerry has a substantial diaspora, with many leaving for college outside the county, never to return. This can limit access to representative role models.

17 https://www.epigeum.com/courses/research/research-integrity-uk-edition/ (accessed 19 November 2021).

3 Work Package 2 – Place-based STEAM for Sustainable Development

3.1 Introduction

In this chapter we outline the process undertaken to develop and iterate the resources through work with students and teachers. Section 3.2 outlines WP2's work and the changes that occurred between phase 1 (January–May 2018) and phase 2 (September 2018 to May 2019) due to staff and delivery changes (see also Chapter 4). Section 3.3 outlines the development of specific resources for Ocean Literacy, SDG 14 – Life Below Water. Section 3.4 presents the process that the team used to ensure that the resources developed were appropriate and contributed to the aims to develop place-based STEAM learning that could contribute to the broader aims of localising the SDGs while increasing self-directed learning and 21st century skills.[18] Section 3.4 is presented as four subsections relating to the VSM evaluation of the WP (rather than the resources) and the key learning from this process.

3.2 Educational Resources for SDGs 4, 11, 14 and 15

The focus of WP2 was to develop place-based STEAM learning interventions that could ground students' learning in their location yet be adapted to other locations. WP2 was designed to develop educational resources for Transition Year (TY) students and teachers, to deliver on SDG 4 – Quality Education that would encourage localised understanding and action on SDG 11 – Sustainable Cities and Communities, SDG 14 – Life Below Water and SDG 15 – Life on Land in their daily lives. Our WP design focused on the development of greater links and understanding of local resources, as well as beginning to facilitate a re-presentation of the location, which could present opportunities for engagement with these four SDGs.

The CoDesRes research team was embedded in Coláiste na Sceilge (CnS), Cahersiveen (January 2018 to May 2019), a non-denominational post-primary community college with 550 students (aged 11–18 years) from Kells to Castlecove on the Iveragh Peninsula. TY offers pupils a broad educational experience with a view to attaining increased maturity before proceeding to further study and/or vocational preparation. TY helps pupils make the transition from a highly structured environment to one in which they will take greater responsibility for their own learning and decision-making (DES, 2014). TY offers a number of opportunities to intervene in Ireland's education system towards supporting future-ready students both strategically and tactically, as:

1. The TY curriculum varies from school to school. There is no standard TY curriculum.
2. The aim of TY is to develop the experience, resilience and awareness of the student. This sits well with CoDesRes's educational aims to augment the National Curriculum with future-ready skills and raise awareness of the SDGs and their implications for future work and life.
3. Teachers are keen to implement project- and enquiry-based learning; however, many project resources are not scaffolded and require tasks that assume an expertise or need more input from the teachers. Teachers use "off the peg" resources, which can be difficult to implement, e.g. forming a team to create an effective awareness campaign and produce a short film.
4. Students and teachers with a high-status exam-focused perspective can struggle to see the benefit of an approach that will not "tell the student what they need to know", which could be explored more concretely within TY.
5. Introduction to the application of knowledge in different contexts, research developments and discussions around future challenges and opportunities that are not covered in the national curriculum can be foregrounded here.

18 The 21st century skills framework covers the following areas: core subjects with contemporary themes; life and career skills; learning and innovation skills; and information technology and media skills (Fadel, 2008).

In phase 1 (January–June 2018), members of the team developed lesson plans connected to specific subjects within TY – leadership, young entrepreneurship and art classes – to augment existing teacher delivery. This experience informed phase 2, the CoDesRes class that would span the academic year 2018–19 with three double classes per week delivered to all 75 TY students through team teaching by the CoDesRes team.

Phase 1 identified additional opportunities and challenges within the education system in relation to sustainable development and localising the SDGs, as well as necessitating changes to the proposed delivery. Informed by this experience, CoDesRes piloted a specific programme around the SDGs, in particular SDGs 4, 11, 14 and 15, over a full academic year with 68 students (three groups of students with an 80-minute class per week each). This produced a series of micromodules and lesson plans that, where possible, incorporated an outdoor enquiry-based learning process within its place-based STEAM approach, using the classroom environment to prepare for and reflect on these sessions. This helped to situate the students' learning in the local context and ecosystem, both social and environmental, with the lesson plans signposting how to include local expertise and knowledge in students' learning.

Learning activities, lesson plans and modules were developed and delivered through team teaching, aiding the iterative process that would create the resources. Collectively, the modules that were devised embedded the pCr praxis through active, hands-on learning and participation to support students to develop projects that could contribute to SDG 11, 14 and 15 targets and simultaneously show the inter-relatedness of the goals. Using the cognitive, strategic and practical processes by which design concepts are developed (design thinking) in combination with the pCr praxis, the modules provide access points for supporting student-led enquiry, dialogue and critical thinking. We also developed learning interventions in a range of formats, including working on teachers' micro-projects or offering support with their lessons and focused design challenges, e.g. Problem to Pitch (P2P) (see section 3.3). The CoDesRes curriculum resources include SDG introduction lessons; module introductions (overview content/key skills/learning outcomes); SDG-linked activities and lesson plans across all modules, including links to other subjects and CoDesRes resources; and the Global Goals art and design case studies. An overview of all the education resources developed can be found in the OSD (pp. 33–55).

3.3 Educational Resources for SDG 14 – Life Below Water

The SDG 14 work in WP2 began with an audit using the first phase of the OBREDIM log and the pCr zoning method, which maps proximal relationships and actors (OSD, p. 13). This was used to map marine operations (defined as ocean conservation organisations, marine research centres, and marine activity and education centres and organisations.) Two snapshots were taken, one in April 2018 and the other August 2019, which analysed 74 international marine operations, enabling the team to understand global engagement with SDG 14. The initial assessment searched for use of the SDG 14 logo or reference to SDG 14 in the operations' online presence to understand the general awareness of the SDGs and to consider Ireland's position in relation to international marine activity and best practice in the SDGs.

Of the 74 marine operations reviewed, 20 were located in Ireland, five of which were sea sports centres with few to no education activities. Of the eight that presented an awareness of sustainability, conservation and ocean literacy, no operator explicitly connected with SDG 14. Ten operations offered (mostly informal) educational activities delivered through camps (kids, family fun or with an activity focus) and experience activities targeted towards tourism, with little to no focus on the 12–18 years age group. When reviewed in year 2, only one organisation presented an awareness of SDG 14 on its website. The lack of connection between the SDGs and the marine operators' work, despite activities potentially contributing to targets and indicators, offered useful insights for further raising awareness of the SDGs, creating SDG-related opportunities and capturing data that could contribute to Ireland's National Implementation Plan.

With little to no focus on marine educational activities for young people aged 12–18 years, in either formal or informal education, CoDesRes developed a foundational module on ocean literacy as an introduction to SDG 14, led by WP2 lead, Lucy Hunt. Lucy has extensive experience in marine awareness

and education and had previously developed an online primary curriculum for the Volvo Ocean Race Sustainability Education programme 2017–2018.[19] This had been delivered to over 100,000 primary-level (aged 6–12 years) international students and formed the basis of the first resources to be developed and trialled. Within WP2 the original resources core topics of "Ocean connection and ocean plastic pollution", "Ways to reduce plastic pollution" and "My positive plastic footprint" were further developed for the CoDesRes Ocean Literacy module for age-appropriate learning with a place-based focus expanded specifically for TY students. Ten 80-minute SDG 14 lesson plans, resources and student worksheets (9.5 hours of planned content) were created, alongside an SDG 14-specific PTP module supplement for marine plastic waste (8 hours of planned content).

The PTP module was first presented as a series of trialled activities during a week-long work experience offering at CnS (February 2019) and at St. Catherine's Vocational School, Donegal (November 2019), through the sister project, MARplas, as a 5-day intensive design challenge. The design challenge used the real-world problem of synthetic fishing net off-cuts and marine plastic waste and led students through the full design thinking process: considering the problem, developing solutions and creating prototypes. The week culminated in a *Dragons' Den*-style pitch using a lean canvas[20] to construct a PechaKucha[21] presentation.

After the success of PTP SDG 14, the module was further developed as a 40-hour core module for a project-based (challenge led, solution focused) approach to learning, including generic SDG place-based learning. Further trials within the Muinín Catalyst programme (see section 6.3.3) were undertaken at CnS, comprising "DREAM Designs", which involved repurposing derelict buildings, and "Seeding Sustainability", which involved the creation of a 1 km health and wellbeing-linked walking trail. The resources were also shared with teachers for feedback at four other schools in County Kerry and Schull Community School in County Cork.

3.4 Resource Development and Iteration

The research design in WP2 focused on addressing the three key research questions in an educational context, and trialling and iterating a series of learning interventions, iteratively informed by consistent resource evaluation throughout with students. The team delivered the same resources across all three weekly classes, enabling triangulation across cohorts and the teaching teams. Each class delivered was evaluated by a 3–2–1 method: students were asked to report three things they felt they learnt in the class, two things they enjoyed, found particularly interesting or would like to know more about and, finally, one thing about their overall feeling of the class, whether they liked it or not, and how it could be improved.

A practitioner's reflective log was used within the team to reflect on all the activities undertaken, for self-evaluation and for improving the trialled lessons and providing a systematic approach to gathering data documenting the experience in the activity while drawing on the practitioners' knowledge beyond the project context. CoDesRes also involved a midway-point World Café[22] session with each class and a focus group at the end of the year with 20 student participants. The team's approach and the insights gained from students and teachers informed a teaching and learning approach encouraging the development of 21st century skills and the 4Cs (communication, critical thinking, collaboration and creativity) through practical and tangible learning activities that build the foundations for skills transfer.

19 The Volvo Ocean Race (https://archive.theoceanrace.com/en/sustainability/education.html; accessed 22 November 2021).

20 LEAN canvas is a one-page business plan template adapted by Ash Maurya from Alex Osterwalder's Business Model Canvas to help deconstruct your idea into its key assumptions. See https://www.youtube.com/watch?v=8n20QGWiFYQ (accessed 22 November 2021).

21 PechaKucha is a storytelling format in which a presenter shows 20 slides for 20 seconds of commentary each (6 minutes and 40 seconds in total).

22 World Cafés are unique events that encourage dialogue and discourse around questions with small groups (see http://www.theworldcafe.com/key-concepts-resources/world-cafe-method/; accessed 22 November 2021).

3.5 The Vital Signs Matrix – Evaluating Impact in Complex Situations

The VSM was developed as a tool for use in emergent adaptive complex situations (McKeown, 2015) to enable the capture of dynamic results by identifying a correlation between input and output. The VSM seeks to show the results of what was achievable for that specific situation, including the time and resources that were available. This enables insights and possibilities to inform future activities rather than fixed solutions, an appropriate goal for an agile systemic approach. Sections 3.5.1–3.5.4 present a narrative evaluation of WP2 (separate from the iterative assessments for developing the resources) using the core indicators of the VSM. The full VSM evaluations can be found in the OSD (pp. 59–65).

3.5.1 VSM criterion 1: building a micro-ecology

Building the micro-ecology, the first criterion of the pCr praxis underpinning CoDesRes, develops critical foundational relationships that are necessary in HCCs. In 2017, Dr McKeown spent 3.5 months at CnS, enabling her, as principal investigator, to begin developing a relationship with the school, students and staff. This experience underpinned CoDesRes's phase 1 of the pCr's OBREDIM audit log, OBR and the zoning methods (January–June 2018), initiating the close reading of the school as an HCC system, and as a community of interest, practice and geolocation.[23]

Working closely with the "school as a system" benefited both the project and resource development, by:

- facilitating the development of "go-to" contacts who could help overcome obstacles, trouble-shoot problems and identify additional signposts towards opportunities to evolve the project;
- fast-tracking awareness of processes and protocols for the team;
- developing recognition of resource possibilities and limitations;
- building in multiple entry points and opportunities for participation, encouraging a reconsideration of the situation;
- encouraging an intimacy through a detailed interrelated knowledge of the physical and social context;
- introducing localised and context-specific expertise into the research project and, by association, the school system.

Key learning – timetabling

Through WP2, it became apparent that, although agreed in principle and confirmed in writing with the Education Training Board, embedding phase 1 of the research in TY required adaptation and increased formalisation. Otherwise, the research was at risk due to sporadic interaction, subject to the teachers' discretion and the TY timetable, which can change overnight. The impact of these issues was, to some extent, offset by the combination of the team's diverse professional experience and the robust methodology. However, it should be noted that every school is different, it is uncommon to have a research team embedded in post-primary education and this initial phase aided the development of familiarity with the school's culture and helped to develop an effective foundation for phase 2.

To address this, phase 2 evolved to CoDesRes delivering three 80-minute classes per week, ensuring the consistent trialling and iteration of the interventions. This provided three groups, each one the same size as the initial projected TY cohort, on which to test and iterate each lesson or resource. The dynamics of the three groups were different, enabling the team to discern if responses to the lessons were due to group dynamics, individual students, team teaching combinations or the lesson, providing evaluation checks and balances. It also enabled the team to iterate the delivery of the lesson plan across the week through each class.

23 The term "community" can also be applied beyond a physical location to mean groups of people who operate in a similar field (of practice) or who share an interest in common issues (of interest).

3.5.2 VSM criterion 2: strategic intervention tactics

TY offers a number of opportunities to intervene in Ireland's education system and support future-ready students, both strategically and tactically, through its non-standardised curriculum. This, in turn, has the potential not only to augment the national curriculum with future-ready skills and raise awareness among both teachers and students of the SDGs and their implications for future work and life, but also to arouse the interest of teachers in project- and enquiry-based learning (as opposed to existing and limited resources). However, currently such capacities necessitate support by external expertise to ensure the application of knowledge in different contexts, research developments and discussions about future challenges and opportunities, as they are not covered in the national curriculum.

At times, the completion of micromodules was curtailed because of internal issues beyond the control of the team, e.g. scheduling issues, changes to timetables and prioritising other activities. This is not unusual when working in schools and complex situations, and the pCr methodology aided management of this to some extent. The COVID-19 pandemic restrictions also had an impact on the end of the project.

Key learning – skills deficit

Reflections on the future of work, skills required and the impact of technological advances on the STEM disciplines were limited within the student cohort. Classes often used blended learning, which highlighted a number of challenges. Students were not used to self-directed learning, even when scaffolded (building up learning supports) or using digital tools. The 3–2–1 evaluation showed that many students considered not only content knowledge, but also the aquistion of technological skill such as using Microsoft Education and its tools or simply attaching files, saving to shared drives or refreshing a browser, as learning. This identified a potential blind spot in education, namely that, although students use mobile technology for socialising or entertainment, competence with gaming, applications (apps) or social media does not necessarily equate to skills with technology for learning. This places more pressure on educators to bridge this skills deficit; however, many teachers have not had extensive training in blended learning or ICT, which may perpetuate this issue.

The experience of implementing CoDesRes in schools has revealed a wide range of ICT capacities. Digital exclusion comes in numerous forms, and students are subject to a number of factors, including teachers' confidence and competence with using technology for learning, as well as access to technological infrastructure. Although access to Microsoft Education was available within CoDesRes, staff and students' use of the tools was inconsistent. School closures caused by the COVID-19 pandemic improved this situation, and also further identified the need for structured blended learning that integrates analogue pedagogical principles with available technology as an area for development in teacher training. This has been included within the toolkits and has been formalised for continuing professional development (CPD) on 21st century skills. Through the legacy Muinín Catalyst programme (see section 6.3.3), members of the team have built on CoDesRes's research to develop a digital literacy micromodule for delivery in the academic year 2021/22.

3.5.3 VSM criterion 3: reseeding local knowledge

Like many other rural communities, a dominant colloquial narrative from parents on the Iveragh Peninsula is "we are raising our young people to leave", while from the young people: "there's nothing here, I can't wait to get out". A deeper discussion with TY students in phase 1 revealed that many of those planning to stay in the location were connected to a family business, so for them future opportunities were more easily recognised. For those with ambition to leave, the dominant narrative was further consolidated by a limited awareness of non-traditional local opportunities or an inability to envisage potential or reimagine new possibilities in recognised career paths. Informal discussions with parents confirmed that leaving was encouraged and contemporary changes to professions, and the consequent additional skills required, were not necessarily understood. This informed both the Global Goals case studies and

the WP2 Future of Work[24] event (targeted at parents and students), with presentations from convened panellists from the corporate and public sectors and an exhibition showcasing local entrepreneurs. This event was cancelled because of COVID-19 restrictions, and we are planning to run this in 2022.

STEM was clearly recognised, but not STEAM. There was little or no recognition of the creative skills (concept development, realisation, innovation, less formal experimentation) that sit at the heart of STEAM and human endeavour. Rather, the arts were still considered as extracurricular, or as innate talent rather than skills that can be taught and applied in other contexts, or considered only for their ability to teach or illustrate STEM concepts. CoDesRes's resources introduce the concept of open-source culture and technology, an important area but one that many of the students and teachers had little experience or knowledge of. Within the context of resilience, open-source approaches offer additional tools, easily accessed with less reliance on expensive software and hardware (see section 3.5.2).

When possible, local resources, such as the physical aspects of the town and the peninsula, its communities and entrepreneurial or innovative examples, were built into lesson plans. Transferable recommendations, along with the OBREDIM audit to develop the skills to observe aspects of the "everyday" that are often overlooked or ignored included interpersonal mapping, the rational and the emotional, as well as shared and distinct ways of knowing. Such cross-pollination of knowledge and skills is necessary to address a local and global landscape and reimagine and re-present place.

The concept of shaping the physical and social (and in turn economic) character of place while tying these aspects into SDGs 11, 14 and 15 was scaffolded into the trialling of lessons. Examples of possibilities, e.g. the Global Goals case studies, examples from open source culture and technology, and the CoDesRes research concerns, introduced students to new tools and processes to explore, document and re-present their learning. This process expanded the conventional and traditional approaches to social, economic and environmental resilience towards a more agile and networked approach to co-production for resilience, with the foundations delivered through TY education.

3.5.4 VSM criterion 4: resituating arts, culture and design

WP2 explored place-based STEAM learning interventions that shared the CoDesRes arts-led praxis in an accessible way to develop an awareness of the SDGs. It sought to integrate the measurable, extrinsic values of the arts into lesson plans and embed design thinking and disruptive innovation in its learning interventions and the creation of its five key modules. WP2 fostered the development of skills that improve cognitive, linguistic, social and emotional development and, importantly, creativity, with lesson plans, which also included foundational communication skills, for instance video, audio, graphics and presentation as part of this process.

Increasingly, the importance of the arts and design skills within STEAM education (Bakhshi and Mateos-Garcia, 2014) is being recognised for enhancing the understanding of problems and encouraging graduates who are more creative, innovative and solution and user focused. CoDesRes's place-based STEAM is grounded in systems and design thinking to encourage these skills at an earlier stage. CoDesRes's approach and its ethos with regards to learning and the future of work is further supported by the recent report, *Together for Design: Digital, Product and Strategic Design Skills of the Future* (DETE, 2020). This report by the Expert Group on Future Skills Needs (EGFSN) acknowledges that design disciplines are agile and constantly evolving to embrace new opportunities. As a result, these skills are in high demand, and not just for design programme graduates. EGFSN's perspective provides a solid foundation and context for CoDesRes's education resources, strengthening the argument for earlier engagement with STEAM.

24 The Future of Work event was targeted at parents, introducing them to contemporary approaches to existing industries and the skills required. The event included four speakers, an exhibition of local entrepreneurs and break-out rooms for more detailed discussions about the key issues raised.

Key learning

WP2's approach affirms the importance of investing in the arts and creativity in post-primary education, with student feedback attesting to their engagement with the lesson content and its efficacy. The place-based STEAM approach provided real-world problems and scenarios to learn from and encouraged the students to think through questions rather than providing rote answers. Thus, the CoDesRes approach supports, and adds an essential dimension to, the recent investments in Ireland both in STEM [e.g. Science Foundation Ireland's (SFI) €173m investment in science (SFI, 2018) or the €200m investment in the Institutes of Technology (IT), of which €7.85m will go to IT Tralee's new STEM institute (DES, 2017)] and in the arts, through Creative Ireland and the whole-government initiative ambition to offer every person in Ireland the opportunity to realise their full creative potential (CI, 2017) and place creativity at the centre of public policy (2017–2022). Such ambition could also serve to embed creativity at the centre of our nation's education.

3.6 WP2 Summary Findings

This section presents WP2's 12 key findings. An upcoming book with Emerald Publishing in 2022, journal papers, book chapters and the OSD provide extended discussions on the granular detail of the project.

1. Place-based STEAM post-primary approaches enabled diverse educational activities and included individual, paired and group learning to establish students' preferences and to explore differentiated learning[25] strategies. Students enjoyed both group work and individual work, specifically noting their enjoyment of group situations, interactive class elements and presentation of information. Opportunities for outdoor learning in lessons were also commented on positively by a large number of students.
2. Students (97–100%) reported that they learned something new in each class. One specific indicator showed that students' prior education on the ocean or their connection to the ocean was limited, despite living in a coastal community.
3. A place-based STEAM approach instils the foundations for self-organisation and resilience but does not exclude the intrinsic value of the arts to society, i.e. enriching our emotional world, encouraging us to see broader perspectives and helping us to make sense of the facts and evidence that explain our world in a human way.
4. Blended and self-directed learning requires a different pedagogical approach, using many of the skills teachers already have in a new context. Furthermore, CoDesRes has revealed numerous avenues for development and clear directions to build on its findings, particularly concerning digital literacy and project- and place-based STEAM education.
5. CoDesRes's STEAM approach offers benefits for students in developing future-ready skills in digital literacy. This is achieved through media and communication modules.
6. CoDesRes's approach to teaching and learning methods offers an evidence-based foundation for the proposed changes on completion of the senior cycle education review (NCCA, 2020; OECD, 2020).
7. CoDesRes's teaching staff engagement supports Irish Aid's Development Education Strategy (DFAT, 2017). Conversations undertaken with staff to discover what they knew, what would help and what was frustrating or difficult for them logistically in the confines of the post-primary education system revealed that time pressures, lack of funding or budgetary pressures, and an already full curriculum were barriers to sustainable education development. The opportunity to engage with frontline workers, learn from their expertise and understand their perspectives on the challenges and obstacles, alongside observations of students' knowledge, enabled the team to effectively operate in the gaps, develop useful resources and identify limitations of many "off the peg" project-based resources. Activities to develop team building and leadership and ensure

25 Differentiated learning strategies offer a range of teaching and learning methods so that all students in a classroom can learn effectively, regardless of differences in their ability.

effective understanding of project outcomes are often beyond the experience of the students, with little or no guidance for educators on how to bridge that gap.

8. The CoDesRes resources embed social, environmental and economic justice in their ethos and approach, which will be important for systemic approaches to education.

9. Eco-anxiety[26] is increasing and was evident in the core TY cohort (68 students in 2018/2019), with 91% reporting fear of what their life and environment might look like in the future – if they had a future – and how a lack of information was not helpful to them. Although psychological recommendations advocate talking about eco-anxiety with family or peers (Clayton *et al*., 2017) it was evident that this was not happening in this cohort. They stated that the adults around them seem not to be engaged in issues of climate change and have no solutions, adding to their already anxious state. To this end, an eco-anxiety micromodule has been developed through the Muinín Catalyst legacy programme with the Global Goals case studies showing youth and adult action for sustainable development.

10. The cohort appreciated the knowledge of the broader context provided by CoDesRes and classroom discussions, even if the content meant that the lessons were challenging at times. The students reported that without a realistic understanding of climate change and sustainability it was difficult to make effective changes. They further appreciated that, although the content was difficult, it was always delivered with positive actions and insights into tangible and accessible directions for change. Being project- and enquiry-based learning, the resources supported students to acknowledge and engage with real-world problems to develop, through imagination, creativity, and tried and tested methods, solutions that are tangible and achievable. They will not change the world overnight, but they will have an impact locally and support students to believe that they can effect change.

11. The CoDesRes team's expertise and additional experience of project management, workshop facilitation and research skills enabled the scaffolding of these skills in the modules with practical and experiential learning activities that included content and process.

12. The research presented numerous possibilities to develop the programme and extend the place-based STEAM learning into a global context to connect teachers and students and develop peer networks with the potential to create global co-design teams for problem solving. Such exchanges could be integrated into learning opportunities to encourage global student exchanges, e.g. the projects "Seeding Sustainability" and "DREAM Designs" (seven themes and eight micromodules) for linked learning can be transferred, for instance through the international relationship with BioSTEAM,[27] New Mexico (www.stemarts.com/biosteam/home).

26 Eco-anxiety is fear of the future focused around fear of environmental disaster (Clayton *et al.*, 2017).

27 BioSTEAM encourages students to imagine and design their future, now. It is more urgent than ever for our young people to be informed and inspired to respond to the complex challenges of the 21st century, such as climate change, biodiversity loss and the potential, as recently demonstrated, for pandemic diseases.

4 Work Package 3 – Community Transition towards Sustainable Development

4.1 Introduction

This chapter focuses on WP3 and the development of resources enabling community groups to use the pCr methods in their existing projects as an approach to localising the SDGs. The process of engagement sought to raise awareness of the SDGs while building capacity for locally scaled resilience, defined in this instance as the ability to adapt to changing conditions through self-organisation in a local context. To this end, WP3 aimed to develop community resources that included support for governance, organisational structures and step-by-step project development and implementation. This would raise awareness of the SDGs and enable groups to present their existing work within the national and global SDG context while also increasing localisation of the SDGs. Section 4.2 provides an overview of WP3's process and is followed by section 4.3, comprising four subsections presenting the VSM evaluation of the WP (rather than the resources) and the key learning.

4.2 Developing Community Resources

Consolidating local knowledge, particularly that of the WP3 lead, Eleanor Turner, in a situated research practice shaped WP3. Eleanor grew up on a farm in Caherdaniel, attended the Aonad, the Irish-speaking stream of CnS, trained as a marine biologist and has experience of initiating community placemaking projects in south Kerry. At the time of writing, she is completing her PhD, focused on supporting coastal communities in implementing biodiversity and climate policy through place-based engagement. Geographically, the focus was on the Iveragh Peninsula, engaging with south-west Kerry's coastal communities and organisations, the villages between Kells and Castlecove, administered under the Kenmare Municipal District. Projects were identified through local knowledge, professional contacts and the Kerry Public Participation Network (PPN) resource (Kerry Public Participation Network, 2020) with the Clean Coasts interactive web map. The PPNs[28] are local networks that aim to facilitate relationships with community and voluntary organisations and the local authorities. This is the main conduit for citizens to engage with local policy and decision-making, build local capacity and share information on building stronger communities.

As such, the PPN was a useful database for identifying and increasing engagement with the SDGs while tracking localised efforts. The pCr zoning and OBREDIM methods were used to understand which groups had an environmental management aim and sought to engage communities that were operating in the region and if they linked their work to any policy, in particular SDGs 11, 14 and 15. Through the database, we also tracked Local Agenda 21 (LA 21)[29] funding and analysed LA 21-funded projects, where relevant. Most organisations identified through this mapping had aims predominantly conforming to one of three models: a land management project, a citizen science project or an education and awareness project. Several projects also had a secondary community engagement aim.

This process highlighted to the team potential opportunities for how, where and when to intervene in community processes, including developing the Policy Hacking Process (PHP),[30] trialled in the Caherdaniel river restoration workshops. The PHP harnesses the disruptive innovative stage of the VSM's second evaluative criterion – *the strategic intervention tactic*. When used as a project development tool, the VSM

28 There are 31 PPNs with over 12,000 member groups across Ireland (DRCD, 2016).

29 LA 21 is a local government-led, community-wide participatory effort to support environmental protection, economic prosperity and community wellbeing. Groups and organisations can apply for funding that sits within these criteria.

30 The PHP is tailored to an organisation to facilitate an assessment of policy for leverage points – identifying opportunities that groups can use to enable them to understand and reconfigure policy in the context of their project aims and their own terms.

facilitates groups to simultaneously work tactically and strategically. The PHP supported groups to deconstruct policy in line with their own work and projects, shifting the power deficit from simply being regulated to adhere to policy towards using the policies to discuss and position their work.

CoDesRes's launch comprised a weekend of structured activities that illustrated the ethos of the project and simultaneously introduced the project and its aims (OSD, p. 12) to the local community – this is part of building a micro-ecology and also an evaluative indicator of the VSM. WP3 focused on the development of a number of activities and proof-of-concept projects, each one with a different focus and evaluated using the VSM. The CoDesRes team had initially proposed working with the following community groups: the Caherdaniel Japanese Knotweed Group (CJKG), Waterville Lakes and Rivers Trust (WLRT), ACARD Ltd and Cahersiveen Tidy Towns. The idea was to allow the praxis to be considered in different dynamics, foci and projects and contribute to the creation of the community resources. In bringing together a diverse range of knowledge in CoDesRes, the pCr praxis could be expanded to develop accessible resources that could be used without the team's input.

In reality, WP3's engagement was challenging for a number of reasons, none of which were particularly unusual when working in community contexts. For example, owing to different aims and objectives WLRT has split to form the Iveragh Rivers Trust (IRT) and the Waterville Fishing Association (WFA) and, although the WFA remains active, IRT has yet to come to fruition. The CJKG transformed to become the Caherdaniel River Restoration Group. As an emergent methodology, the pCr praxis can readily incorporate change into its processes and the CoDesRes project enabled the team to trial ideas, consider aspects that were successful and gain feedback on how things could be improved or consider what needed revising. Despite significant changes to the original submission, WP3 yielded valuable insights for the community toolkits.

4.3 Vital Signs Matrix: WP3 Evaluation

In this secton we present an overview of the VSM evaluation for WP3's four core criteria. For the full evaluation, see the OSD (pp. 59–65).

4.3.1 VSM criterion 1: building a micro-ecology

Using the OBREDIM log as the first step in the pCr praxis enables the detailed mapping and audit of the local contextual landscape. This includes actors, organisations and projects – cultural and natural heritage, archival and political. Mapping the project landscape begins to identify opportunities for partnership and collaboration to maximise existing resources through sharing and adding value to all partners. It was found that HCCs, such as the Iveragh Peninsula, have extensive networks, a form of social capital, that when mapped can bring added value to projects in the form of skills and resources. In such cases, new relationships can be made, while common or recognised relationships can also be reconfigured. Including local residents in the process to reimagine existing resources encourages local resilience by embedding sustainable practices across environmental and economic aspects.

To be clear, the pCr praxis embeds social, environmental and economic justice considerations into its processes, as well as the ethical framing from open-source culture and technology. This ensures that resources are harnessed for the benefit of the local context and not for profit, unless agreed collectively in advance. The "web of relations", an adaptation of inclusive fitness theory (Hamilton, 1964), tracks the pCr praxis across its interactions and enables a consideration of resource integration in a life cycle analysis, based on inputs, processes and outputs. By capturing this knowledge formally, the project's "web of relations" identifies a micro-ecology of organisations, partnerships and individuals, creating a tangible community of practice through proximity to the project. The extent of the team's knowledge informed the project mapping owing to their personal and professional experiences, which fast-tracked building a complex picture of the peninsula. The CoDesRes launch initiated this by engaging residents and organisations in practical ways.

CoDesRes's launch and subsequent deep mapping supported WP3's macro aim: to develop a local research micro-ecology, demonstrating the benefits of locally embedded researchers in regional research hubs. The research team held fractional contracts, with all research assistants employed in other positions, as is often common in rural/peripheral communities.

As a result of the CoDesRes intervention, team collaboration has extended to activities and organisations beyond the project. Tracking the increased capacity to deliver on other projects and CoDesRes's legacy beyond the project's lifetime shows the tangible benefits of the pCr methodology and ethos. Tracking these benefits illustrates one of the key indicators of the pCr's VSM evaluation: inclusive fitness. The pCr praxis supported the development of new knowledge, which was then reconfigured by the team and community actors. For example, the WP4 joint lead and curriculum developer is, at the time of writing, working with Sea Synergy, increasing its capacity to deliver educational experiences and teacher training. Eleanor Turner, in her new position as the United Nations Educational, Scientific and Cultural Organization (UNESCO) Kerry Biosphere Reserve officer, has since worked with Sean O'Laoghaire (OSD, p. 26) to create StoryScapes (KUBR, 2020), supported by Creative Ireland.

The VSM, combined with the "web of relations", tracked tangible outcomes to further show the impact of a culturally responsive intervention across social, economic and environmental indices. As the project sought to encourage awareness and, more importantly, behavioural change, the web of relations offers a useful way of tracking the spread of the CoDesRes ethos, working methods and approaches. This becomes an effective tool to identify the project's impact, with the VSM indicating the health of a localised ecology – a complex dynamic system.

4.3.2 VSM criterion 2: strategic intervention tactics

CoDesRes found that the Kerry PPN (KPPN, 2019) comprised a total of 711 registered groups, of which only 19 identified as an environmental group. The Iveragh Peninsula (Kenmare district) has 162 community groups, five environmental groups and 16 social inclusion groups. Local knowledge of community groups, their aims and projects showed that, despite a low level of awareness of the SDGs, there is the opportunity to align actions with SDG targets and indicators. Anyone applying for LA 21 funding must be registered with the PPN; therefore, analysing the LA 21 funding awards between 2016 and 2019 gave insights into potential local government-supported SDG activities.

Applying SDG targets to the LA 21 funding review in the 4-year period 2016–2019 showed that the projects receiving support were predominantly biodiversity and awareness projects. No projects during this time focused on mountain ecosystems, which is surprising given that the predominant landscape in County Kerry comprises upland ecosystems. Furthermore, few projects focusing on marine issues were funded during this time period. Only 35 out of a total of 194 projects (18%) funded in this time frame mentioned the marine environment (17 concerning marine plastic and 18 coastal conservation). This figure is also surprising given that County Kerry has one of the longest county coastlines in Ireland and is known globally in the tourism industry for its beach destinations along the Wild Atlantic Way.

In 2020, County Kerry had two Blue Flag marinas and 12 Blue Flag beaches (Blue Flag, 2020), the highest number of any county in Ireland, relevant when looking at the projects that have been funded in the context of the marine environment. The LA 21 funding analysis identified that Sea Synergy, a locally based education and awareness-raising organisation that offers educational workshops on Blue Flag Beaches, has received the largest amount of funding to date. As the awarding of Blue Flags to beaches has a requirement for an educational aspect, the motivation for supporting Sea Synergy is clear. However, LA 21 funding has no clear link to SDG delivery, which led the team to consider how this could be improved on and how the data from this award could be collected to capture any contributions to Ireland's national SDG indicators.

Twenty working partnerships and WP4's work within the community enabled the testing of methods and consideration of ways to share the pCr praxis that could contribute in the longer term to behavioural change. The praxis's inclusive circular co-design approach[31] encouraged awareness of daily impacts in relation to increased participation and localised agency towards finding solutions to address waste,

31 The pCr praxis (McKeown, 2015) has, built into its tools, processes that encourage a systemic approach and life cycle analysis to encourage circular economy principles of both materials and processes. Using the VSM as a project development tool further embeds inclusive design at the heart of the project.

environmental issues and local projects. Examples of this include the Caherdaniel River Restoration project and integrated wetlands, Cahersiveen Tidy Towns and the edible–medicinal trail, as well as the various campaigns and increased community engagement and participation in our projects and partnerships. WP4 encouraged community agency and participation through the intervention of the pCr praxis in the partnerships by sharing new approaches and encouraging participation in existing debates, which could lead to ongoing citizen engagement with policy.

4.3.3 VSM criterion 3: reseeding local knowledge

CoDesRes has seeded ideas in local development organisations, e.g. Living Iveragh and the Cahersiveen Community and Business Alliance, aligned with the local Cahersiveen socioeconomic development plan (Prescience, 2019) and with the CoDesRes ethos of localising the SDGs through peer-to-peer networks. In relation to the CoDesRes team, the research assistants' (RA) UCD annual employment review identified increased skills and confidence for the researchers. As local residents, being an RA, has increased their future capacity through working within an interdisciplinary place-based research project. The sister project, MARplas, in which CoDesRes' principal investigator mentored the project and team, provides evidence of this. Sea Synergy's reputation as a small to medium-sized enterprise (SME) research partner was increased, and the project manager's CV was bolstered, building local capacity and increased social, environmental and economic local resilience.

Since CoDesRes began work with Cahersiveen Tidy Towns, new and highly motivated members have increased the capacity to start new green campaigns within the town, e.g. crisp packet recycling, installing bee hotels, regular clean-ups/beach cleans and native planting. This builds on the expanded understanding of what Tidy Towns is and can be ("more than just litter picking") as promoted through the CoDesRes project, e.g. street feasts, beach cleans and local festivals, such as the Saint Patrick's Day parade. CoDesRes supported Cahersiveen Tidy Towns' submission of an expression of interest to the Towns and Villages Renewal programme[32] to fund the implementation of a three-phase programme of work. CoDesRes's work with the group is ongoing, albeit consciously diminishing as the group evolves. Examples include the CoDesRes's edible–medicinal sculpture trail, research and supporting applications for additional funding submissions and helping the group, in professional correspondence with KCC engineers, to seek permission for planting schemes and trail nodes.

Members have since verbalised their commitment and ambition to promote Cahersiveen as a "green" hub in the south-west and have devised a 3-year plan to this end. CoDesRes also supported a GAISCE[33] student to design and build a website for Tidy Towns – an example of in-service learning[34] – the development of which will continue through the Muinín Catalyst legacy programme during the 2021/22 academic year, following on from the previously brokered relationship in 2019/20 that was interrupted because of the COVID-19 pandemic (see OSD, p. 46).

4.3.4 VSM criterion 4: resituating arts, culture and design

The pCr praxis is a situated, disruptive methodology, employing a creative skillset to harness and represent diverse inputs and bring ideas into being: an acupuncture-like intervention into a localised system. As a slow, durational intervention,[35] evolution of the partnerships and relationships developed through ongoing engagement and the CoDesRes project's lifecycle creates foundations for future

32 Introduced in 2016 and administered by the Department of Rural and Community Development, the programme is funded under Project Ireland 2040.

33 GAISCE – The President's Award is a self-development programme for young people aged 15–25 years, participation in which often begins in TY.

34 In-service learning provides students with experiences of working through a process of applying what they are learning to community problems. This involves cycles of action and reflection as students use their experience as they seek to achieve community objectives and cognitive and emotional understanding.

35 CoDesRes' intervention takes place over time, developed to be generative rather than the "one and done" approach of most development projects or tactical interventional processes. Like the slow food movement, it engages with localised traditions and culture as well as considering existing and under-utilised resources.

projects and collaborations. As an intervention tactic, CoDesRes was inserted into targeted aspects of the geolocation to reveal latent, potential, undervalued or unrecognised information or existing under-used resources. The activities created acted as a means to stimulate the flow of information contained in a localised dynamic environment and the distributed knowledge networks, which are often hidden within HCCs.

On a local scale, CoDesRes' interventions into festivals and celebrations, e.g. Halloween, Christmas, Saint Patrick's Day, 4 May or Heritage Week, developed a number of proof-of-concept projects that reimagined the potential of these events to engage with the SDGs in creative and tangible ways. This process offered foundations on which to build year on year beyond the completion of the research. The projects undertaken increased active participation in activities that sought to encourage a localised leadership from the inside out through supported opportunities to trial new ideas. This builds a competence and confidence that can be harnessed, a conscious process devised to cultivate the conditions for emergent self-organising behaviour. This was demonstrated through Cahersiveen Tidy Towns taking responsibility for Saint Patrick's Day in 2020 (although it was cancelled), Caherdaniel's implementation of the co-developed natural and cultural heritage strategy and Cahersiveen's Wellbeing Festival, 2019.

The last activity, the Wellbeing Festival, was created, managed and promoted by a local resident who had worked closely with CoDesRes in developing the Street Feast, performed in Spookemon 1 and 2 (OSD, p. 24), and had enterprise and innovation support from the principal investigator. In most cases, the CoDesRes team, using their knowledge and experience, supported residents to try something new, in turn building (inter)personal skills and capacity or developing a track record for future funding or scaling up activities. Additionally, CoDesRes's methods supported cross-organisation activities and partnerships, which also strengthened their resilience.

4.4 WP3 – Summary Findings

This section provides a summary of WP3's nine key findings. The upcoming book (Emerald Publishing, 2022), journal papers and other book chapters provide extended discussions (details of which are available at www.codesres.ie/publications).

1. Despite the commitment of significant resources to funding projects at a grass-roots level in the context of SDGs 14 and 15, little of this work was captured or accounted for in Ireland's voluntary national review (DCCAE, 2018a). Reviewing other PPNs to capture these data for Ireland's SDG targets is advised.
2. Analysis of national funding trends in terms of applications and area focus is advised.
3. The CoDesRes approach has contributed to local capacity through its partnerships with community groups, increasing their ability to deliver self-organised projects. Local interest in short- and long-term delivery on SDGs 4, 11, 14 and 15 was further enabled through the creation of accessible ways to inform and disseminate environmental understanding and knowledge.
4. CoDesRes revealed the benefits of a circular economic approach. These include creativity and knowledge sharing, when integrated with the team's field-specific research skills, training and existing local knowledge, with other organisations and projects.
5. The projects created formed dynamic "in-between" spaces and states, locales, professional roles, emergent projects and unique reconstructions of space–place–time, which can be used to confront assumptions around the geolocations where they were enacted. The project's context-responsive approach provided threshold spaces – spaces of opportunity for realising hidden potential.
6. Embedding local researchers framed the participants' engagement in a new context. This spotlighted the nuances of the context often overlooked by those who are familiar with it and unnoticed by those to whom the context is unknown. Furthermore, the reflective logs in the pCr praxis's toolbox encouraged the local researchers to reflect on their experiences and knowledge in ways that would not normally be part of their working practices.
7. The generative experimental nature embedded in CoDesRes's projects brought a playful curiosity to the process of resilient placemaking. Exploring

"I wonder" or "what if" scenarios encouraged a trial-and-error approach, scaffolded by the pCr praxis. In this way, the projects operated as structured improvisations that allowed for the adaptation and complexity that embodies an in-built localised resilience.

8. Playful curiosity is maximised, as the apparent "lightness" of the projects enabled deeper issues around sustainable development or climate action to be presented in engaging, accessible ways. The knowledge gathering that CoDesRes facilitated is an exemplar of how the localised knowledge held within HCC networks is made explicit and harnessed for the benefit of the community, whether this is a geo-specific community or community of interest or practice.
9. CoDesRes raised awareness of the SDGs and the project-specific goals. The capacity for locally scaled resilience was built through self-organisation and sensitive resource management, and the community toolkit integrated the findings from WP3 to provide methods that can be used for developing governance structures and supporting the development of appropriate organisational processes and step-by-step project development and implementation.

5 Work Package 4 – Rapid Media Transition: Upskilling for SDG 11

WP4 was conceived as a capacity-building programme for TY students and the community, involving training in media and 3D printing. This was to support the development of a local maker space and media cooperative. A cooperative was considered as a sustainable way to ensure ongoing access to skills, training and equipment, as the nearest facilities are in Tralee or Cork. This chapter provides an overview of the activities in WP4, the VSM evaluation and a summary of the key findings.

5.1 Introduction

WP4 was designed to support WP2 and WP3 by creating a cohort with media and technology skills who could fulfil the digital documentation of the project while simultaneously developing learning resources. Owing to significant challenges, including the departure of the proposed research assistant from the project, WP4 evolved with the readvertising of the position as a job share. Owing to the unique skillset required, the administration, approval, advertising, interview selection and interviewing was not completed until July 2018, which had an impact on the proposed January–June 2018 period for TY engagement. In addition, a 6-month delay in issuing the principal investigator's contract inhibited the procurement of the necessary media and 3D printing equipment. As a result, WP4's community training commenced 11 months into the project, which had a further impact on the external expertise timetable, delaying the innovation and rapid prototyping training until February 2019.

However, using an adaptive, context-responsive methodology, in combination with the new WP4 leads and the external expertise's resourcefulness, WP4 was reconfigured in a meaningful way to deliver similar outcomes within the constraints of the situation. These outcomes were to:

- enable participants to develop skills to operate camera and audio equipment;
- learn how to transfer audio/footage to a computer;
- develop the use of industry-standard editing software for basic post-production tasks;
- become familiar with storyboarding, saving assets, copyright/ownership, and open-source editing software.

With the rapid prototyping training, WP4's aims were to enable participants to:

- develop skills to operate the 3D printers and the extruder;
- learn how to develop and manage 2D models for 3D printing;
- develop their use of modelling software to complete basic production;
- become familiar with innovation, open-source and circular economy concepts.

In addition to the impacts previously mentioned, COVID-19 restrictions meant that rapid prototyping facilities were inaccessible, further halting training. We plan to resume training through SMARTlab Skelligs, an interim precursor to the Ballroom project (see section 6.3.3).

5.2 Vital Signs Matrix Evaluation

The next section demonstrates how the VSM evaluation tool was used for WP4 to present an overview of the four core VSM criteria, which serve as indicators of particular activities. The full VSM evaluation is provided in the OSD (p. 59).

5.2.1 VSM criterion 1: building a micro-ecology

The initial rapid media cohort was recruited from local partnership organisations, self-employed residents and small businesses. Training members of active organisations would enable potential cooperative members to use the shared equipment within their organisations and support each other to create media content on an ongoing basis. CoDesRes met with interested participants to gain an understanding of

what they hoped to achieve, and to optimise training and ensure success and attendance. The group attending the initial meeting knew each other, yet had not worked together, and did not fully understand the work or the aims of the others' organisations; thus, the meeting providied an important opportunity for knowledge exchange. The same approach was used to recruit the rapid innovation community cohort, while additionally broadening the reach of WP4 through social media and word of mouth.

5.2.2 VSM criterion 2: strategic intervention tactics

The rapid media project was designed to enable participants involved in community-based projects and events to gain training in pre- and post-production skills. Building this capacity with access to equipment facilitated participants' ability to promote their own work, at the same time developing collaborative approaches to delivering on SDGs 4 and 11. Such organisations are often under-resourced, and having access to a shared equipment library with a supportive peer cohort would enable them to produce engaging, high-quality content and potentially increase their capacity to deliver their projects and services. The opportunity to work with the WP4 co-lead, media production company Bold Puppy's director, developing basic skills and sharing industry tips, instantly increased the quality of their media content. The CoDesRes team was the first to use the library's new state-of-the-art video-conferencing system for the training programmes: media, 3D printing and virtual reality/augmented reality training. Furthermore, an embedded research team and its institutional links demonstrated tangible examples of maximising existing resources strategically and tactically to contribute locally to the aims of SDGs 4 and 11.

5.2.3 VSM criterion 3: reseeding local knowledge

By purposefully convening a micro-ecology (creating a set of relationships within a micro-environment), the cross-pollination of knowledge through the participant cohort's interactions facilitated the revelation of hidden or undervalued tacit knowledge, resources and relationships. Local expertise was further embedded in the project, informing the peer-learning process by integrating shared place narratives into the training. This strengthened the ability to work collaboratively and supportively to expand existing practices, creating a "narrative biodiversity", which potentially enriches future project development, delivery and, ideally, their impact. Creating a biodiversity of narratives challenges the dominant narrative and, within a psychosocial ecology such as environmental biodiversity, this helps to strengthen locally scaled resilience across the system.

5.2.4 VSM criterion 4: resituating arts, culture and design

CoDesRes also offered a week of intensive training in mixed reality (virtual and augmented reality) with Dr Zi Siang See (University of Newcastle, SMARTlab Australia), and a public talk by Stephen Howell (Microsoft). Participants attending the workshop achieved a SMARTlab Mixed Reality Development Skills – Level 1 certificate, while those attending the talk had access to state-of-the-art innovation and emerging technologies, and insights into their impact on future education and work.

5.3 WP4 Summary Findings

WP5 summary findings are presented below, with full details in the OSD (p. 66):

1. Embedding a team of skilled researchers with institutional links creates opportunities for learning digital skills and emerging technology in community contexts.
2. WP4 aligned to SDG 4 – Quality Education and SDG 11 – Sustainable Cities and Communities through locally relevant, innovative training activities. CoDesRes's delivery pre-empted recommendations from the Cahersiveen socioeconomic plan (Prescience, 2019), the educational review (NCCA, 2020) and the EGFSN governmental think-tank (DETE, 2020).
3. Engagement with emergent skills was made possible by research and third-level input. Such skills are uncommon in many rural contexts, furthering the argument for embedding interdisciplinary researchers and establishing local facilities.
4. Longitudinal research is needed. CoDesRes contributed to the skillsets required for

SDG 9 – Industry, Innovation and Infrastructure and SDG 8 – Decent Work and Economic Growth through upskilling and capacity-building for SMEs, local employment and support services.

However, to capture the extent of the impact and contributions to the SDGs' targets and indicators, longer-term tracking of the impact of the research would be necessary.

6 CoDesRes Impact, Legacy and Beyond

Between January 2018 and May 2020, CoDesRes ran 183 activities, directly engaged with 4599 participants, attracted 5467 digital platform followers and published 59 written outputs (blogs, articles, reports and papers), with 20 working partners delivering 12 discernible impact factors. Chapter 6 presents the diversity of the research's impact. Sections 6.1–6.3 demonstrate CoDesRes's contributions to society, assessed using SFI's impact framework (SFI, 2013). Section 6.4 outlines how CoDesRes had an impact beyond these classifications, achieving and surpassing its initial targets (see Appendix 1, Table A1.3). The social, environmental and economic impacts of the VSM are reported in Tables 7–12 in the OSD (pp. 58–70).

6.1 Social Impacts

In this section we present the research's social impact in terms of two impact factors: community upskilling (section 6.1.1) and citizen science (section 6.1.2). SFI's criteria for social impacts define beneficiaries, in the main, as "individuals, groups of individuals, organisations or communities whose quality of life, knowledge, behaviours, creative practices or other activity have been influenced positively" (SFI, 2021).

6.1.1 Impact factor 1: community upskilling

CoDesRes led activities that incorporated the pCr praxis in training to develop the individual and community capacity to analyse a problem and recognise and reconfigure existing resources, both human and physical, so as to use these resources more effectively. This supported the trialling of new solutions, further tapping into new resources that aligned with the SDGs, resulting in an improved analysis of outcomes and how to improve future iterations. The design and execution of WPs 2, 3 and 4 resulted in the development of step-by-step, easy-to-use resources, which facilitated a process that promoted and supported self-organisation and localised agency.

Furthermore, the pCr's SMART(ER) objectives benefited the project and its specific local context. The pCr methods enabled the project to develop useful ways to share the pCr principles, to develop the foundation for the place-based STEAM educational and community resources to build local capacity (see below), and to introduce the circular economy. The United Nations Development Programme (UNDP, 1990) recognises that community capacity-building is an ongoing long-term multi-stakeholder process, advocating the active participation of all sectors of society: citizens, governments, international organisations, non-governmental organisations (NGOs) and charities. As a disruptive arts-led approach within the context of long-standing knowledge networks, CoDesRes encouraged self-organisation to reimagine local possibilities through nine distinct actions:

1. seven proof-of-concept interventions and step-by-step plans for community projects;
2. a series of formal and informal education interventions to localise the SDGs;
3. producing open-source resources (SDGs 4, 11,14 and 15) freely available at www.codesres.ie/resources;
4. Caherdaniel River Restoration project natural and cultural heritage strategy and implementation plan and pilot project;
5. securing Muinín Catalyst legacy programme funding to build and trial the education SDG toolkit – €50k with continued development and delivery by Future Focus21c, a spin-out company;
6. a successful Rural Regeneration Development Fund bid in partnership with KCC – €200k to develop a "shovel ready" feasibility for place-based STEAM education and a placemaking research, development and innovation centre of excellence in Cahersiveen;
7. the development and transfer of the project's circular economy focus and co-design approach to SDG 14 through the EPA-funded sister project, MARplas, addressing marine plastic waste in coastal communities through innovation and local sustainable enterprise and continuing to

contribute to six part-time employment positions and additional learning resources;

8. embedding an upskilled research team within the local context, with economic impacts demonstrated through employment positions and new professional collaborations;
9. establishing an educational development spin-out company, Future Focus21c.

6.1.2 Impact factor 2: citizen science

Through the project, participants became active contributors to research, as well as becoming active researchers themselves, including:

- uploading to the National Biodiversity Data Capture app[36] images of native flora taken during the "Incredible Edibles and Medicinal Plants" mapping and walk with a medical herbalist;
- participating in the seaweed information and tasting session, informing attendees of the chemical and biological processes of seaweed and the importance of seaweed for healthy marine ecosystems;
- undertaking source-to-sea catchment sampling in the "Sensing the Catchment" STEAM event (see the OSD, p. 24);
- using the SDGs 14 and 15 toolkit, including accessible scientific content within the resources;
- facilitating the development of a future partnership, the "LIVE project", which will integrate ecological expertise into CoDesRes legacy work at CnS.

6.2 Environmental Impacts

An assessment of environmental impact provides an indication of how effectively the built world integrates with nature. Being able to integrate effectively with nature through sustainable practices benefits individuals, groups and society. This section describes how CoDesRes has contributed to sustainable development and considers its impact on the environment, particularly at a local level. The subsections set out CoDesRes's contribution to developing this conversation and stimulating localised engagement with the SDGs and other national policies to create a foundation for accessing the wider policy context.

6.2.1 The CoDesRes policy context

Within the CoDesRes micro-ecology, the lack of awareness of the SDGs was only one of a number of policies and local initiatives that are not generally understood or used in local development. CoDesRes revealed a general lack of awareness and little or no engagement with national plans, e.g. Project Ireland 2040 (DPER, 2018, 2019) or the Marine Planning framework (DHPLG, 2018). Furthermore, knowledge of the local area development plans or the KCC Climate Adaptation Strategy consultation (2019b) was limited, inhibiting community participation in these agendas. Some local groups were unaware of the PPN, which, among other services, advertises funding, although in some instances membership is mandatory for funding eligibility. Finally, understanding around climate change showed little sense of the urgency or required changes; for example, there was minimal awareness of the reports from the Intergovernmental Panel on Climate Change (IPCC) and the scale of the issue was considered sceptically.

6.2.2 Impact factor 3: supporting SDG policy

CoDesRes's activities raised awareness of the SDGs and provided opportunities for citizens to participate in national efforts to achieve them by operating as a strategic intervention tactic to develop localised understanding and meaningful interventions towards meeting the 2030 Agenda and to facilitate longer-term engagement. It is clear from the outputs that awareness, education and understanding of the SDGs in the local context have been enhanced by engaging citizens with the CoDesRes research activities. Many of the students and the community groups the project worked with had not heard of the SDGs, and those that had did not know about all 17 Goals, their history or the 2030 Agenda. Evidence of this was apparent in both discussion and the baseline learning that the project supported.

Through the development of initiatives to increase the awareness of the SDGs within the school and the wider community, CoDesRes facilitated practical,

36 National Biodiversity Data Capture application (https://www.biodiversityireland.ie/resources/apps/; accessed 23 November 2021).

locally scaled solutions that contribute positively to the combination of social, economic, environmental, cultural and political conditions. These factors have been identified as essential for communities to flourish and fulfil their potential (What Works Centre, 2017). Through the development and production of self-organised projects, systemic approaches and innovative models, CoDesRes contributed to the following SDG targets (www.unsdgproject.com):

- 14.1: By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution.
- 15.1: By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species.
- 15.5: Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species.

Local organisations leveraged CoDesRes's knowledge exchanges for local action, approaching the team for advice regarding how to present projects and develop organisational capacity and undertake strategic planning. For example, the Caherdaniel river restoration workshops (May–October 2019) proved successful in expanding the group's understanding of engagement with policy and how this could be used to present its work as relevant to broader stakeholders. CoDesRes's structured process crafted a strategic plan to support the group's transition, as well as improving the health of the river ecosystem by capturing the community's awareness and engagement with the local environment. The process raised awareness of national policies to leverage opportunities that may have been overlooked or not been considered and that may support innovative and radical approaches to waste in marine and terrestrial environments, for example sculptural reed bed/landscaping. The research developed an innovative approach to policy "leveraging", the "Policy Hacking Process" for communities, which is now part of the community development toolkit. The Caherdaniel River Restoration Group is now implementing its roadmap, commencing with a programme of citizen science activities and a pilot project.

Since CoDesRes's inception, local and national SDG policy initiatives and activities have increased, an example being the national educational "Take One" campaign (December 2019).[37] CoDesRes contributed three SDG activities within the school, namely the development of the SDG 14 resources, the beach cleans and the coordination of the Green School programme, in particular the new flag, Global Citizenship – Marine. This increased awareness of existing policy (within marine and terrestrial ecology). CoDesRes presented to CnS's Board of Management and parents' council, informing the school community about contemporary education approaches and development opportunities within sustainable environmental practices.

In addition, the collaborative partnership between CnS and Cahersiveen Tidy Towns, brokered by CoDesRes, provided an SDG 15 programme of work including composting, rewilding and biodiversity, food growing and waste initiatives (OSD, p. 50). Although the ambition to further develop working together during the project lifespan was thwarted by the COVID-19 pandemic, the team was able to embed aspects of the programme (food growing, biodiversity and sustainability) in the 1 km wellbeing Greenway being developed through the Muinín Catalyst legacy programme between September 2020 and May 2021. This partnership, and our experience of working with the GAISCE student, also formed the foundation of in-service learning and engagement with local challenges, which will be explored within Future Focus21c, the spin-out company from the research.

Working with community organisations enabled CoDesRes to gain understanding and insights regarding the obstacles and inhibitors to behaviour change, informing the development of the community resources to augment gaps in local capacity. Evidence

37 "Take One": during Take One Week in December 2019, each teacher was asked to teach about one SDG to one class group over the course of 1 week. The programme has received endorsement from the Centre for Schools Leadership (CSL) for providing leadership learning.

of localised engagement with SDGs 4, 11, 14 and 15 can be demonstrated through the following activities:

- mentoring a University College Cork (UCC) student and a Cahersiveen Tidy Towns member to undertake a biodiversity and sustainability report and use the National Biodiversity app to upload findings;
- the recruitment of new, highly motivated Cahersiveen Tidy Towns members who, with CoDesRes team input, implemented changes to practices and thinking regarding native planting and maintenance, including new activities within the edible–medicinal landscape project;
- Cahersiveen Tidy Towns' creation of a 3-year plan that includes a native planting scheme, management of green spaces and ambition to recreate Cahersiveen as a Green Hub and, with the aid of CoDesRes, submission of an expression of interest for €43.6k to the Town & Village Renewal Scheme[38] to support this ambition.

CoDesRes developed community projects and shared local project activities on social media channels (5467 digital followers) to raise awareness of the SDGs and highlight the project-specific SDGs 4, 11, 14 and 15. Such activities included:

- contributing to local/public discussions and submissions on the Greenway through Cahersiveen Tidy Towns, Acard Ltd and the Alliance with strategic input from Dr Damian Ó Tuama and submission comments that were noted during the public hearing;
- contributing to understanding on the future of work and broader economic possibilities as part of KCC consortium's successful €1m bid to the Rural Regeneration Development Fund;
- expanding discussions on social media around the SDGs, our four Goals and their local implementation.

6.2.3 Impact factor 4: public policy

Within the context of the SDGs, CoDesRes's methodology readily lends itself to working with the interconnected strategy of the Global Goals with country- and region-specific policy consideration. CoDesRes identified opportunities for enhancing policy adherence through offering additional points of reference and relevance for community organisations to discuss their work. This was invaluable for developing strategic partnerships, fundraising or presenting the relevance of existing work or new initiatives, beyond a locally specific context.

CoDesRes's impact in the arena of education policy and development has national policy significance. Input from students, teachers and the principal of our host school, and from those in other schools who have experienced the place-based STEAM approach and resources, affirmed the value of the approach for supporting learners and teachers. This not only informed the development process of the resources, but also offered an evidence-based approach that will be valuable for implementing future insights and requirements of the senior cycle review. The National Council for Curriculum Assessment's review and the Organisation for Economic Co-operation and Development's (OECD) evaluation confirm that the purpose of the senior cycle seems "narrow for Ireland's future aspirations" (OECD, 2020, p. 3). As outlined by the OECD (2020), it will require commitment and trust from stakeholders in the educational community and the wider landscape to push beyond the findings of the review process. The findings from CoDesRes and its legacy, namely resources and a proposed beta programme to scale trialling, allow the risks identified by the OECD in trialling new approaches to be managed. CoDesRes's recommendations offer an opportunity to facilitate the transition from the long-standing tradition in which the senior cycle is rooted.

By contributing to community development and regeneration in practical ways, and using multiple non-academic formats and inclusive communications to present the research as it unfolded, CoDesRes stimulated local action on the SDGs (see Tables 1 and 7–12 in the OSD, pp. 58–70). Furthermore, achievements from CoDesRes had impacts on policy noted in the local development plans (KCC, 2015b, 2019a), the socioeconomic plan (Prescience, 2019) and the local climate adaptation strategy (KCC, 2019b).

6.3 Economic Impacts

CoDesRes sought to address economic impact through the creation of skills and resilient practices, rather than direct economic revenue or job creation.

38 https://www.kerrycoco.ie/town-village-renewal-scheme-2021/ (accessed 23 November 2021).

This was a strategic action, with the money benefiting local projects directly and successful applications being combined with mentoring to deliver larger-scale projects, upskill employees and expand the organisations' track record in delivering these larger-scale projects. In this section we outline the areas in which CoDesRes interventions contributed to a positive economic impact.

6.3.1 Impact factor 5: expanding local economic activity

Over the project's lifespan, CoDesRes raised an additional €359.1k in funding for legacy projects (new projects that emerge from the original project) and €41.2k in in-kind contributions, multiplying the initial investment of €165k over 2 years by approximately 2.25. This has meant a total investment of €502k in the region, contributing to the employment of ten people, eight of whom lived in the region. The per person cost of direct engagement (calculated as €165,000/4482) equates to €36 per person over 2 years. The positive financial ripple effect of CoDesRes, using a standardised multiplier effect of 1:3 (i.e. each local euro of new funding circulates three times) and the stimulation of new funding (1:2, on the same basis), increased disposable income through local expenditure. This increases stability and resilience through subsidising the incomes of small and local business activities and shows the value of embedded/local research satellites and that research is likely to continue to generate revenue and support for activities in the region.

In addition, the project and its legacy funding from Living Iveragh and CPL plc, Ireland's largest recruitment company, has enabled the development of two more modules (six additional SDGs), "Dream Designs" (repurposing derelict buildings) and "Seeding Sustainability" (1 km health and wellbeing trail developed and implemented by students using the module resources). Each module comprises eight micromodules across seven subjects, each with lesson plans, teachers' guides, worksheets and blended learning resources. Furthermore, this funding has supported additional micromodules addressing eco-anxiety and digital literacy. Finally, the legacy project has also supported the development of a spin-out company for learning development within place-based STEAM and sustainable design thinking.

Participation on the executive committees of the recently formed Cahersiveen Community and Business Alliance and ACARD Ltd facilitated ongoing contributions to discussions and raising awareness of the importance of engaging with the SDGs. In addition, there is a need for more agile and participatory opportunities and governance regarding climate, work and local priorities. This includes developing the activities that were outlined with the recent socioeconomic plan for Cahersiveen, whether evolving protocols for simple commonplace actions, e.g. agendas, minutes and governance structures, or engaging strategically with policy.

6.3.2 Impact factor 6: economic activity aligned to the SDGs

The CoDesRes project's key economic impacts are most closely aligned to the specific targets/indicators for SDG 4 – Quality Education and SDG 11 – Sustainable Cities and Communities:[39]

- Target 4.4: By 2030, substantially increase the number of young people and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship.
  - Indicator 4.4.1: Proportion of youth and adults with ICT skills, by type of skill.
- Target 11.A: Support positive economic, social and environmental links between urban, suburban and rural areas by strengthening national and regional development planning.

Since CoDesRes began in 2018, KCC has employed an economist to create a socioeconomic development plan, 2019–23 (Prescience, 2019). One of the plan's recommendations is "to introduce and trial 3D printing and other additive manufacturing technologies for educational, enterprise, cultural, artistic, social and environmental use and benefit" (Prescience, 2019, p. 27). This was an activity already delivered through WP4's local organisations' media and rapid prototyping training. The rapid innovation/prototyping module was to be delivered through an engineering training module, which was adapted for the school and

39 SDG 4 has seven outcome targets with three means of implementation and SDG 11 has seven targets with three means of implementation (https://www.un.org/sustainabledevelopment/; accessed 23 November 2021).

community contexts. Completion of this was delayed by COVID-19 restrictions and will be restarted once these restrictions are lifted.

The Future of Work event (see the OSD, p. 5) was devised to introduce future possibilities in terms of careers, jobs and opportunities and the future-ready skills that will be in demand. It was also conceived to identify changes to professions that technology and research are bringing to the world of work. This was suspended because of COVID-19 and has been rescheduled. It will hopefully take place during the 2021/2022 academic year. The Future of Work event is important for the local community, perhaps more so now than originally envisaged, as the understanding of "no longer business as usual" has been brought sharply into focus with the COVID-19 pandemic. Topics that were the subject of local conversations as recently as February 2020, for instance the vulnerability of tourism, the need for future-ready skills, particularly technology, and potential threats to travel, but which were downplayed at the time, have since come to pass.

Necessary contemporary approaches around innovation and enterprise are embedded in the CoDesRes core PTP module, which was shown to be effective during trials of the resources. Five of the students we worked with using the PTP module in Cahersiveen developed projects that could have evolved into start-ups; however, the motivation to proceed was not sustained, despite follow-up by the team. The PTP module delivered with the Donegal students and the MARplas project led to them developing the concept of a Youth Innovation café and potential products. Although this does not show direct economic impact, it demonstrates the efficacy of both the CoDesRes resources and approach to develop future-ready students with the foundations for innovation, enterprise and the creative approach to future challenges.

The impact of activities from the P2P module, and CoDesRes's embedded researchers as part of the research design and the legacy projects (see section 6.3.3), collectively demonstrate the early-stage contributions to SDG 8 – Decent Work and Economic Growth and SDG 9 – Industry, Innovation and Infrastructure, even though these were not the focus of CoDesRes. The pCr praxis is a systemic approach that factors in social, environmental and economic health to its processes; therefore, CoDesRes, in contributing to SDG 11, always considered these elements in its research design. By situating a project that focused on innovative processes for SDGs 4, 11, 14 and 15 and embedding researchers in a rural community, CoDesRes is itself a proof of concept. The project provides evidence for applied research and systemic enquiry to achieve impact beyond the initial research question, e.g. tangible economic benefits through employment and leveraging local resources.

6.3.3 Impact factor 7: legacy projects

Despite the time specificity, CoDesRes had an exit and maintenance strategy built into its methods to ensure that, from the beginning, pathways to ongoing work were generated by simulating the generative conditions of a healthy resilient ecosystem. The development of the projects, as legacies of CoDesRes (Table 6.1), will, we estimate, support the impact of CoDesRes.

Aspects of CoDesRes's underpinning pCr praxis (McKeown, 2015) were biomimetically designed, influenced by evolutionary biology and the emergence and complexity inherent in the planet's physical systems. As an eco-psychosocial intervention, the praxis's methods ensure that the development of legacy projects is a key output from the process. The process is designed to be generative, with legacy projects seeding knowledge from the original project, in this instance CoDesRes. By maximising the resources realised in a project, a dynamic ongoing process of behaviour change can be cultivated; for example, integrating the need to diversify the area's economic opportunities and to use Kerry's outstanding physical attributes underpinned a successful CAT 2 application to the Rural Regeneration Development Fund.

This is to undertake the foundational work to repurpose a large derelict ballroom in Cahersiveen town centre, as a research, development and innovation centre of excellence focused on place-based STEAM and sustainable placemaking. This will also host a repair cafe and library of things, as well as a research institute with an immersive "edutainment" centre focused on Earth systems science. The project's feasibility and development process has also been devised to act as a tangible educational activity for the community, linking into in-service learning

Table 6.1. Summary of CoDesRes legacy projects

Project	Summary details	Organisation	SDGs
Net Re-use	Bord Iascaigh Mhara – €25k co-design and community engagement; local marine plastic waste solutions focusing on Kerry, Howth	Sea Synergy, south Kerry	4, 8, 9, 11, 14
MARplas	EPA STRIVE Green Enterprise €75k scale-up of Net Re-use × 3 regional case studies (Cork, Donegal, Clare/Galway) local marine plastic waste solutions	Sea Synergy, south Kerry	4, 8, 9, 11, 14
The Ballroom, Cahersiveen	Rural Regeneration Development Fund – €200k CAT 2 successful "shovel-ready" bid, place-based STEAM centre of excellence – in partnership with KCC	Living Iveragh, south Kerry	4, 8, 9, 11, 12 13, 14
Muinín Catalyst	CPL plc with Living Iveragh – €50k successful funding to deliver an additional year to develop the educational toolkit and resources for further modules	Art Services Unincorporated and Greenspace Education	4, 8, 11
Pilot river engagement	EPA events funding – €4.3k to undertake an initial pilot project as recommended in the strategy document	Caherdaniel River Restoration project	4, 11, 14, 15
Expressions of interest (submitted grant)	KCC and the Towns & Renewal Scheme, €43.6k Main Street animation – €121k Both expressions of interest build on the CoDesRes work to localise SDGs 11, 12, 13 and 15	Cahersiveen Tidy Towns Living Iveragh	11, 14,15 11, 12, 13, 15
SFI Discover Programme (submitted grant)	Initial submission (€300k) unsuccessful but evolving into regional pilot model with Kerry Education Training Board	Future Focus21c designated activity company to continue the Muinín Catalyst programme	4

and apprenticeships, research and teacher training from early years to third level. The ballroom will also support education and training initiatives that develop the skills necessary for the future of work, e.g. peer-to-peer, business-to-business, the circular economy, blockchain, Internet of Things/Fourth Industrial Revolution and those sectors not susceptible to replacement by robotics or artificial intelligence.

To further the research's ambitions, CoDesRes is pursuing the possibility of a regional pilot with Kerry Education and Training Board through the legacy project Muinín Catalyst. CoDesRes's findings and broader pedagogical perspective were presented to the Green Party's Working Group for Education, and our in-service CPD began in spring 2021. Longer term, CoDesRes aspires to have the TY resources formally recognised by the Department of Education and Skills and, as part of this process, has presented to Kerry Education and Training Board, with a view to a regional roll-out of a beta programme and further developing its in-service CPD.

The development of the proposed rapid media cooperative has two strands: (1) as a community and youth cohort that support each other's projects and (2) to offer a low-cost subscription service to facilitate the local hire of media equipment. As part of CoDesRes's exit strategy, the equipment will be held in trust by Living Iveragh, a small, local, designated activity company focused on innovation, entrepreneurial education and research. The media cooperative will support residents to access work opportunities in south Kerry through accessing hire services readily available in urban centres, but which are often non-existent in rural contexts, while reducing consumption by sharing resources. A local production company has already made use of the equipment, an activity that can continue to be supported with the coordination and management of the equipment and development of the cooperative concept through the Muinín Catalyst programme and the Ballroom project.

6.4 Beyond Impact Factors: People, Place and Performance

This section outlines CoDesRes's impact beyond the SFI's societal impact classifications, highlighting the impact generated beyond its initial targets, aims and objectives as a result of using a systemic methodology (see Appendix 1, Table A1.3, and Tables 7–12 in the OSD, pp. 58–70, which show the full VSM evaluation including the social, environmental and economic impacts).

6.4.1 Impact factor 8: in-migration

CoDesRes found that new business and civil society initiatives in the region were often implemented by those returning to Kerry (e.g. Skellig Six18 Distillery) and those who have chosen to relocate as they see enterprise opportunities (e.g. Asana School of English) and are also motivated by sustainable local employment and opportunities. Those returning or relocating bring skills attained from working in corporate sectors after university, particularly organisational and strategic skills and interpersonal skills gained through diverse experiences. Conversely, in the purview of this project, it was found that the impact of out-migration can contribute to a lack of diversity of skills and capacity in voluntary organisations. CoDesRes focused skills and expertise in the local context, to support building existing capacity, and in combination with local expertise and new initiatives explored new avenues for engagement and capacity-building.

6.4.2 Impact factor 9: knowledge exchange and community upskilling

Local organisations leveraged CoDesRes's knowledge exchanges for local action, approaching the team for advice about how to present projects, develop organisational capacity and undertake strategic planning. For example, the Caherdaniel river restoration workshops (May–October 2019) proved successful in expanding the group's understanding of engagement with policy and how this could be used to present its work as relevant to a broader range of stakeholders. CoDesRes's structured process crafted a strategic plan to support the group's transition, as well as improving the health of the river ecosystem by capturing the community's awareness and engagement with their local environment. The process raised awareness of national policies to leverage opportunities that may have been overlooked or not been considered, which may support innovative and radical approaches to waste in marine and terrestrial ecosystems, e.g. sculptural reed bed/landscaping. The research supported an innovative approach to policy "leveraging" for communities, which is now part of the placemaking and community development resources.

Ongoing opportunities for dissemination of the project's outputs will be leveraged through three place-based legacy projects: Muinín Catalyst educational programme, the Ballroom project and MARplas. Discussion initiated with CoDesRes and MARplas with the Centre for Sustainable Design, University for the Creative Arts, Farnham, UK, and the BCE project (UK, Ireland, Sweden, Norway)[40] are ongoing, with a view to providing access and linking participants at MARplas' local innovation workshops to business/enterprise expertise from the Centre for Sustainable Design, Dr Martin Charter/Western Development Commission and the Circular Oceans Innovation Labs (COINLabs) initiative. An invitation to present the methodology (MARplas shares the pCr praxis) to the BCE stakeholders by the Irish partner, the Western Development Commission in Galway, was withdrawn owing to COVID-19 and the event will be rescheduled in 2022.

6.4.3 Impact factor 10: employability and career development

A key aim within CoDesRes's original application was to mentor and develop emerging researchers, evidenced through published journal submissions and conference presentations (see the OSD, p. 10). In addition, the WP3 lead used her experience with CoDesRes and the legacy MARplas project in a successful application for the position of Kerry UNESCO Biosphere Reserve Officer. CoDesRes's principal investigator has been invited to mentor an artists' project in Carlow, the Drummin Bog,[41] increasing the capacity to develop links with Carlow's

40 The Blue Circular Economy Project (https://bluecirculareconomy.eu; accessed 20 December 2021).

41 The Drummin Bog Project (https://drumminbog.com; accessed 23 November 2021).

local authority for disseminating the project's findings. Carlow's local authority has recently submitted a funding application for arts-led behaviour change using the pCr praxis as its methodology. Ongoing connections have also been made by the principal investigator with UCC researchers to co-develop Kerry research projects through invited attendance at UCC's Creative Connections[42] project. It is hoped that in the longer term this could link to work with the Kerry UNESCO Biosphere Reserve beyond the CoDesRes. Other impacts include:

- Ecostructure[43] researcher requesting CoDesRes findings.
- Research assistant Ms Eleanor Turner successfully applied for the Kerry UNESCO Biosphere Reserve Officer's role.
- Disseminating the pCr praxis: mentoring, local authority and university engagement.

6.4.4 Impact factor 11: international connections

Connections developed for further exploration include:

- STEMarts Lab/BioSTEAM lab collaborations in autumn 2021,[44] and cited in National Endowment for the Arts field scan (Chavez, 2021);
- Professor Ted Jojola,[45] Director, Indigenous Design + Planning Institute, Community & Regional Planning Program, University of New Mexico, USA;
- Centre for Sustainable Design, University for the Creative Arts, Farnham, UK, and Blue Circular Economy[46] (BCE);
- the principal investigator presented CoDesRes as co-keynote speaker at the Gener8tor Psychology of Place Conference, Indiana,[47] to tech start-up founders and accelerator managers (investors);
- the principal investigator was nominated for inclusion for the Women's Economic Forum's Women Awards – Creating a Better World for All – for place-based STEAM/social enterprise;
- the principal investigator was invited to join Creative Placemaking Communities, USA.[48]

6.4.5 Impact factor 12: placemaking

As a systemic approach to working with place, the pCr praxis acknowledges social, environmental and economic factors and, as an intervention into education and placemaking, supports the planning, design and management of public space through community-led change. Although focused on localising the SDGs, CoDesRes was an integrated approach and supported and promoted policies beyond the SDGs and the 2030 Agenda. This included development [Project Ireland 2040 (DPER, 2019), the KCC local development plan (2016–2022) (KCC, 2015a) and the Cahersiveen socioeconomic plan, (Prescience, 2019)], education and future-ready skills gaps (DES, 2014, 2015; NCCA, 2019), or the bio-psychosocial, such as the European Green Deal (European Commission, 2019).

The increased level of engagement with the SDGs resulting from CoDesRes has extended into the communities and local organisations, and through increased engagement with KCC events and other national campaigns that contribute to the SDGs. Campaigns included Conscious Cup, Clean Coasts, Big Clean and the 2030 Agenda, in particular SDGs 3, 4, 7, 8, 9, 11, 12, 13 and 17. The CoDesRes team also contributed to local development and policy discussions by:

- contributing to local and public discussions on the local area, including submissions to the KCC sustainable development plan and socioeconomic plan;

42 UCC Creative Connections (https://peatlands.ucc.ie/author/peatlands; accessed 23 November 2021).

43 The Ecostructure project involves five leading universities in Wales and Ireland that are researching and raising awareness of ecoengineering solutions to the challenge of coastal adaptation to climate change (https://www.ecostructureproject.eu; accessed 23 November 2021).

44 http://www.stemarts.com/biosteam/home (accessed 23 November 2021).

45 https://saap.unm.edu/people/faculty/theodore-s-jojola/index.html (accessed 23 November 2021).

46 The Blue Circular Economy is a transnational project funded by the Northern Periphery and Arctic Programme that helps SMEs offering products and services in fishing gear recycling solutions to attain a great market reach. https://bluecirculareconomy.eu/

47 https://www.gener8tor.com/ (accessed 20 December 2021).

48 https://cpc.cpcommunities.org (accessed 20 December 2021).

- contributing to Kerry Green's sustainable development submission to KCC;
- attending the "Silos to Systems – Connecting Stakeholders/Facilitating Citizen Engagement on Climate Action and the SDGs" talk at the National Dialogue on Climate Action event/EPA funded;
- presenting to KCC's Head of Services and Head of Economic Development Unit – presentation entitled "Circular Economies and SMEs";
- contributing to the Kerry Greenway public hearing on behalf of Cahersiveeen Community and Business Alliance (CCBA) and Acard Ltd;
- coordinating CCBA's submission to the Bank of Ireland Begin Together programme meant an €5000k award as a finalist for Ireland's most enterprising town. This can now be used as match-funding for future funding applications to benefit the town.

7 Concluding CoDesRes: Its Meaning for Present and Future Ireland

CoDesRes was a time-limited project. As such, it sought only to demonstrate proofs of concept and initiate, demonstrate and evolve a methodology that had been trialled in other locations, as an approach to localising the SDGs through self-organised responses in rural Ireland. In this chapter (see also Table 13 in the OSD, p. 70) we present a series of learnings, recommendations and ambitions for present and future Ireland that have emerged. These present interwoven challenges and opportunities in the local, regional, national and international arenas. Importantly, CoDesRes offers transferable learning and a praxis for a scalable model that can be applied and easily adapted to local educational and community contexts in other rural and coastal areas.

7.1 Community as Expert, Change-maker and Leader

Learning 1. The experts on the "local" are often local residents who have a nuanced understanding of the location and its sociopolitical dynamics and knowledge of its strengths and weaknesses. The CoDesRes praxis further leveraged this "insider" knowledge to build local capacity, facilitate more strategic self-organisation and enable new perspectives.

Learning 2. Embedded and/or resident research capacity supports community development. As embedded and residential researchers, the CoDesRes team brought additional and potentially under-used contextual knowledge to the project and had existing interpersonal and trusted relationships. CoDesRes's embedded research model and praxis ensured that bias was acknowledged and accounted for and laid the foundations for collaborative problem-solving and learning.

Learning 3. It is apparent that, although there are localised skills, talent and opportunities for intervention, these are often unrecognised or under-used. This is not specific to the Iveragh Peninsula; indeed, this is a global concern and informed the conception and development of the pCr praxis (McKeown, 2015). Within the local Kerry context, self-organisation was evident and measurable through citizen engagement and active leadership in local activities. However, there is room for growth in local capacity that is not always recognised. Bringing forward new leadership has not been fully implemented, as a result of out-migration for opportunities in urban contexts and long-established stakeholders. This has impacts on two levels: out-migration removes capacity from the local context, and limited local opportunities do not support the ongoing development of leadership skills.

Learning 4. If we are to adopt a beyond-compliance strategy, we should recognise and capture what communities and schools are already doing, as well as supporting them to do more. The need for an integrated approach, which incorporates sustainability on socioeconomic factors with an environmental lens, is nascent. Within the context of the climate crisis and the rate of adaptation required, an accessible adaptive change method that is easy and quick to use will be necessary if communities are to be active and resilient.

Learning 5. Leadership and organisation needs to be supported through professional development and capacity-building programmes. This would help mitigate the evidently high levels of volunteer burnout and under-use of extant skills, and introduce and nurture contemporary approaches and agile adaptive processes to project management and collaboration. Specialised skills and knowledge are required to deliver on contemporary approaches that may be lacking within organisations, and the resources to outsource these skills are often non-existent or limited.

Learning 6. Improving collaboration and skill sharing would enable a better use of resources and more effective data capture of work that could contribute to the SDG national review and Ireland's targets. Initially, some responses to CoDesRes's approaches to solutions were dismissive, owing to a lack of understanding of the broader context. This changed during the project as a result of reliable

working partnerships and increased recognition and acknowledgement of CoDesRes's results. CoDesRes's research, informed voice and expertise also facilitated support for those who were keen to step into leadership roles, but lacked the confidence or experience to do so. Through this process, CoDesRes identified clear areas for development with resources in the toolkit for effective coordination and governance, as well as for project development and management, innovation and enterprise, and policy.

Learning 7. Effective communication to enable the creation or recognition of common ground overcomes challenges and fosters consensus building. CoDesRes research found new opportunities for communities and educators to align their existing practices and shared aims and objectives not only to the SDGs, but also with each other. CoDesRes produced a simple template and presentation resource as part of the toolkits for groups and educators to share their localisation of the SDGs in a coherent way and on their social media. Although the templates may seem prescriptive, any scaled inclusion methods need to be as simple and effortless as possible to ensure minimal impacts on groups already overwhelmed because their capacity is limited.

7.2 Futureproofing for Cahersiveen and Kerry

Learning 8. COVID-19 has indicated what the future might hold and the challenges the climate crisis could pose. The towns' (and county's) most important economic sector after agriculture, i.e. tourism, has been decimated by the pandemic, with Kerry the place the most affected by COVID-19 restrictions (Dorgan, 2020) owing to its heavy dependency on tourism. In Kerry, tourism and hospitality account for 18% of the workforce, and at the local level the economy is predicted to drop by €400m due to lost revenue from tourism; this is equivalent to a 10% drop in the income of every family in the county (Dorgan, 2020). Kerry needs to diversify its economic opportunities.

Learning 9. CoDesRes is a tangible example of how policy in action improves awareness of the SDGs and encourages local work towards them, resulting in expectations being exceeded in terms of delivery of the SDGs. Citizen exclusion from the 2030 Agenda highlights a missed opportunity to capture and harness essential indigenous knowledge for Ireland's national review or implementation process, without which many policies will mean little.

Learning 10. CoDesRes demonstrated how an arts-led critical praxis and an embedded research team raise awareness of the SDGs. Increasing SDG awareness in Ireland is a strategic priority within the National Implementation Plan. Awareness in 2018, at 36%, was below the EU average (DCCAE, 2018b). CoDesRes contributed to networks of experience and capacity-building through a novel methodology that raised awareness of the SDGs and was translated into action.

Learning 11. CoDesRes built on local track record and leveraged existing skills to deliver state grant funding. This developed local capacity and fiscal sustainability and demonstrates the impact that CoDesRes has on the region beyond the timeline of the project.

Learning 12. A quadruple helix approach (government, academic, industry, civil society) to stakeholder engagement and collaboration is needed. This approach supports all actors to meet the targets necessary for transition and develops a multi-stakeholder approach that includes actors from the political system (government) and those from academia and industry, as well as citizens (communities, civil society).

7.3 A Situated Approach to Sustainable Development

Learning 13. CoDesRes's praxis promoted localised resilience and a sustainable future and thus contributes to the 2030 Agenda and the SDGs. The original praxis was built on 25 years of socially engaged art and creative placemaking practices, trialled in three countries and geopolitical contexts, in three different ways. Now, in combination with additional STEAM (marine biology, ecology, engineering, innovation and enterprise, education and media) expertise, CoDesRes offers a suite of tools for post-primary education and community to embed self-organised and adaptive change methods in the local context that, in the longer term, will contribute to Ireland's SDG targets.

Learning 14. The "solution is in the problem" ethos values and builds on local knowledge, expertise

and leadership and resources, interfacing with policy. The praxis enables a reading of the system to determine where the gaps, obstacles and opportunities are, introducing innovative approaches that can bridge or facilitate action in the absence of substantial infrastructure. It does not replace the need for infrastructure, but it can provide an agile interim solution while the infrastructure or necessary policy and practices are developed.

Learning 15. As an adaptive change method that has been extensively tested and is open source, communities and educators can now use the resources in their own contexts. The research design, itself a proof of concept, can now be transferred to other regions, with any risks, economic or otherwise, mitigated by the findings from the project and methods proven through its outputs.

Learning 16. CoDesRes is a tangible example of generative planning. For example, local support and inclusion of the Ballroom project in KCC's Rural Regeneration Development Fund submission shows how the project is contributing to the debate on addressing environmental and planning decisions with approaches that integrate social, environmental and economic aspects within strategically developed projects.

7.4 "Any Place"-specific Transferability and Scalability

Learning 17. CoDesRes's findings confirm the pCr praxis's potential to illustrate the importance of encouraging systemic approaches to education and placemaking. The proof of concept demonstrates the praxis's ability to facilitate a creative revisioning and challenging of dominant development narratives. The trialling of the methods in a local context enabled the team to embed the praxis in the toolkits in an accessible way; however, this is only a beginning.

Learning 18. CoDesRes offers a scalable model to initiate action and propose manageable new ways of operating using creative, locally responsive and relevant ways of managing risk. The project proved that the SDGs have the potential to be leveraged for action and to contribute to Ireland's resilience in the face of its greatest challenge – systemic breakdown in the face of climate crisis. The recent impact of the COVID-19 pandemic across all aspects of society, social, economic and environmental, while temporary, has given tangible insights into systemic breakdown and the need for agile adaptation.

Learning 19. CoDesRes open-source toolkits can be used in formal and informal educational or community contexts. Agility and transferability are inherent to the process. The easy-to-use methods developed do not require specific experts, resulting in toolkits for teacher-led resources for TY and self-directed learning. However, transfer to other locations, within professional contexts, should include training, regular mentorship and careful consideration of team selection, depending on the local context and to address the aims or requirements of the specific context.

Learning 20. CoDesRes has expanded understanding of the value of artists and researchers in local delivery teams. To this end, the CoDesRes team has ambitions to inform the practices of the Creative Ireland teams in local authorities, through the dissemination tour.[49]

Learning 21. Legacy projects are already illustrating inclusive fitness and the seeding of practices in other rural peripheral communities. These are a key indicator in the pCr's VSM evaluation. The CoDesRes capacity-building skills have been transferred to the newly formed Cahersiveen Community and Business Alliance, in particular with youth engagement with the Rural Regeneration Development Fund project. The Drummin Bog project, Carlow and MARplas (Donegal, Schull and Galway) have all benefited from the pCr praxis and the CoDesRes approach.

7.5 Education Anchored in 21st Century Skills

Learning 22. A hyper-focus on high-status exam results by all actors limits the ability to develop future-ready students. Time and motivation to

49 As part of the project's dissemination, a tour of selected Creative Ireland local authority teams is proposed to present the toolkits and discuss the concept and potential of embedding arts-led processes within creative placemaking, community development and research.

develop resources and activities that do not quickly and easily contribute to teaching the curriculum and therefore ensure points attainment are not prioritised. This includes education for sustainable development, mostly taught within social, personal and health education (SPHE) or civic, social and political education (CSPE), which are deprioritised as they are considered "unexamined" subjects. Project activities and awards schemes are secondary considerations and, given the rapidly changing data, post-primary educators face extensive challenges to deliver information on the latest developments.

Learning 23. CoDesRes educational STEAM resources increased and diversified teaching and learning through a range of training modalities. The resources place emphasis on the higher-order skills, including problem-solving, critical thinking, communication through creativity, innovation and research skills within a localised tangible context that is connected to global concerns. This finding supports the National Council for Curriculum Assessment review of the senior cycle (NCCA, 2020).

Learning 24. Students' evaluation of the CoDesRes learning interventions evidenced the need for interdisciplinary learning and knowledge application. Student feedback included a desire for more contemporary citizenship, political, sustainability and climate change education, group work, practical and interactive activities, and foundational and creative technology skills, as well as support on how to apply knowledge to contemporary issues.

Learning 25. CoDesRes place-based STEAM education enables interdisciplinary learning and knowledge application. This includes being able to apply existing skills in new contexts and gaining skills and competencies beyond the curriculum for application to real-world contexts. It also provides the foundations for an agile platform that can be updated to augment the national curriculum with contemporary research and field-specific developments.

7.6 Local Authority and State Agency Policy Engagement

Learning 26. Citizen contribution to SDG delivery is inhibited by lack of awareness, which in turn affects potential inclusion. This is despite the multiple opportunities for citizens to use and contribute to SDG delivery by state agencies and local authorities.

Learning 27. Citizens' main point of contact with local authorities and state agencies is rarely at strategic or managerial level, which can affect citizen participation in delivering policy aims. Although communications from local authorities and state agencies expect alignment to the 2030 Agenda, CoDesRes found that SDG awareness was often limited to senior management level. Project interactions with other staff revealed a lack of awareness of the SDGs and a perceptual disconnect between policy aims and the SDGs. The importance of the SDGs and the climate crisis should be communicated to all staff, across all departments, with targets and indicators clearly measurable within departmental aims.

Learning 28. CoDesRes has shown how the pCr praxis is primed to support concrete actions on a local level – overcoming citizen inertia and structural distrust. Firm and accessible messaging about the reality of the climate crisis is an imperative; however, distrust of government means that messaging can be overwhelming and cause inaction. It is hard to envision beyond 20 years and there is no offer of the simple narrative people desperately desire. CoDesRes offers a model of tangible, locally scaled processes of how to implement said actions that can counter the evident governance trap (where citizens expect elected officials to act, yet do not trust their government to either provide accurate information or follow through appropriately) and communication avoidance.

8 In Summation

1. Localising the SDGs as part of the portfolio of actions required to tackle the unprecedented challenge of climate crisis is a “wicked” problem, yet embedding arts-led approaches and interdisciplinary researchers can aid the localisation of the SDGs in relevant and place-based ways, as demonstrated through the research’s focus on SDGs 4, 11, 14 and 15 and beyond.

   To account for the complexity and scale, each problem needs to be broken down into manageable actions and shared responsibilities. The research demonstrated how a critical praxis (the pCr methodology), originally developed for systemic solutions to wicked problems, if transferred to a rural context, could be applied to localising the SDGs. CoDesRes’s outputs and legacy projects indicate how the potential roll-out of this praxis in rural Ireland could significantly contribute to Ireland’s SDG targets, through approaches that develop self-organisation and locally resilient practices.

2. The 2030 Agenda and climate action should be the lens through which all school subjects are taught using an active participatory STEAM enquiry and thematic learning approach. This would shift the focus from value and belief systems towards an integrated pedagogical approach grounded in real-world and scientific data.

   It is understood that such a radical change to the national curriculum is unlikely in the short term. The research confirms that an important area to address would be ocean literacy and ocean health, an area noticeably absent from the existing curriculum. As an island nation with almost 50% of the population living within 5 km of the coast, Ireland needs to be connected to the importance and impact the ocean has for its citizens, indeed for both environmental and economic stability. As an interim measure, the SDG 14 – Ocean Literacy and Health module is recommended for inclusion in the curriculum.

   The junior cycle’s philosophy short course has possibilities to blend from the electives (Strand 4 – Philosophy of Art; Strand 6 – Philosophy of Science and Technology; Strand 7 – Moral Philosophy; and Strand 8 – Social and Political Philosophy) to produce a bespoke programme. While Politics and Society (senior cycle) could address issues of active citizenship, power and decision-making and allows for project work, education for sustainable development is only one aspect (Strand 4, Topic 8).

   Programmes such as GAISCE, the Green Schools programme, SPHE and CSPE could be leveraged more effectively to create a direct communication channel from schools to government. Such channels could be facilitated within schools or existing organisations, such as ECO-UNESCO, Foráige, the National Youth Council or even a Youth DECC, as a conduit for student-led governance. Students could and should be considered the experts on how to reach other students and educators, and other professionals need to be supported to share their skills through systemic infrastructure, e.g. the national curriculum, local and national government. The foundations are in place but, as with everything in the 21st century, the infrastructure will need to become more agile and adaptive and create new platforms where needed.

   To bridge the gaps and inevitable time-lag between the curriculum and real-world knowledge production, the development of a recognised TY focus with a corresponding learning platform is recommended. Such a platform could be regularly updated with contemporary research, scaled to age-appropriate content. Such a model is being explored through Future Focus21c, a legacy company of CoDesRes research and the Muinín Catalyst programme.

3. On a local level, CoDesRes contributed clear positive impacts to areas, for instance the built environment, natural resources and cultural infrastructure, community health and wellbeing, and local adaptation governance. The legacy

projects facilitated local actions to continue progress in these areas and build capacity based on the foundations that were cultivated in the CoDesRes project.

The development of a formal micro-ecology, a quadruple helix approach to stakeholder engagement and collaboration, is recommended to meet the targets necessary for transition and to develop a multi-stakeholder approach. The knowledge exchange and ecosystems necessary for this (clustering, resources sharing, cross-collaboration, local/global interaction) have yet to be developed. This will require support and upskilling to ensure the diversification necessary to be effective.

CoDesRes provides the foundation for such an approach. The Iveragh Peninsula, indeed Kerry as a whole, has experienced a loss of skills through out-migration, which perpetuates the lack of access to, and availability of, expertise required for contemporary approaches. A localised network that includes KCC, local organisations registered with the PPN, the interagency Tascfhórsa Uíbh Ráthaigh, the South Kerry Development Partnership, the Cahersiveen Community and Business Alliance and the local Kells to Castlecove development groups is important if we are to build on CoDesRes's legacy and the legacy projects developed by the CoDesRes team, e.g. the Ballroom project (see the OSD, p. 17). Embedding a trained interdisciplinary team at the centre of an adaptive change network would be an effective next phase. This would ensure that ongoing work is relevant, appropriate and generative, rather than simply specifying actions for local actors to deliver.

The UCD Earth Institute's ECOBROKER project illustrates a potential knowledge exchange that could be expanded into a quadruple helix "match-making" service. Currently, ECOBROKER facilitates the exchange of research ideas between practitioners and researchers (mainly government and academic) to address multifaceted environmental and societal challenges. The Earth Institute has already undertaken an SDG series, a platform that could be used to develop further partnerships to include civil society and, where appropriate, industry, accelerating necessary conversations and skills sharing. Stakeholders could access partners' skills while institutions would be able to embed their research and knowledge beyond the academy, into real-world contexts, and to ensure ethical practices. Opportunities for co-research would harness localised knowledge through embedded local faculty in satellite campuses, while offering students practical learning with "in-the field" mentors.

4. The financial argument for CoDesRes can be expanded on in the context of Ireland's predicted annual penalties for failure on 2020 targets on energy and cutting carbon emissions, predicted to be €600m per annum (Houses of the Oireachtas, 2017).

   The CoDesRes staffing (five fractional contracts for an interdisciplinary approach) cost €97,000 for two years. Embedding two similar teams in each county in Ireland would cost approximately €1.27m per annum. Even with increased contracts, this would be easily recouped if offset against potential future penalties and improving the speed of implementation of the SDGs and the national plan. Investment in local teams, as part of a national programme for place-based STEAM and placemaking expertise to undertake focused capacity-building by using systemic thinking and integrated creative approaches, would be worth the effort in terms of longer-term benefits and savings. It makes financial sense to begin to implement a number of initiatives that, while incurring expenditure up front, would, in the long term, save money.

5. Beyond the financial impacts, it is imperative that Ireland, like all nations, develop the capacity of all citizens in terms of both knowledge and skills to implement change if we are to address the climate crisis. Action needs to start immediately and be accelerated across all sectors of society, and to date Ireland's national measures have been unsuccessful (Wall *et al.*, 2020).

   CoDesRes initially proposed that rural areas had a role to play in alleviating our current trajectory. This research has outlined areas of possibility and proof of concept, with resources, which are transferable, to do this. The Iveragh Peninsula is not unique. It is clear that, although there are

citizens with skills and talents, a strategic coherent approach to capacity-building within civil society would be a wise investment.

Despite operating in a local context, the project was situated in the broader context of Ireland's commitments to the global 2030 Agenda through tangible scalable actions for acting locally while thinking nationally and globally. Table 13 in the OSD (p. 70) presents a number of opportunities for future research/project implementation that support sustainable rural development and align SDG delivery to national strategic objectives within Project Ireland 2040 and the national rural development plan, *Our Rural Future: Rural Development Policy 2021–2025* (DRCD, 2020). Many are beyond the scope of the research, yet the opportunities emerged through local conversations on the day-to-day problems faced by those in rural contexts. COVID-19 has shown clearly how scenarios previously unimaginable (travel restrictions, working from home, reduced access to goods and services) can occur with minimal time for adaptation. It is now more critical than ever to embed agile responses that offer the potential to engage with approaches that do not conform to a "business-as-usual" approach.

6. Within specific areas such as enterprise and innovation, digital or otherwise, there are opportunities. Yet, Ireland will need informed citizens and politicians if we are to adequately and accurately assess these opportunities' impacts and consequences within sustainable development and the triple bottom line. The research proposes a situated embedded approach with an adaptive one-size-fits-one model rooted in inclusive design principles.

   CoDesRes demonstrated the transfer of a systemic novel methodology, the pCr praxis, that supports effective interfacing between community, research projects and real-world problems. Through the creation of opportunities for peer-to-peer knowledge production and transfer, and place-based STEAM learning interventions, CoDesRes scaffolds a multi-stakeholder approach. It is hoped that the research will inform further research and actions to encourage sustainable, resilient practices.

   CoDesRes showed how embedding researchers can add value to the local expertise. If those researchers can then continue to support a localised research ecology, then the generative nature required for further agile responses can grow. Any costs incurred upfront will be offset by having an effective programme in place to meet the issues we are facing.

7. Addressing the complexity of those working in an HCC, a national platform or portal could facilitate making information explicit and support collaboration and new partnerships, as well as beginning to capture the hidden SDG data from the work that is occurring in all communities.

   Linking an SDG collaboration portal to LA 21 funding, PPNs, Tidy Towns groups and other voluntary and community groups, and schools, could operate as an SDG one-stop shop and would serve two purposes: (1) it offers an at-a-glance view of "who's doing what, where and when", sharing local implementation on the SDGs and knowledge transfer and (2) it provides data for collation for the SDG voluntary reviews.

   The TURAS/Dublin City Council's "Collaborations" portal,[50] an online portal developed by Johanna Varghese that presents information "at a glance", shows that it is feasible to make available and accessible information visually organised around groups and individuals. A portal that offers a simple easy-to-use template to aid uptake and foster awareness and visibility of shared aims or unique approaches could facilitate a broader understanding of community. Extending the concept beyond geolocation to include communities of practice, interest, entrepreneurs and SDG-focused work would also provide a foundation for collaborative partnerships and facilitate SDG-relevant data capture. Participation in the portal could be ensured through alignment to state, local authority and Tidy Towns funding, similar to the current local authority funding mandate with PPN registration.

50 The Collaborations portal sought to link members of Dublin City Council's PPN with each other and the state agencies and city stakeholders towards cooperating for transition (http://r1.zotoi.com/solution/7.html; accessed August 2021).

Providing a simple template for inclusion would encourage engagement because the effort required would be low: it would be necessary to provide only a name, contact details, a brief summary of the project and the SDG alignment, an image, and a copy of the text that accompanied their PPN registration. Additional hosting capacity for images and SDG information could be supported through corporate social responsibility agendas, e.g. the portal development could be hosted and delivered through technology companies and delivered in partnership with Code for Ireland or hosted by the DECC.

8. The authors maintain that the government and media must present stronger narratives about the reality we are facing as a nation and as a species. In conclusion, the research posits that, for Ireland to effectively implement the SDG national implementation plan by 2030, actions from all levels of Irish society needs to be viewed through the lens of localising the SDGs, whether "local" is defined as an organisation, a corporation or otherwise, or a geophysical context, while strategically encouraging implementation from that perspective. Given the unpredictability of the global context and all this entails, the research demonstrates that creative collaborations that bridge field specificity and engage all abilities and knowledge available can be considered a necessary and logical response.

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Abbreviations

CJKG	Caherdaniel Japanese Knotweed Group
CnS	Coláiste na Sceilge
CoDesRes	Co-designing for Resilience in Rural Development through Peer-to-peer Learning Networks and STEAM Place-based Learning Interventions
COVID-19	Coronavirus disease
CPD	Continuing professional development
CSPE	Civic, social and political education
DCCAE	Department of Communication, Climate Action and the Environment
EGFSN	Expert Group on Future Skills Needs
HCC	High-context culture
ICT	Information and communications technology
IRT	Iveragh Rivers Trust
KCC	Kerry County Council
LA 21	Local Agenda 21
MARplas	Marine Plastic – Closing the Loop
OBREDIM	Observation, boundaries, resources, evaluation, design, implementation, maintenance
OECD	Organisation for Economic Co-operation and Development
OSD	Online supplementary document
pCr	permaCultural resilience
PPN	Public participation network
ROLE	Relationships, OBREDIM, life cycle analysis, evaluation
SDGs	Sustainable Development Goals
SFI	Science Foundation Ireland
SME	Small to medium-sized enterprise
SPHE	Social, personal and health education
STEAM	Science, Technology, Engineering, the Arts and Mathematics
STEM	Science, Technology, Engineering and Mathematics
TY	Transition Year
UCC	University College Cork
UCD	University College Dublin
VSM	Vital signs matrix
VUCA	Volatility, uncertainty, complexity and ambiguity
WFA	Waterville Fishing Association
WLRT	Waterville Lakes and Rivers Trust
WP	Work package

Appendix 1

Table A1.1. Summary of work packages

Work package details	Lead	Activities
WP1 Project management	Dr Anita McKeown (PI)	Reporting – technical progress and finance Project coordination and project development
WP2 Youth transition and education Place-based STEAM 21st Century Skills for Sustainable Development	Lucy Hunt with Dr Anita McKeown, Eleanor Turner, Rebecca White and James Murphy	Review of Ireland's marine operators that include education working with the SDGs, 2018–2020. Intervention into 4th year education to develop and test STEAM- and place-based lessons for TY toolkit. Expected outcomes: • Systematic testing methods using design thinking for delivering curriculum resources on SDGs on the theme of circular economies, waste and biodiversity within marine and terrestrial contexts • Co-production of youth knowledge and information on issues and obstacles to localised delivery on SDGs 4, 11, 14 and 15 • A set of SDG-aligned pCr resources for TY • Academic papers and poster on findings
WP3 Community transition Considering Sustainable Development within Rural Communities	Eleanor Turner with Dr Anita McKeown and Rebecca White	Review of Kerry PPN engagement with SDGs, 2018–2020. Working with community groups to develop community toolkit. Expected outcomes: • Co-production of community knowledge and information on the issues and obstacles • Systematic testing methods using pCr design thinking for delivery on community SDG transition (circular economies, waste and biodiversity) within marine and terrestrial contexts • A set of SDG aligned pCr resources for the community • Academic paper and poster on findings
WP4 Rapid media and rapid prototyping Self-organised agency on a localised scale	Rebecca White, James Murphy with Dr Anita McKeown, Dr Colin Keogh/Rapid Foundation	Working with students and residents to teach media skills and rapid prototyping, set up media and maker space cooperative including a library of things. Expected outcomes: • Media team trained in web/social media, audio and video recording, development of narrative for a range of media including vlogs, blogs, newsletters • Media archive to document the project • Accessible toolkit resource designed for post project dissemination • Legacy – rapid media cooperative equipment resource • Academic paper and poster on findings
WP5 Rapid media and rapid prototyping	Dr Anita McKeown with full team	Dissemination – social media and academic outputs Design of communication media Development and maintenance of communication plan

OBREDIM AUDIT **Activity:** **Date:**

Audit Phase	**Details reference: What to look for and record.**
 O – Observation **Phase 1**	Survey all local 'organisms' e.g., organisations, stakeholders, businesses, arts and cultural orgs, community groups, charities, people, animals, vegetation, socio-cultural landscape, history, news / media, politics. Try to create as full a picture of the residency ecosystem.
Ways and things to observe: Patterns of growth, distribution, town layout business layout etc. Traffic flow, people motion, dead spots, flow of information, traffic people, the dynamics; social, cultural physical. Is there an impact? Does it last? Where' does it start and stop. Natural system aspects: Weather, Sun, Water sheds, air, flora fauna animals, migration routes or diversions of water, desertification, forest, History – what's changed and why is there a pattern, does this have impact on the future? Community; connections and relationships, distance/ proximity, inter-species, inter-generational. What is successful? What has adapted are there any common traits? Are there any recognisable patterns, numerical patterns? Are their functions of these patterns? Look at textures / shapes – Draw them, photograph them, record audio, video. Use the senses; What can you see, hear, taste, smell and touch.	
 B –Boundaries	The edges / limits of the ecosystem; the location's geo boundaries, organisational boundaries, people's responsibilities, shared values, cross-over of aims, power dynamics. Limits to growth expansion, Laws, regulations and policies. Where do things stop and start? Are there diversity, tensions and encounters? Is there a difference between the edges and centre? Zoning analysis: This can highlight responsibilities, existing partnerships, focus for effort.
 R - Resources	Physical and non-physical resources; Time, money, services, skills and knowledge, existing networks and partnerships, groups, what already exists and how it works (or doesn't). Sample Questions: Venues: what's there, what does it do, how does it function, who sponsors events. Groups: who's doing what, when and with who?
 E – Evaluation **Phase 2**	Begin to map a web of relations – using the info from Phase 1 and the Zoning analysis. Evaluate what exists and where the gaps are – how does info flow, notice relationships and communication. Include a SWOT / SMARTER analysis
 D - Design	Design on paper, becomes a map for the implementation stage or if there's an existing project in mind re-design in light of information gathered in Phase 1 and evaluation stage.
 I – Implementation **Phase 3**	Implementing design: inc. logistics e.g., timelines, production milestones, communication, fundraising, skills needed.
 M - Maintenance	Maintaining the project and any maintenance needs or opportunities to evolve the project, handing over passwords, admin details, resource directory – anything needed to move the project forward or maintain its existence and evolve it.

Figure A1.1. The pCr praxis OBREDIM audit log (McKeown, 2015, 2020).

Table A1.2. Overview of CoDesRes resources

Sustainable Development Goal and module name	Module descriptor
SDG 4 Quality Education Problem to Pitch	Introduction to design thinking – eight lesson plans, resources and worksheets developed to support this
SDG 4 Quality Education Media Communication	Introduction to audio-visual communication – 15 lesson plans, resources and worksheets, covering: • moving image • audio • presentation • graphic communication
SDG 4 Quality Education Supporting Skills	Supporting skills – leadership, enterprise, report writing, data gathering – lesson plans, worksheets and resources
SDG 11 Sustainable Cities and Communities	Rapid prototyping for communities – four lessons and practical activities for full- or half-day workshops: • Introduction to engineering • Waste recycling • 3D printing • Innovation Rapid media for communities – pre and post production Rapid governance for communities – organisational toolkit StoryBank – for primary schools
SDG 14 Life Below Water	“Ocean Literacy” – 10 lesson plans, resources and worksheets “Problem to Pitch” – Marine plastic waste
SDG 15 Life on Land	“What is your Waste” lesson plan and resource “Know your River” lesson plan and resource “Waste to Taste” – eight lessons and worksheet to develop an edible – medicinal trail “Pollinators and Adaptations” – for early years and primary students

Table A1.3. Original targets and actual outputs – Iveragh Peninsula as of February 2020

Project's EPA-proposed targets	Project's actual outputs as of February 2020
110 people actively engaged in commons-based youth and community transition over phases s1 and 2, a total of 15 months (January 2018 to February 2020)	Total number sustained = 400 people (265 TY students and 135 from community groups) Interventional (min. 1.5 hours) – 874 people Additional direct engagement – 3325 people
WP2, January 2018 to June 2019, working with TY students at CnS: Leadership, Youth Entrepreneur and Youth Justice – confirmed. 20 students	Total number = 265 Phase 1 – 68 students (SDGs 11 and 15) Phase 2 – 75 students (SDGs 11, 14 and 15) Work experience × 4 students Work Experience × 6 students GAISCE × 1 student LCA – Saint Patrick's Day Parade – 6 students building float, 8 students involved in décor, 5 student performers Aonad PechaKucha module – 16 CSPE action project – 24 SEAI project – 26 and 7 media training Waste 2 Taste student concept development × 25 595 (students and staff)
Interventional engagement – December 2019	SDG "Take One" awareness week – 745 SDG awareness science scavenger hunt – 75 students SDGs 2 and 3 Fermentation workshop – 75 students SDG slide show
Primary school development in three schools Informal education and one grandparents day – May 2019	StoryBank – 129 students and family members
WP3, January–June 2019, working with Caherdaniel Parish/ Coiste Pobail Cathair Dónall/CJKG and the integrated constructed wetland to treat sewage and ensure biodiversity. Confirmed – 30 people	Developed Caherdaniel River Restoration strategy and implementation plan, as well as visioning process for new focus of the group – 18 people Implementation was proposed but curtailed due to COVID-19. It is unsure at this point as to the groups' future plans
Engage two additional community groups – 1. the Kerry PPN and its environmental, social inclusion and community voluntary groups will be targeted and 2. In communication with Kerry Mens' Sheds; Cahersiveen Kenmare, Killarney and Sneem Mens' Sheds	Cahersiveen Tidy Towns (including Cahersiveen Men's Shed, ACARD Ltd and the Old Barracks Heritage Centre) total – 27 people with different levels of engagement. Waterville Lakes and Rivers Trust, Sensing the Catchment – 15 people Two innovation workshops in collaboration with Sea Synergy and MARplas – 21 people, 10 hours
WP4 will develop its team from the two groups and will train them to be "roving" reporters, as well as having set tasks and milestones	Rapid media – 12 people trained, media – toolkit resources Year 2 – rapid innovation and prototyping – nine people and community printing toolkit resources Media – 26 students SDG 7, SDG 13 – SEAI awareness campaign training and media production training (seven students) – Toolkit resources

Table A1.3. Continued

Project's EPA-proposed targets	Project's actual outputs as of February 2020
Academic attendance – 400 people Two academic papers, three posters and attendance at four conferences (see www.codesres.ie/conferences) Four conferences post project (Nov 2020–Sept 2021)	Book chapter in *The Handbook of Placemaking*, Routledge, 2020, Dr Anita McKeown Conference attendance/presentations – 17 Three research posters – Royal Geographic Society annual conference 2018, 2020 (postponed until 2021) European Marine Science Educators Association, September 2019 Virtual Design Practices and Principles, Pratt Institute of Design, online, March 2020 Two academic papers from WP2 – a paper by Lucy Hunt and a case study by Rebecca White and Dr Anita McKeown, both peer-reviewed: *Ireland's International Conference on Education* and *Media Politics* *South Kerry Advertiser* (circulation 6000) – 14 articles *The Kerryman* (circulation c.14,000) – five articles confirmed and submitted in the environmental column
Online dissemination 600 online project connections: 2000 Project dissemination	5467 digital connections: website (blogs, six newsletters, Facebook, Academia.edu, ResearchGate, Twitter, Pinterest, LinkedIn) Post-project dissemination to be completed
Unpredicted additional direct engagement	Total = 3325 people
Launch with Hedge school/Tidy Towns, February 2018	88 people – mixed community event
Seachtain na Gaeilge 2018	8 students
Climate Action Workshops	20 people
Saint Patrick's Day 2018, 2019	1788 (parade, floats, workshops and night-time parade × 2)
May the 4th Be With You 2018, 2019	212 children and families 138 people – mixed community event
Street feast, beach clean and wildflower planting	147 people – mixed community event
Sensing the Catchment	15 people
StoryBank Culture Night and Heritage Week exhibition 2018, 2019	48 people
Spookemon 2018	450 people
BOI Enterprise Fair	36 people
Recycled Grotto and activities, December 2018	375 people

BOI, Bank of Ireland; LCA, Leaving Certificate Applied; SEAI, Sustainable Energy Authority of Ireland.

AN GHNÍOMHAIREACHT UM CHAOMHNÚ COMHSHAOIL
Tá an Ghníomhaireacht um Chaomhnú Comhshaoil (GCC) freagrach as an gcomhshaol a chaomhnú agus a fheabhsú mar shócmhainn luachmhar do mhuintir na hÉireann. Táimid tiomanta do dhaoine agus don chomhshaol a chosaint ó éifeachtaí díobhálacha na radaíochta agus an truaillithe.

Is féidir obair na Gníomhaireachta a roinnt ina trí phríomhréimse:

Rialú: *Déanaimid córais éifeachtacha rialaithe agus comhlíonta comhshaoil a chur i bhfeidhm chun torthaí maithe comhshaoil a sholáthar agus chun díriú orthu siúd nach gcloíonn leis na córais sin.*

Eolas: *Soláthraímid sonraí, faisnéis agus measúnú comhshaoil atá ar ardchaighdeán, spriocdhírithe agus tráthúil chun bonn eolais a chur faoin gcinnteoireacht ar gach leibhéal.*

Tacaíocht: *Bímid ag saothrú i gcomhar le grúpaí eile chun tacú le comhshaol atá glan, táirgiúil agus cosanta go maith, agus le hiompar a chuirfidh le comhshaol inbhuanaithe.*

Ár bhFreagrachtaí

Ceadúnú
Déanaimid na gníomhaíochtaí seo a leanas a rialú ionas nach ndéanann siad dochar do shláinte an phobail ná don chomhshaol:
- saoráidí dramhaíola *(m.sh. láithreáin líonta talún, loisceoirí, stáisiúin aistrithe dramhaíola)*;
- gníomhaíochtaí tionsclaíocha ar scála mór *(m.sh. déantúsaíocht cógaisíochta, déantúsaíocht stroighne, stáisiúin chumhachta)*;
- an diantalmhaíocht *(m.sh. muca, éanlaith)*;
- úsáid shrianta agus scaoileadh rialaithe Orgánach Géinmhodhnaithe *(OGM)*;
- foinsí radaíochta ianúcháin *(m.sh. trealamh x-gha agus radaiteiripe, foinsí tionsclaíocha)*;
- áiseanna móra stórála peitril;
- scardadh dramhuisce;
- gníomhaíochtaí dumpála ar farraige.

Forfheidhmiú Náisiúnta i leith Cúrsaí Comhshaoil
- Clár náisiúnta iniúchtaí agus cigireachtaí a dhéanamh gach bliain ar shaoráidí a bhfuil ceadúnas ón nGníomhaireacht acu.
- Maoirseacht a dhéanamh ar fhreagrachtaí cosanta comhshaoil na n-údarás áitiúil.
- Caighdeán an uisce óil, arna sholáthar ag soláthraithe uisce phoiblí, a mhaoirsiú.
- Obair le húdaráis áitiúla agus le gníomhaireachtaí eile chun dul i ngleic le coireanna comhshaoil trí chomhordú a dhéanamh ar líonra forfheidhmiúcháin náisiúnta, trí dhíriú ar chiontóirí, agus trí mhaoirsiú a dhéanamh ar leasúchán.
- Cur i bhfeidhm rialachán ar nós na Rialachán um Dhramhthrealamh Leictreach agus Leictreonach (DTLL), um Shrian ar Shubstaintí Guaiseacha agus na Rialachán um rialú ar shubstaintí a ídíonn an ciseal ózóin.
- An dlí a chur orthu siúd a bhriseann dlí an chomhshaoil agus a dhéanann dochar don chomhshaol.

Bainistíocht Uisce
- Monatóireacht agus tuairisciú a dhéanamh ar cháilíocht aibhneacha, lochanna, uiscí idirchriosacha agus cósta na hÉireann, agus screamhuiscí; leibhéil uisce agus sruthanna aibhneacha a thomhas.
- Comhordú náisiúnta agus maoirsiú a dhéanamh ar an gCreat-Treoir Uisce.
- Monatóireacht agus tuairisciú a dhéanamh ar Cháilíocht an Uisce Snámha.

Monatóireacht, Anailís agus Tuairisciú ar an gComhshaol
- Monatóireacht a dhéanamh ar cháilíocht an aeir agus Treoir an AE maidir le hAer Glan don Eoraip (CAFÉ) a chur chun feidhme.
- Tuairisciú neamhspleách le cabhrú le cinnteoireacht an rialtais náisiúnta agus na n-údarás áitiúil *(m.sh. tuairisciú tréimhsiúil ar staid Chomhshaol na hÉireann agus Tuarascálacha ar Tháscairí)*.

Rialú Astaíochtaí na nGás Ceaptha Teasa in Éirinn
- Fardail agus réamh-mheastacháin na hÉireann maidir le gáis cheaptha teasa a ullmhú.
- An Treoir maidir le Trádáil Astaíochtaí a chur chun feidhme i gcomhair breis agus 100 de na táirgeoirí dé-ocsaíde carbóin is mó in Éirinn.

Taighde agus Forbairt Comhshaoil
- Taighde comhshaoil a chistiú chun brúnna a shainaithint, bonn eolais a chur faoi bheartais, agus réitigh a sholáthar i réimsí na haeráide, an uisce agus na hinbhuanaitheachta.

Measúnacht Straitéiseach Timpeallachta
- Measúnacht a dhéanamh ar thionchar pleananna agus clár beartaithe ar an gcomhshaol in Éirinn *(m.sh. mórphleananna forbartha)*.

Cosaint Raideolaíoch
- Monatóireacht a dhéanamh ar leibhéil radaíochta, measúnacht a dhéanamh ar nochtadh mhuintir na hÉireann don radaíocht ianúcháin.
- Cabhrú le pleananna náisiúnta a fhorbairt le haghaidh éigeandálaí ag eascairt as taismí núicléacha.
- Monatóireacht a dhéanamh ar fhorbairtí thar lear a bhaineann le saoráidí núicléacha agus leis an tsábháilteacht raideolaíochta.
- Sainseirbhísí cosanta ar an radaíocht a sholáthar, nó maoirsiú a dhéanamh ar sholáthar na seirbhísí sin.

Treoir, Faisnéis Inrochtana agus Oideachas
- Comhairle agus treoir a chur ar fáil d'earnáil na tionsclaíochta agus don phobal maidir le hábhair a bhaineann le caomhnú an chomhshaoil agus leis an gcosaint raideolaíoch.
- Faisnéis thráthúil ar an gcomhshaol ar a bhfuil fáil éasca a chur ar fáil chun rannpháirtíocht an phobail a spreagadh sa chinnteoireacht i ndáil leis an gcomhshaol *(m.sh. Timpeall an Tí, léarscáileanna radóin)*.
- Comhairle a chur ar fáil don Rialtas maidir le hábhair a bhaineann leis an tsábháilteacht raideolaíoch agus le cúrsaí práinnfhreagartha.
- Plean Náisiúnta Bainistíochta Dramhaíola Guaisí a fhorbairt chun dramhaíl ghuaiseach a chosc agus a bhainistiú.

Múscailt Feasachta agus Athrú Iompraíochta
- Feasacht chomhshaoil níos fearr a ghiniúint agus dul i bhfeidhm ar athrú iompraíochta dearfach trí thacú le gnóthais, le pobail agus le teaghlaigh a bheith níos éifeachtúla ar acmhainní.
- Tástáil le haghaidh radóin a chur chun cinn i dtithe agus in ionaid oibre, agus gníomhartha leasúcháin a spreagadh nuair is gá.

Bainistíocht agus struchtúr na Gníomhaireachta um Chaomhnú Comhshaoil
Tá an ghníomhaíocht á bainistiú ag Bord lánaimseartha, ar a bhfuil Ard-Stiúrthóir agus cúigear Stiúrthóirí. Déantar an obair ar fud cúig cinn d'Oifigí:
- An Oifig um Inmharthanacht Comhshaoil
- An Oifig Forfheidhmithe i leith cúrsaí Comhshaoil
- An Oifig um Fianaise is Measúnú
- Oifig um Chosaint Radaíochta agus Monatóireachta Comhshaoil
- An Oifig Cumarsáide agus Seirbhísí Corparáideacha

Tá Coiste Comhairleach ag an nGníomhaireacht le cabhrú léi. Tá dáréag comhaltaí air agus tagann siad le chéile go rialta le plé a dhéanamh ar ábhair imní agus le comhairle a chur ar an mBord.

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Co- designing for Resilience in Rural Development through Peer-to-peer Learning Networks and STEAM Place-based Learning Interventions

Authors: Anita McKeown, Lucy Hunt, James Murphy, Eleanor Turner and Rebecca White

Identifying Pressures

The United Nations 17 Sustainable Development Goals (SDGs) and the 2030 Agenda for Sustainable Development are not legally binding; however, they require governments to take ownership and establish frameworks for the achievement of the 17 global goals, which call for equitable economic growth, social inclusion and environmental protection. The global goals are aspirational. Despite the lack of mandatory or legal requirements for countries to deliver on the goals, Ireland has mapped existing policies and programmes against each of the 169 SDG subtargets, setting out a roadmap for achieving the goals. Although Ireland has had a sustainable development policy for over two decades, to achieve these goals in a meaningful way, the development of a "beyond compliance approach" (which engages civil society) will be necessary. Furthermore, to move beyond a top-down policy approach, localising the SDGs will require new approaches to policy engagement and participation that are easily translated into action through collaborative action between all sectors of society. A systemic approach to the integration of national social, economic and environmental policy and implementation of the SDGs is required.

Informing Policy

Moving the SDGs from a theoretical set of goals from a national plan to a localised tangible vision requires confronting a number of challenges. The global goals offer an opportunity for all sectors of society (citizens, governments and businesses) to collaborate towards shared aims and policy delivery. However, how to do this effectively will be an ongoing dynamic process rather than any single solution. Novel creative methodologies and processes that create local opportunities to participate in the national delivery of the SDGs and capture these efforts are under-researched because the 2030 Agenda, a 15-year programme, was only recently created. To date, CoDesRes (CoDesigning for Resilience in Rural Development through Peer-to-Peer Learning Networks and STEAM Place-based Learning Interventions) is the only research project in Ireland that has considered and sought to integrate place-based STEAM (science, technology, engineering, arts and mathematics) educational interventions with arts-led community development activities. CoDesRes adapted a novel, innovative and systemic methodology that contributes to localising the SDGs by creating knowledge exchanges and building capacity to reimagine locally engaged activities.

Developing Solutions

CoDesRes developed and explored a series of proof-of-concept methods and from this created two toolkits. As interventions, the toolkits (community peer-to-peer learning and place-based STEAM education) localise the implementation of the SDGs and offer insights into adaptive opportunities to engage the public. The project considered that the rural context has a vital role to play in developing viable realistic alternatives to urban dwelling and support citizen-led resilience. CoDesRes sought to reimagine equitable green and blue opportunities within a rural area. The Iveragh Peninsula offered a prime location to explore the opportunities for citizens to localise the SDGs within a rural setting and utilise existing policy for local resilience.

Through STEAM place-based educational interventions, community activities and peer-to-peer knowledge networks, the process trialled an adaptive change model for complex systems. CoDesRes utilised creativity, innovation and practical processes to develop home-grown solutions to global concerns from the inside out. In this project, which works towards the 2030 Agenda, beta resources (structured around SDGs 4, 11, 14 and 15) built capacity for systemic approaches and encouraged self-organisation and localised resilience by reimagining local and rural possibilities.

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