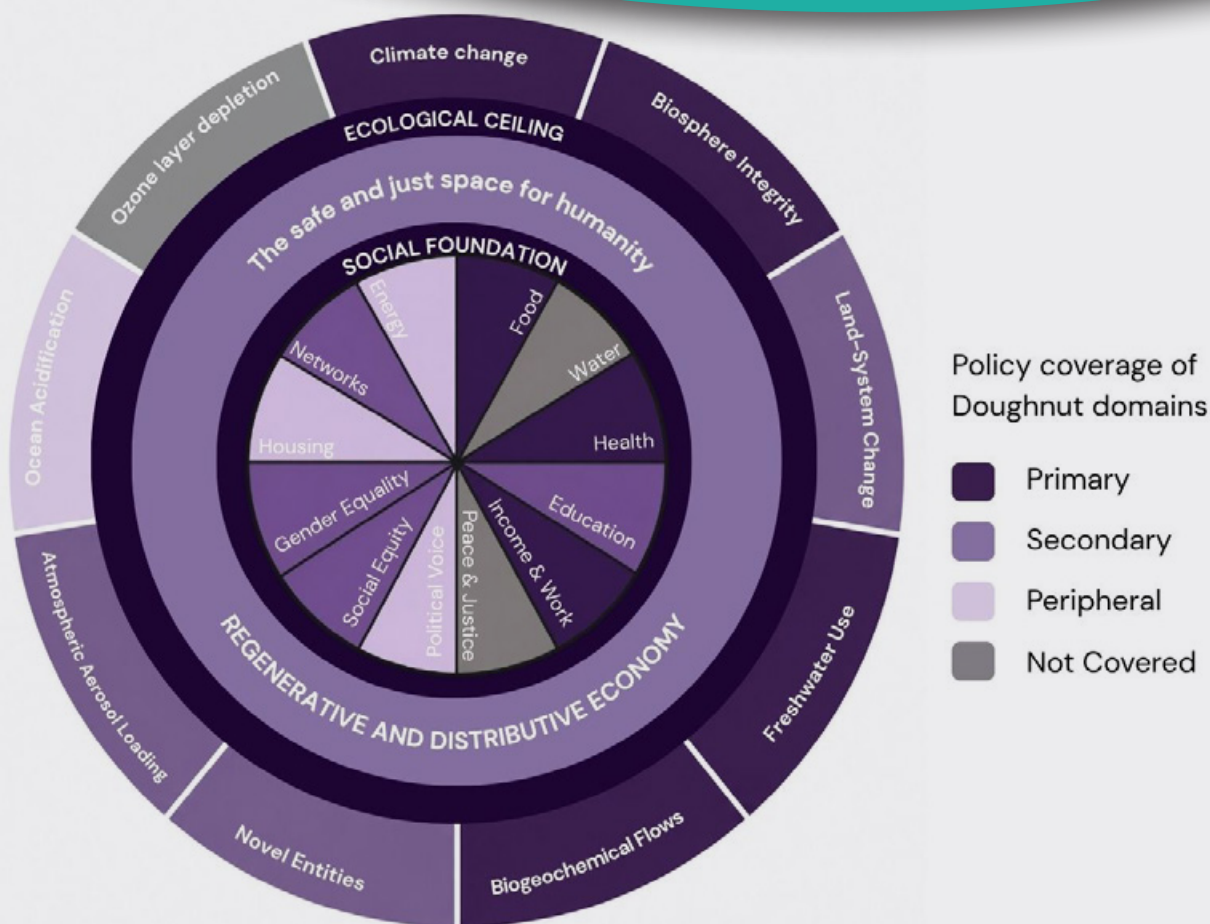


Evidence Synthesis Report 15

Doughnut Economics: A Framework for the Sustainable Development of Ireland's Bioeconomy



Authors: Luke Kelleher, J. Andrew Kelly, Eoin O'Neill, Hannah Gould, Yanika Farrugia, Angela Milimu, Vishwajeet Pundkar and Nimisha Setia

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Rialtas na hÉireann
Government of Ireland

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Executive Summary

This report examines whether the Doughnut Economics framework could usefully support the sustainable development and monitoring of Ireland's bioeconomy. The framework brings together social foundations and ecological limits to identify a space in which human needs can be met without exceeding environmental limits (Raworth, 2017). Commissioned under the EPA Research Fast-Track to Policy funding scheme, this study responds to a policy request that is linked to the preparation of the National Bioeconomy Strategy (2026–2030) and its associated action plan, the growing importance of improved bioeconomy monitoring, and the need for approaches that may better identify trade-offs and avoid unintended consequences. The analysis draws on desk-based policy research and reviews of governance arrangements and indicators, supported by stakeholder engagement, including a workshop held on 19 March 2026, and subsequent expert and Steering Group input.

The analysis finds that Ireland does not lack indicators or policy frameworks relevant to the bioeconomy. A substantial body of monitoring activity already exists and is being further developed across sectoral strategies, cross-cutting frameworks and emerging initiatives, including the ongoing work under INFORMBIO (Integrated Framework for Mapping, Modelling and Monitoring Ireland's Bioeconomy), BIO-INSIGHT (Bioeconomy Indicators for Foresight) and BioValue. However, bioeconomy work remains fragmented across policy domains and institutions. No single structure brings together ecological constraints, economic performance and social outcomes in a manner that supports integrated interpretation for policy decision-making. The core issue is therefore not the absence of indicators, but rather the absence of an organising framework through which they can be interpreted together.

The sectoral review in this report reinforces this conclusion. Some Doughnut Economics domains are already well represented in policy and monitoring, particularly Income and Work, Climate Change, and Biosphere Integrity. However, others, including Peace and Justice, Political Voice, Housing, Ocean

Acidification, and Ozone Layer Depletion, remain weakly developed or are largely absent. This uneven coverage may reflect the perception or reality of limited impacts in certain contexts, but can also highlight strengths in the existing system and clear gaps, and thereby point to areas where potential proxy indicators, supplementary datasets or further development may be justified. The case-study review suggests that Doughnut Economics approaches are most useful in this context when they are understood as selective, policy-facing interpretive and decision-support tools linked to existing governance systems, rather than as comprehensive indicator dashboards.

The report also presents an indicative overall bioeconomy policy-coverage doughnut, derived from the four policy-anchor reviews. This provides a visual summary of how current policy attention and indicator visibility are distributed across the social foundations and ecological ceilings. It should be read as a policy-coverage summary rather than as a performance assessment, quantified dashboard or measure of ecological overshoot and social shortfall.

The overall conclusion of this work is that Doughnut Economics has value, but in a specific role. It is not currently suited to function as a stand-alone monitoring system. Instead, its primary contribution is likely to be as an organising, interpretive and decision-support framework that can bring existing indicators, priorities and trade-offs into a single structure, making system interactions, gaps and trade-offs more visible for policy discussion and decision-making.

At this point, governance is the critical factor in determining whether such an approach would be workable and useful in practice. Key requirements include institutional ownership, alignment with emerging observatory work, clearly defined use cases and the identification of users within the policy system. Without these, there is a risk of adding complexity without improving decision-making. The analysis also clearly cautions that activity-based indicators alone are insufficient to assess sustainability outcomes, and that fuller treatment of trade-offs and value-chain effects will require complementary approaches such as life cycle assessment, modelling and foresight.

Overall, the report recommends a staged approach. Doughnut Economics should be developed as an organising and interpretive layer alongside existing systems, building on current policy and monitoring architectures and focusing initially on clearly defined use cases. This means first clarifying purpose, users and governance; building from the existing systems; selecting a small initial indicator set; piloting defined uses; and reviewing usefulness before broader development and application. This will then require further engagement and exploration with stakeholders who are the prospective users and beneficiaries of

the approach. Governance arrangements, including ownership, stewardship and maintenance, should also be clarified at an early stage in this process. More ambitious applications, such as a fully quantified cross-government dashboard or evaluation tool, would require further methodological development, stronger institutional alignment and explicit agreement on indicators, thresholds and intended use. These are substantial undertakings and would be appropriate only after an initial stage of development has been delivered and tested within the Irish bioeconomy context.

1 Introduction: Project Scope and Doughnut Economics

1.1 Project Context and Purpose

This research was commissioned under the EPA Research Fast-Track to Policy funding scheme. At the time of the research (April 2026), government departments were preparing the National Bioeconomy Strategy (2026–2030) and its associated action plan, and the need for improved bioeconomy monitoring has been identified as an area for further development. This project primarily responds to a request from the Department of Climate, Energy and the Environment to examine whether the Doughnut Economics framework, developed by Kate Raworth (2017), could provide a suitable structure to support development and monitoring of Ireland's bioeconomy in line with the Bioeconomy Action Plan and broader environmental and social policy objectives.

1.2 What is Doughnut Economics?

Doughnut Economics is a conceptual framework that defines a space for sustainable development between two boundaries: a social foundation and an ecological ceiling. The social foundation sets the minimum conditions for human well-being, including access to income, food, housing and education. The ecological ceiling reflects planetary boundaries that should not be exceeded if environmental stability is to be maintained, including limits related to climate change, biodiversity loss and land and water use. Between these boundaries is a space in which social needs can be met without placing unsustainable pressure on environmental systems (Raworth, 2017). In policy terms, the framework is relevant because it brings environmental limits and social conditions into a single organising structure, rather than treating them through separate reporting systems.

1.3 Project Objectives and Staged Methodology

This research is based primarily on desk-based policy, governance and indicator analysis. It examines how far the framework can help identify gaps,

avoid unintended consequences and support more integrated policy interpretation and monitoring.

For this purpose, the report tests the approach through four broad policy anchors: agriculture, food, forestry and the marine sector. These are used as a first-round demonstration of the method rather than as a complete representation of all bioeconomy activity in Ireland. The findings are then summarised in an indicative overall bioeconomy policy-coverage doughnut, which shows how current policy attention and indicator visibility are distributed across the social foundations and ecological ceilings.

1.4 Overview of the Bioeconomy Policy Landscape

Ireland's bioeconomy is shaped by a distributed policy landscape rather than a single framework or government department. It spans multiple sectors, including agriculture, food, forestry, marine resources, waste management and emerging bio-based industries, and is influenced by national policy, EU strategy and cross-cutting governance frameworks. Since the publication of the National Policy Statement on the Bioeconomy in 2018 (Government of Ireland, 2018), this landscape has moved from high-level strategic framing towards more structured implementation and emerging monitoring arrangements. Table 1.1 summarises the key bioeconomy-specific policy frameworks relevant to Ireland, illustrating the shift from broad principles towards implementation, coordination and early-stage monitoring.

These frameworks illustrate a clear progression in bioeconomy governance. This progression is important for the present research because it suggests that the issue is no longer simply whether the bioeconomy should be governed, but how it should be monitored and interpreted in a way that supports implementation and decision-making across environmental, economic and social dimensions. While monitoring initiatives are now emerging at the national and EU levels, the challenge of integrating them in a coherent

Table 1.1. Key bioeconomy policy frameworks relevant to Ireland

Policy document	Strategic role and scope	Governance and implementation	Monitoring and indicators
National Policy Statement on the Bioeconomy (Government of Ireland, 2018)	Ireland's first cross-government bioeconomy statement. It sets out a national vision for Ireland to become "a global leader" in the bioeconomy and is underpinned by four guiding principles: sustainability, cascading use of biomass, a precautionary approach and a food-first principle.	Established an implementation group jointly chaired by the departments responsible for agriculture and environment/climate, signalling that bioeconomy development requires cross-government coordination rather than a single-sector approach.	Set out principles and an implementation framework, but did not establish a dedicated indicator set, reporting system or monitoring architecture for bioeconomy performance.
Bioeconomy Action Plan 2023–2025 (Government of Ireland, 2023)	Ireland's first national action plan for the bioeconomy. It translates the 2018 vision into 33 actions across seven pillars and is explicitly oriented towards implementation, policy coordination, innovation deployment and sectoral uptake.	Strengthens governance through the High-Level Bioeconomy Implementation and Development Group and the reconvened Irish Bioeconomy Forum. It also includes Action 1.7 on developing the next national bioeconomy strategy in light of EU developments.	Action 1.4 supports development of a bioeconomy observatory, beginning with economic reporting and moving towards environmental, social and economic indicators. This is a significant step towards monitoring, but it does not yet amount to a fully operational integrated system.
2018 EU Bioeconomy Strategy (European Commission, 2018), which updated the 2012 EU Bioeconomy Strategy (European Commission, 2012), and the Strategic Framework for a Competitive and Sustainable EU Bioeconomy (European Commission, 2025a)	Provides the wider strategic context within which Ireland's bioeconomy policy evolves. The 2018 strategy emphasised innovation, sustainability, circularity and rural development; the 2025 framework places greater emphasis on deployment, competitiveness, resilience, lead markets, sustainable biomass use and support for primary producers.	The 2025 framework places stronger emphasis on scaling bio-based innovation, simplifying regulatory requirements, stimulating private investment and strengthening biomass governance. However, it remains an EU-level framework rather than a national governance model for Ireland.	The European Commission continues to monitor the bioeconomy through the Knowledge Centre for Bioeconomy and the EU Bioeconomy Monitoring System, which provide data tools and indicator resources across economic, environmental and social dimensions. These are important reference points, but they do not resolve national coordination or implementation challenges within Member States.

governance structure remains unresolved in Ireland and across the EU.

1.5 Cross-cutting Irish Frameworks Influencing the Bioeconomy

The bioeconomy in Ireland does not operate within a single policy framework. In addition to bioeconomy-specific strategies, wider national frameworks that set environmental goals, investment priorities, planning arrangements and social monitoring systems are also shaping the bioeconomy.

1.5.1 Implications for bioeconomy governance

Table 1.2 highlights that bioeconomy governance in Ireland is shaped by a layered policy landscape. Cross-cutting frameworks set overarching constraints and priorities, while sectoral strategies define the

operating context for agriculture, food, forestry and marine activity. These frameworks are largely organised within separate policy domains and led by different departments and agencies, reinforcing the need for coordination across institutions, targets and monitoring systems (Food and Agriculture Organization of the United Nations (FAO), 2025; O'Riordan *et al.*, 2025).

This is directly relevant to the present project, which examines whether a Doughnut Economics-based approach could help organise environmental, economic and social dimensions for policy interpretation and decision support, while also identifying gaps in the indicators, tools and metrics available for monitoring the bioeconomy. The issue is therefore not only whether indicators exist, but how available indicators can be interpreted together across a distributed governance system. Several of the sectoral strategies listed in Table 1.2 are examined in more detail in Chapters 2 and 3.

Table 1.2. Cross-cutting and sectoral documents relevant to the governance of Ireland's bioeconomy

Framework/sector	Key policy document(s)/lead department or body	Strategic focus	Relevance to bioeconomy governance
Circular economy	Whole of Government Circular Economy Strategy 2022–2023 (Government of Ireland, 2021d) and Whole of Government Circular Economy Strategy 2026–2028 (Government of Ireland, 2026)/DCEE	Provides a whole-of-government framework for the transition to a circular economy, with emphasis on resource efficiency, reuse, repair, recycling, circular material use and reduced reliance on virgin raw materials.	Relevant where the bioeconomy intersects with organic waste, by-products and biomass utilisation. It shapes resource efficiency and waste-valorisation policy but does not function as a stand-alone governance framework for the bioeconomy.
Climate governance	Climate Action and Low Carbon Development Act 2015 (Government of Ireland, 2015); Climate Action and Low Carbon Development (Amendment) Act 2021 (Government of Ireland, 2021a); annual Climate Action Plans/DCEE	Establishes the legally binding framework for the transition to a climate-resilient, biodiversity-rich, environmentally sustainable and climate-neutral economy by 2050, implemented through carbon budgets, sectoral emissions ceilings and annual Climate Action Plans.	The strongest cross-cutting environmental constraint affecting the bioeconomy. It directly influences agriculture, land use, energy and industry through carbon budgets, sectoral ceilings and annual Climate Action Plans.
Ireland's Well-being Framework	Understanding Life in Ireland: The Well-being Framework 2025 (Government of Ireland, 2025c)/Department of the Taoiseach; Central Statistics Office data hub	Provides a national dashboard of 35 indicators across 11 dimensions to assess quality of life, with explicit attention to equality and sustainability across economic, environmental and social issues.	Relevant as the State's principal framework for monitoring social and distributional outcomes. However, its indicators are not directly embedded in sectoral bioeconomy governance or monitoring systems.
Spatial planning (Project Ireland 2040)	National Planning Framework: First Revision (Government of Ireland, 2025a) and National Development Plan Review 2025 (Government of Ireland, 2025b)/DHLGH and DPER	Provides the national spatial planning and capital investment framework for housing, infrastructure, regional development and renewable energy, and guides the review of regional and local plans.	Relevant because it shapes land use, infrastructure and regional development patterns that influence where bio-based activities can develop. Its effect on the bioeconomy is indirect but significant.
Agriculture	Ireland's CAP Strategic Plan 2023–2027 (Department of Agriculture, Food and the Marine, 2022)/DAFM	Supports viable farm incomes, the rural economy, safe food production, and climate and environmental action through the Common Agricultural Policy framework.	The principal governance and monitoring framework for primary agriculture relevant to the bioeconomy. It shapes farm-level income support, land management, climate action and environmental measures.
Food	Food Vision 2030: A World Leader in Sustainable Food Systems (Government of Ireland, 2021b)/DAFM	Sets a 10-year strategy for the food sector through four missions covering environmental sustainability, viable primary producers and well-being, safe and trusted food, and innovation, competitiveness and talent.	The main strategy for the wider food system. It links environmental ambition, producer viability, food-system outcomes and innovation, supported by monitoring and reporting arrangements.
Forestry	Ireland's Forest Strategy Implementation Plan (Department of Agriculture, Food and the Marine, 2023b)/DAFM	Implements the forest strategy through the Forestry Programme 2023–2027 and associated actions, with a stated role in delivering the shared vision for 2050.	The main operational forestry policy framework, governing afforestation, forest management, timber supply and related climate and biodiversity objectives.
Marine	National Marine Planning Framework (Government of Ireland, 2021c)/DCEE	Provides the national marine spatial plan to 2040, bringing together marine activities within an ecosystem-based, plan-led framework for sustainable use of marine resources.	The principal framework governing marine spatial planning and the interaction of marine activities, including fisheries, aquaculture, offshore energy and environmental protection.

CAP, Common Agricultural Policy; DAFM, Department of Agriculture, Food and the Marine; DCEE, Department of Climate, Energy and the Environment; DHLGH, Department of Housing, Local Government and Heritage; DPER, Department of Public Expenditure, Infrastructure, Public Service Reform and Digitalisation.

1.6 Emerging Monitoring Initiatives (Ireland and EU)

Table 1.3 shows that there is a range of initiatives that are contributing to the development of bioeconomy monitoring and indicator systems at the Irish and EU levels. These initiatives vary in scope and maturity, with some developing monitoring systems or dashboards, and others focusing on indicators, methods or governance tools.

At the EU level, the EU Bioeconomy Monitoring System developed by the Joint Research Centre (JRC) provides the most established reference framework.

It includes a structured set of indicators that cover economic, environmental and social dimensions, and is used in this report as a key reference point for later analysis.

At the national level, the INFORMBIO (Integrated Framework for Mapping, Modelling and Monitoring Ireland's Bioeconomy), BIO-INSIGHT (Bioeconomy Indicators for Foresight), BioValue and JusTACE (Just Transition for Agriculture in the Circular Bioeconomy) initiatives contribute different parts of the emerging evidence base, including prototype monitoring, key performance indicator development, economic and environmental measurement, and socio-economic

Table 1.3. Selected monitoring and indicator development initiatives relevant to Ireland's bioeconomy

Initiative	Scope/lead institution(s)	Current status	Main outputs relevant to monitoring and indicators
INFORMBIO	Ireland/led by MTU, with Teagasc, the University of Galway and CSO; supported through DAFM-funded research	Launched in 2022; at the time of the research (April 2026), final prototype work with Teagasc was expected in August 2026.	Supports preparation for an Irish bioeconomy observatory. Published and emerging outputs include a Bioresource Mapping Tool, a Bioresource Modelling Database, a Bio-Based Value Chain catalogue, the GOBLIN model and a Bioeconomy Monitoring Framework with a prototype monitoring dashboard (INFORMBIO Project, n.d.).
EU Bioeconomy Monitoring System	EU-wide/European Commission JRC and Knowledge Centre for Bioeconomy	Operational platform: dashboard continues to be updated	Main EU reference platform for bioeconomy monitoring. Provides dashboards and metadata across economic, environmental and social dimensions. The 2024 technical report documents the extension of the system with social indicators and reports 154 indicators published on the platform as of December 2023 (Patani <i>et al.</i> , 2024).
BIO-INSIGHT	Ireland/University of Galway	Funded in 2026	Focuses on evaluating the sustainability of production systems using biological resources in cascading and circular use. The planned output is a decision-support tool that generates key performance indicators for biomaterials and bioenergy from wet wastes and cascading uses of wood (University of Galway, 2026).
BioMonitor	EU-wide/consortium led by Wageningen University & Research	Completed; 2018–2022	Developed a sustainable data and modelling framework for measuring the economic, environmental and social impacts of the bioeconomy. Outputs included improved datasets, modelling tools, stakeholder platform functions, and analytical methods for quantifying the size and dynamics of EU and Member State bioeconomies (BioMonitor Project, n.d.).
BioValue	Ireland/collaborative bioeconomy research involving the University of Galway and other project partners	Ongoing at the time of the research (April 2026)	Relevant to economic and environmental measurement of the bioeconomy. BioValue supports assessment of bio-based transition pathways through life cycle assessment, land-use modelling, foresight analysis and economic measurement, including value added, employment and bio-based shares. It also highlights data limitations, including time lags in input–output tables and the limited visibility of emerging bioeconomy sectors in national accounts.
JusTACE	Ireland/EPA-funded partnership involving University College Dublin, MTU, University College Cork and Maynooth University	Ongoing; start date 31 March 2025, projected completion 30 March 2029	Relevant to the social dimension of monitoring. The project uses stakeholder engagement through Living Labs to assess socio-economic impacts and evaluate circular business and collaborative consumption models and aims to develop progressive indicators and evaluation frameworks for a just transition in the agri-food sector of the circular bioeconomy (CircBio, n.d.).

CSO, Central Statistics Office; DAFM, Department of Agriculture, Food and the Marine; GOBLIN, General Overview for a Backcasting approach of Livestock Intensification; MTU, Munster Technological University.

assessment. Together, these initiatives show that Ireland is developing relevant monitoring and analytical capacity, but that a fully integrated bioeconomy monitoring architecture has not yet been established.

These initiatives show that monitoring work is progressing at both the EU and national levels. However, many systems remain under development, and a fully integrated Irish monitoring architecture linking environmental limits, economic activity and social outcomes has not yet been established. More broadly, developing such systems has been described as a “Herculean” task (Jander *et al.*, 2020), reflecting challenges related to coordination, governance and practical application.

1.6.1 Measuring the bioeconomy: approaches and limitations

Measuring the bioeconomy is difficult because it spans multiple sectors rather than forming a single statistical category. Existing studies therefore often rely on input–output and national accounting approaches to estimate value added, employment and sectoral linkages, but results are sensitive to definitions, sector classifications and assumptions about bio-based shares (Ronzon and M'Barek, 2018; Cingiz *et al.*, 2021; Ronzon *et al.*, 2022; Leavy *et al.*, 2024). Irish research highlights similar issues, including time lags in official input–output tables and the limited visibility of emerging sectors in national accounts (Can *et al.*, 2026).

1.7 Cross-framework Analysis: Coherence and Gaps

Ireland's policy landscape for sustainable development, including the bioeconomy, climate action, the circular economy and well-being, shows a relatively high level of coherence in strategic intent. Common objectives include sustainability, innovation, resilience and societal benefit (Wesseler and von Braun, 2017; Government of Ireland, 2021a, 2023). However, as shown above, this coherence is stronger at the level of ambition than in governance design, indicator systems and implementation. Earlier Irish research reached a similar conclusion, highlighting inconsistencies across sectoral strategies and the risks of siloed approaches (Kelleher *et al.*, 2019).

At the operational level, however, the main frameworks remain uneven and institutionally separate. Climate governance is supported by legally binding carbon budgets and sectoral emissions ceilings, while areas such as biodiversity, soil and water are addressed through more fragmented frameworks and programme measures (Government of Ireland, 2021a; O'Riordan *et al.*, 2025). Circular economy policy has advanced resource-efficiency monitoring (Government of Ireland, 2021d, 2026), while Ireland's Well-being Framework provides a structured dashboard of social indicators (Government of Ireland, 2025c). However, neither is directly embedded within an integrated bioeconomy monitoring system. This reflects wider limitations in the integration of social and environmental dimensions within bioeconomy monitoring and policy frameworks (Melim-McLeod *et al.*, 2022; Faulkner *et al.*, 2024). This reflects a broader trend identified in JRC analysis, where bioeconomy policy has tended to prioritise economic and technological dimensions over social and justice considerations (Giuntoli *et al.*, 2023).

Monitoring maturity also varies across systems. At the EU level, the EU Bioeconomy Monitoring System is the most developed framework, with 154 indicators as of December 2023, including recent extensions to social indicators (Patani *et al.*, 2024). In Ireland, initiatives such as INFORMBIO and the proposed bioeconomy observatory indicate progress but remain under development. This suggests that the challenge is increasingly one of coordination and application rather than indicator availability (O'Connor *et al.*, 2023).

These governance challenges are reinforced by recent Irish research. Pender *et al.* (2024) identify limited cross-government integration, continued siloing, gaps in leadership, regulatory lag and resource constraints. EPA-funded research similarly highlights the need for clearer structures, defined roles and stronger coordination (O'Riordan *et al.*, 2025).

Overall, the evidence suggests that, while policy intent is broadly aligned, implementation remains fragmented across sectors, institutions and monitoring systems. No single mechanism currently brings together ecological constraints, economic performance and social outcomes in a way that supports integrated monitoring. The key challenge is therefore not the creation of additional indicators, but rather the development of a structure through which existing evidence can be interpreted together.

2 Bioeconomy Sectoral Overview through the Doughnut Economics Lens

2.1 Interpreting Social and Ecological Dimensions through the Doughnut Economics Lens

Within the Doughnut Economics framework, sustainability is understood through two interdependent sets of dimensions: a social foundation and an ecological ceiling. The social foundation represents the minimum conditions necessary for people and communities to live secure and dignified lives, while the ecological ceiling reflects the biophysical limits that human activity must respect in order to maintain the resilience and stability of Earth systems (Raworth, 2017).

The social dimensions align broadly with those articulated in the Sustainable Development Goals (United Nations, 2015), including food security, livelihoods, education, health, equity and participation. The ecological dimensions draw on Earth system science and the planetary boundaries framework, including climate change, biodiversity loss, land-system change and freshwater use (Richardson *et al.*, 2023). Between these boundaries is a space in which social needs can be met without placing unsustainable pressure on environmental systems (Raworth, 2017).

For the purposes of this report, these dimensions are used as a qualitative policy-analysis framework

rather than a threshold-based assessment tool.

In line with Raworth (2017), the analysis uses 12 social foundations and 9 ecological ceilings to review sectoral policy content. Table 2.1 sets out the dimensions applied in the sectoral classification. At this stage, the value of the framework lies in identifying which dimensions are visible in current policy and monitoring arrangements, which are only partly addressed and which remain weakly represented or absent.

2.2 Sector Selection and Analytical Approach

2.2.1 Sector selection and scope

This report uses agriculture, food, forestry and the marine sector as four broad policy anchors for applying the Doughnut Economics-based policy-screening method. The selection is grounded in Irish bioeconomy policy, but it does not define the full scope of the Irish bioeconomy. The Bioeconomy Action Plan 2023–2025 (Government of Ireland, 2023) identifies “Agriculture, Food, Forestry & the Marine” as one of seven pillars, while the National Policy Statement on the Bioeconomy (Government of Ireland, 2018) identifies farming, food-related activity, forestry and marine resources among the areas through which Ireland’s bioeconomy may develop. These four areas were therefore selected as a manageable first-round basis for examining how existing sectoral policy frameworks can be interpreted through the Doughnut Economics lens.

Bio-based materials, waste valorisation, bioenergy, bio-based chemicals and related industrial applications are important parts of the wider bioeconomy but are not treated here as stand-alone sectors. Instead, the analysis examines how four selected policy frameworks address the social and ecological dimensions of the Doughnut Economics framework, and how far this is supported by targets, indicators and monitoring arrangements. Agriculture is examined through Ireland’s CAP Strategic Plan 2023–2027 (Department of Agriculture, Food and the Marine, 2022), food is examined through Food

Table 2.1. Doughnut Economics dimensions applied in sectoral classification (in line with Raworth (2017))

Dimension category	Dimensions
Social foundation	Food; Water; Health; Education; Income and Work; Peace and Justice; Political Voice; Social Equity; Gender Equality; Housing; Networks; Energy
Ecological ceiling	Climate Change; Biosphere Integrity (Biodiversity Loss); Land-System Change; Freshwater Use; Biogeochemical Flows (Nitrogen and Phosphorus); Novel Entities (Chemical Pollution); Atmospheric Aerosol Loading (Air Pollution); Ocean Acidification; Ozone Layer Depletion

Vision 2030 (Government of Ireland, 2021b), forestry is examined through Ireland's Forest Strategy 2023–2030 (Department of Agriculture, Food and the Marine, 2023a), while the marine sector is examined through the National Marine Planning Framework (Government of Ireland, 2021c).

The sectoral policy analysis is conducted at the national policy level. It does not attempt a full economic accounting of the bioeconomy, nor does it disaggregate by region, commodity, value chain or firm type. Its purpose is narrower: to demonstrate how a Doughnut Economics-based approach can be applied to selected policy anchors and to identify where coverage of social and ecological dimensions is well developed, partial or limited. The approach could be extended in later work to other bioeconomy sectors, value chains or policy areas, including waste, bioenergy, and bio-based materials and chemicals.

2.2.2 Extraction, coding and classification

For each of the four sectors, one up-to-date primary policy document was selected as the anchor text for analysis. This provides a clear and manageable basis for cross-sector comparison. It is recognised that each sector is also shaped by wider legislation, implementation plans and associated policy instruments. The same methodological approach could, in future research, be applied across a broader set of relevant documents, including the Bioeconomy Action Plan 2023–2025 (Government of Ireland, 2023) and the wider cross-cutting and sectoral frameworks identified in Table 1.2 (Kelleher *et al.*, 2019, 2021). For the purposes of this report, however, one primary document per sector offers a manageable and consistent starting point for each sector.

Each policy document was reviewed using structured qualitative document analysis, consistent with earlier Irish bioeconomy policy coherence work (Kelleher *et al.*, 2019, 2021). The review extracted information on sectoral objectives, social and ecological dimensions, indicators, targets, and monitoring and accountability mechanisms. This material was then coded against the Doughnut Economics dimensions as set out in Table 2.1. The purpose was not to assess sectoral performance, but to identify the extent to which current policy frameworks recognise, prioritise and operationalise the 12 social foundations and 9 ecological ceilings used in this study.

To distinguish the prominence of each dimension, coded references were classified as primary, secondary, peripheral or not covered. Primary dimensions are clearly prioritised in the policy text and linked to explicit objectives, targets, indicators or monitoring arrangements. Secondary dimensions are recognised as relevant but are less fully operationalised. Peripheral dimensions are mentioned only indirectly or briefly, or through wider cross-referencing rather than substantive commitments. For reasons of space, only the resulting classifications are reported in Table 2.2, while the fuller basis for classification is provided in Appendix 1. These classifications are intended to identify policy salience and operationalisation, not scientific weighting or actual sustainability performance (Kelleher *et al.*, 2019). The classifications provide a policy-grounded baseline for later sections, particularly the identification of candidate indicators and the feasibility assessment in Chapter 4.

Applied Doughnut Economics studies also require explicit choices about which domains to emphasise, how they are interpreted and how they are adapted to the context under review (Sayers *et al.*, 2014; Sayers and Trebeck, 2015; Turner and Wills, 2022; Cattaneo *et al.*, 2025). Further examples are discussed in section 4.4. The primary/secondary/peripheral classification used here should therefore be understood as a pragmatic policy-mapping tool. It does not determine which Doughnut Economics dimensions are scientifically most important, nor does it assess whether sectors are operating within ecological ceilings or above social foundations. Rather, it identifies how the Doughnut Economics domain structure appears in current Irish sectoral policy, providing a first step towards the more developed bioeconomy Doughnut Economics framework considered later in Chapter 4.

2.3 Cross-sector Findings

Table 2.2 provides a combined overview of the four sectors and shows that current policy frameworks broadly recognise that bioeconomy development must deliver economic value while responding to environmental constraints. Across all four sectors, Income and Work is either a primary or strongly developed social foundation, reflecting the consistent emphasis on economic viability, employment and

Table 2.2. Sectoral policy review through the Doughnut Economics lens

Sector and primary policy anchor	Monitoring basis	Main social foundations identified	Main ecological ceilings identified
Agriculture: Ireland's CAP Strategic Plan 2023–2027 (Department of Agriculture, Food and the Marine, 2022)	CAP result indicator framework, CAP Monitoring Committee, and departmental monitoring and evaluation arrangements	Primary: Food; Income and Work Secondary: Education; Gender Equality; Networks; Social Equity	Primary: Climate Change; Biosphere Integrity; Freshwater Use; Biogeochemical Flows Secondary: Atmospheric Aerosol Loading; Novel Entities
Food: Food Vision 2030 (Government of Ireland, 2021b)	High-Level Implementation Committee and wider Monitoring and Implementation Framework	Primary: Food; Income and Work; Health Secondary: Education; Gender Equality; Networks; Social Equity	Primary: Climate Change; Biosphere Integrity; Freshwater Use; Biogeochemical Flows Secondary: Atmospheric Aerosol Loading; Novel Entities; Land-System Change
Forestry: Ireland's Forest Strategy 2023–2030 (Department of Agriculture, Food and the Marine, 2023a)	Baseline metrics, ambitions, and delivery, governance and monitoring commitments in the strategy	Primary: Income and Work; Health Secondary: Housing; Education; Networks	Primary: Climate Change; Biosphere Integrity; Land-System Change Secondary: Freshwater Use
Marine: National Marine Planning Framework (Government of Ireland, 2021c)	MSFD Good Environmental Status monitoring, programmes of measures, WFD/RBMP cycles and statutory environmental assessment	Primary: Income and Work; Networks Secondary: Food; Health; Political Voice	Primary: Biosphere Integrity; Climate Change Secondary: Freshwater Use; Biogeochemical Flows; Novel Entities; Atmospheric Aerosol Loading

Primary=core sectoral pressures or policy priorities explicitly addressed by the policy framework. **Secondary**=significant but not dominant dimensions. Definitions of peripheral and not covered classifications, and the rationale for the sectoral screening approach, are provided in Appendix 1. The table reflects a first-round screening of four broad sectoral policy anchors and does not separately assess all bioeconomy-relevant areas, including bio-based materials, waste valorisation or bioenergy, as stand-alone sectors.

CAP, Common Agricultural Policy; **MSFD**, Marine Strategy Framework Directive; **RBMP**, River Basin Management Plan; **WFD**, Water Framework Directive.

resilience. Climate Change and Biosphere Integrity also emerge as the most consistently prioritised ecological ceilings, although their framing differs by sector. Agriculture and food place particular emphasis on emissions, nutrient pressures and biodiversity restoration. Forestry gives greater weight to forest expansion and climate mitigation, while marine policy focuses on ocean health, biodiversity protection and Good Environmental Status.

At the same time, Table 2.2 shows clear gaps and asymmetries. Food is central in agriculture and food policy, but only secondary in the marine sector and not substantively covered in forestry. Networks and community-related dimensions are more visible in forestry and marine policy than in agriculture and food, while Health is more strongly developed in food and forestry than elsewhere. Several social foundations, notably Peace and Justice, Water as a social foundation and Housing, are either not covered or only weakly represented, with Housing substantively reflected only in forestry. On the ecological side, Ozone Layer Depletion is not substantively covered in

any of the four frameworks, while Ocean Acidification is only weakly represented outside the marine context. Some of these patterns reflect the sector-specific relevance of particular domains, while others point to genuine gaps in policy coverage. Overall, this indicates that certain Doughnut Economics dimensions remain limited or absent from current sectoral policy design, even where they may be conceptually relevant.

A further cross-sector pattern is the uneven maturity of monitoring arrangements. Agriculture is supported by the most developed monitoring architecture, through the Common Agricultural Policy (CAP) result indicator framework, CAP Monitoring Committee structures and established reporting arrangements. Food Vision 2030 also identifies a substantial set of high-level indicators and is explicit about implementation and progress to 2030 (Government of Ireland, 2021b). Ireland's Forest Strategy 2023–2030 set out a clear governance and monitoring architecture and stated that a list of key high-level indicators would be identified and developed (Department of Agriculture, Food and the Marine, 2023a). A separate Forest

Strategy KPI set was subsequently published in December 2024 (Department of Agriculture, Food and the Marine, 2024). The marine sector is distinctive in that environmental monitoring is comparatively mature because it is linked to statutory EU marine and water governance cycles, while social and economic dimensions are more dispersed across planning policy and wider State reporting systems.

The review also highlights an integration challenge. These sectors are closely connected. Agriculture and food are linked through farm income, food production, nutrient management and emissions. Forestry interacts with agriculture through land-use change and rural development. Marine policy links food production, biodiversity protection, climate transition and coastal community sustainability within a shared maritime space. Yet the monitoring systems attached to these sectors remain largely document specific and institutionally separate. As a result, interactions and trade-offs, such as biomass use versus biodiversity, climate objectives versus water quality or sector growth versus social distribution, are not captured within any single reporting structure.

Because this analysis is anchored in four broad sectoral frameworks, some bioeconomy-relevant areas, particularly bio-based materials, waste valorisation and bioenergy, are not examined directly as stand-alone sectors. Their weaker visibility in this first-round analysis should therefore be understood as a limitation of scope rather than as evidence that they are absent or unimportant within the wider bioeconomy system.

These findings provide the basis for the next stage of analysis. Table 2.2 summarises where current sectoral policy and monitoring arrangements show stronger or weaker coverage across the Doughnut Economics dimensions, providing a first-stage screening basis for the indicator mapping in section 2.4. Primary and secondary dimensions are the clearest candidates for indicator selection, while peripheral and non-covered dimensions point to the potential need for proxies, supplementary datasets or longer-term indicator development, where they are deemed relevant.

2.4 Indicator Identification and Mapping Approach

Building on the policy screening in sections 2.2 and 2.3, the next step was to identify the formal indicators

and monitoring measures explicitly contained within the four selected policy documents and to examine how far these could be related to the social foundations and ecological ceilings of the Doughnut Economics framework. The review remained policy led. Rather than constructing a new indicator set, it began with the indicators already embedded in each document's monitoring and reporting architecture.

This produced four document-level summaries, with supporting evidence set out in Appendix 2. For Ireland's CAP Strategic Plan 2023–2027, indicators were drawn from the CAP's context indicators and result indicators (Department of Agriculture, Food and the Marine, 2022); for Food Vision 2030, from quantitative indicators, qualitative goals and stated progress measures (Government of Ireland, 2021b); for the Forest Strategy, from baseline metrics, ambitions and monitoring commitments (Department of Agriculture, Food and the Marine, 2023a); and for the National Marine Planning Framework, from binding environmental targets alongside quantified economic, social and planning-related measures (Government of Ireland, 2021c). Cross-cutting indicators were kept distinct where no single direct doughnut fit was appropriate.

The sector doughnut diagrams (Figures 2.1–2.4) provide visual summaries of the policy-domain screening undertaken in Table 2.2 and Appendix 1. They show the extent to which each social and ecological dimension is reflected in the selected policy document, using the primary/secondary/peripheral/not covered classification. These are policy-coverage diagrams, not performance assessments. The appendices complement these diagrams, providing the classification rationale in Appendix 1, summary indicator evidence in Appendix 2 and selected mapping examples in Appendix 3.

The figures and supporting indicator mapping show that policy and indicator coverage across the Doughnut Economics framework is uneven. Coverage is strongest for domains linked to economic viability, employment, climate, biodiversity, land use, water quality and nutrient pressures. By contrast, several domains are weakly represented, indirectly addressed or absent in the four selected documents, including Water as a social foundation, Peace and Justice, Political Voice, Gender Equality, Housing, Energy, Ocean Acidification and Ozone Layer Depletion.

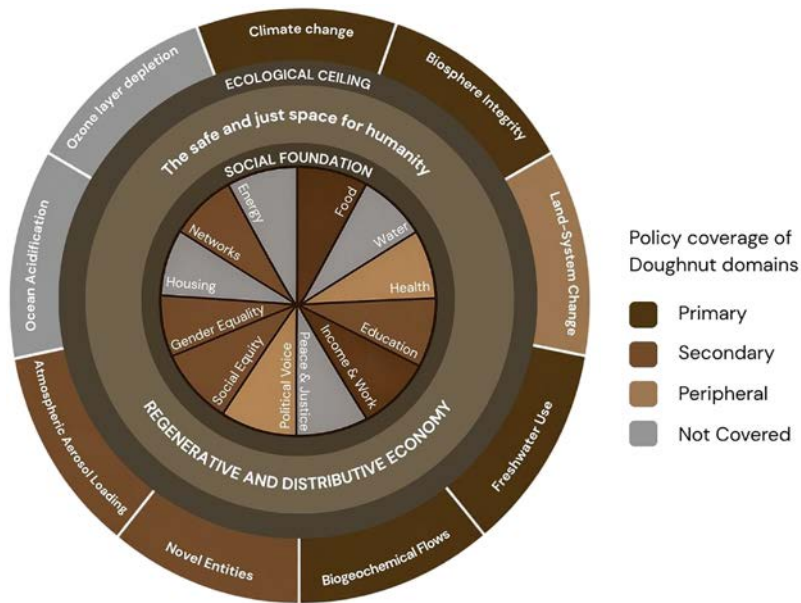


Figure 2.1. Agriculture policy-coverage doughnut.

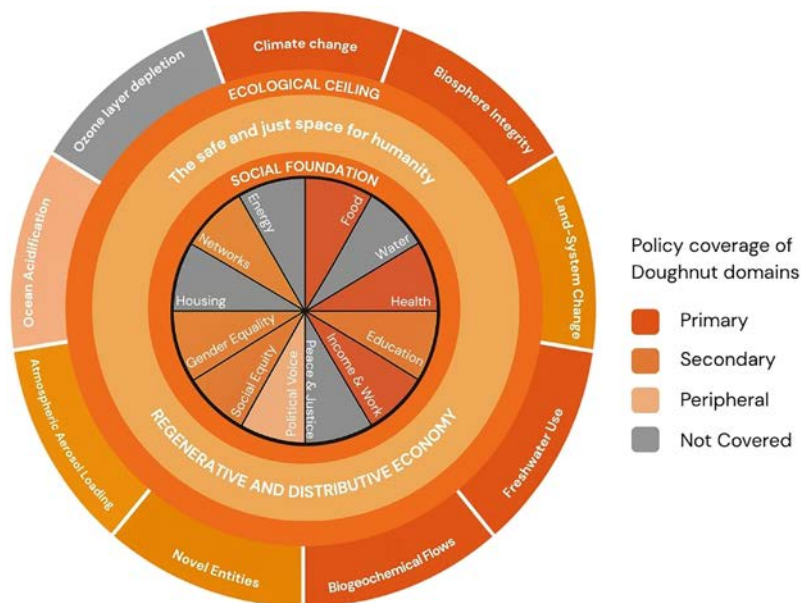


Figure 2.2. Food policy-coverage doughnut.

This indicates where policy-based monitoring is already relatively well developed and where future work would need to draw on proxies, supplementary datasets or further indicator development.

This should be understood as a first-round, policy-led mapping exercise based on four primary documents rather than as a complete monitoring architecture. The same methodology could be applied to wider policy and monitoring materials identified in sections 1.4–1.6, including the Bioeconomy Action Plan 2023–2025 (Government of Ireland, 2023), the EU Bioeconomy

Monitoring System and relevant Irish observatory work. The material presented here therefore provides an initial baseline for the feasibility assessment developed in Chapter 4.

2.4.1 Indicative overall bioeconomy policy-coverage doughnut

The four sector diagrams and the supporting indicator mapping in Appendix 3 provide a basis for producing an indicative overall bioeconomy policy-coverage

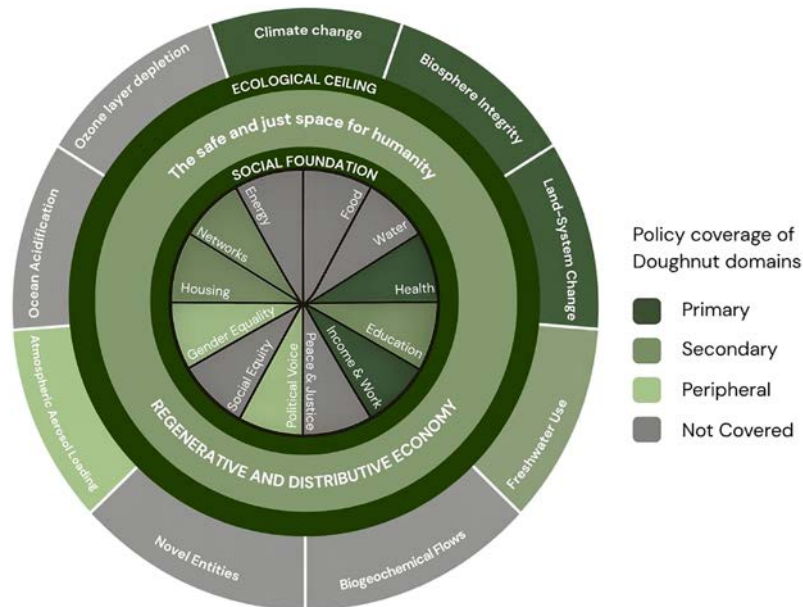


Figure 2.3. Forestry policy-coverage doughnut.

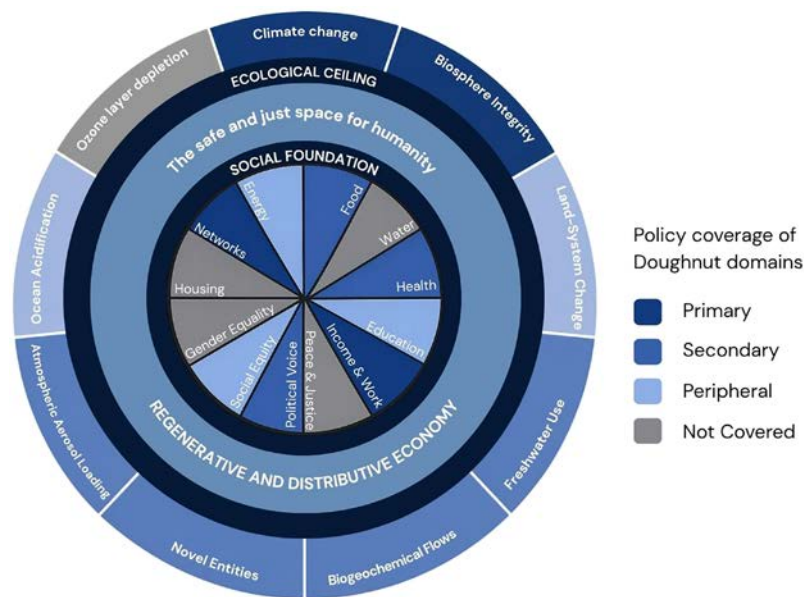


Figure 2.4. Marine policy-coverage doughnut.

doughnut (Figure 2.5). This figure does not represent a measured national bioeconomy doughnut or a sustainability performance assessment. Rather, it summarises what becomes visible when the four selected policy anchors are read together through the Doughnut Economics framework.

The overall classification is based on a synthesis of the sector-level policy classifications in Table 2.2 and Appendix 1, supported by the selected mapping examples in Appendix 3. It is not derived from a simple numerical total, but from the combined assessment

of policy salience, operationalisation and indicator visibility across the four selected policy anchors.

The overall pattern shows that some domains are strongly represented across the selected documents, especially Income and Work, Food, Health, Climate Change, Biosphere Integrity, Freshwater Use and Biogeochemical Flows. Other domains are present but less consistently embedded, including Education, Networks, Social Equity, Gender Equality, Land-System Change, Novel Entities and Atmospheric Aerosol Loading. A smaller group remains weakly



Figure 2.5. Indicative bioeconomy policy-coverage doughnut based on the four policy anchors reviewed. This figure summarises the extent to which the Doughnut Economics domains are reflected across the four policy documents reviewed in this study: Ireland's CAP Strategic Plan 2023–2027 (Department of Agriculture, Food and the Marine, 2022), Food Vision 2030: A World Leader in Sustainable Food Systems (Government of Ireland, 2021b), Ireland's Forest Strategy 2023–2030 (Department of Agriculture, Food and the Marine, 2023a) and the National Marine Planning Framework (Government of Ireland, 2021c). It represents policy coverage and indicator visibility only. It does not measure sustainability performance, ecological overshoot, social shortfall, distance from thresholds or full data readiness. The classification is based on the primary/secondary/peripheral/not covered screening approach described in Chapter 2 and the indicator mapping summarised in Appendix 3.

represented, indirectly addressed or absent in this first-round policy screening, including Water as a social foundation, Peace and Justice, Political Voice, Housing, Energy, Ocean Acidification and Ozone Layer Depletion. This should be read as a policy-coverage summary and not as an assessment of whether Ireland's bioeconomy is operating within ecological ceilings or above social foundations. Its purpose is to

show how the Doughnut Economics framework can help identify areas where existing policy and indicator coverage is relatively strong, where it is partial and where further data sources or indicator development may be required.

Box 2.1 outlines how the screening method could be extended beyond the four policy anchors.

Box 2.1. Extending the Doughnut Economics method beyond the four policy anchors

This report demonstrates the Doughnut Economics-based screening method using four broad policy anchors: agriculture, food, forestry and the marine sector. These were selected as a manageable first-round basis for testing whether existing policy objectives, indicators and monitoring arrangements could be organised through the Doughnut Economics framework. They should not be read as a complete representation of all bioeconomy activity in Ireland.

The same method could be extended to other bioeconomy-relevant areas, including bio-based materials, organic waste and by-product valorisation, bioenergy, bio-based chemicals, construction materials and specific value chains. It could also be applied to wider monitoring sources, including the Bioeconomy Action Plan 2023–2025 (Government of Ireland, 2023), the proposed bioeconomy observatory, INFORMBIO, BIO-INSIGHT, BioValue and the EU Bioeconomy Monitoring System. Such an extension would allow the indicative policy-coverage doughnut developed in this report to be expanded over time as new datasets, observatory outputs and sector-specific indicators become available.

3 Comparative Analysis of Governance Frameworks and Alternative Models

Ireland's bioeconomy operates within a dispersed governance architecture rather than a single integrated framework. Economic development is shaped through national planning and investment frameworks, environmental performance through cross-cutting environmental policy, and social outcomes through separate well-being and statistical systems (Government of Ireland, 2025a, 2025b, 2025c, 2026). As a result, governance relevant to the bioeconomy is distributed across multiple systems with different purposes, instruments and institutional bases.

This chapter offers a high-level comparison of key governance frameworks relevant to bioeconomy monitoring. It focuses on their coverage of social and ecological dimensions, monitoring arrangements and treatment of trade-offs, so as to identify where governance functions are already present and where limitations remain, and whether an additional interpretive framework may be useful.

Each document was assessed using structured qualitative document analysis, consistent with earlier Irish policy coherence work (Kelleher *et al.*, 2019, 2021). Coding was based on explicit policy content, including objectives, governance arrangements, indicators, targets and reporting provisions. Frameworks were then compared using common criteria covering governance focus, indicator and monitoring focus, social and ecological coverage, treatment of trade-offs, relevance to bioeconomy governance and key limitations. Full coding and evidence notes are provided in Appendix 4. Table 3.1 summarises the comparison.

3.1 The Current Economic Governance Model in Ireland

As shown in Table 3.1, Ireland's current economic governance model is most clearly expressed through Project Ireland 2040, which combines the National Planning Framework and the National Development Plan (Government of Ireland, 2025a, 2025b). Together, these provide the core architecture through

which national development is planned, funded and implemented. These frameworks are not bioeconomy specific, but they do shape the conditions within which bioeconomy sectors operate. The current economic governance model in Ireland may be characterised as growth oriented, investment led and infrastructure driven, with environmental and social considerations integrated primarily through linked policy systems rather than any single monitoring framework. This reflects Ireland's wider economic structure as a highly open economy, influenced by international trade and multinational activity (European Commission, 2025b).

The National Planning Framework structures land use, infrastructure, settlement patterns and environmental protection, while the National Development Plan sets capital investment priorities across areas such as housing, water, energy, transport and research (Government of Ireland, 2025a, 2025b). Many issues central to the bioeconomy are therefore shaped by these frameworks, including land use, water infrastructure, renewable energy and rural development. However, bioeconomy development is influenced indirectly through planning and investment processes rather than through a dedicated integrated monitoring framework.

Together, the National Planning Framework and the National Development Plan coordinate development across sectors but do not provide a framework for assessing whether outcomes are socially just and ecologically sustainable. These dimensions are instead addressed through separate policy systems. For this reason, the current economic governance model is an essential part of the context, but is not sufficient for integrated bioeconomy monitoring.

3.2 Circular Economy as an Alternative Governance Lens

The circular economy provides an alternative governance lens centred on resource efficiency, material circulation and waste prevention. It is particularly relevant to the bioeconomy, where many

Table 3.1. Summary comparison of governance frameworks relevant to Irish bioeconomy monitoring

Criterion	Project Ireland 2040: National Planning Framework: First Revision (Government of Ireland, 2025a) and National Development Plan Review 2025 (Government of Ireland, 2025b)	Whole of Government Circular Economy Strategy 2026–2028 (Government of Ireland, 2026)	Understanding Life in Ireland: The Well-Being Framework 2025 (Government of Ireland, 2025c)
Governance focus	National spatial planning and capital investment framework. The NPF structures land use and development through the statutory planning hierarchy, while the NDP allocates public investment and infrastructure funding.	Whole-of-government governance framework centred on resource efficiency, circularity, waste prevention and sectoral transition.	National multidimensional monitoring framework that tracks social, economic and environmental outcomes through a dashboard of indicators.
Indicator and monitoring focus	Strongest in planning compliance, capital allocation, project appraisal and delivery oversight. Monitoring is procedural and investment-focused rather than a unified socio-ecological dashboard.	Comparatively strong monitoring architecture, including a Circular Material Use Rate target, annual progress reporting, sectoral targets and a planned circularity dashboard.	Centred on 35 indicators across 11 dimensions, with trend analysis, equality analysis and sustainability tagging. As strong as a national reporting framework but not linked to targets or compliance.
Social coverage	Moderate – social and distributional objectives are present through housing, regional development, essential services and just transition language, but without a dedicated social indicator architecture.	Moderate – social equity, jobs, skills, household benefits and community action are recognised, but are less fully operationalised than resource and waste measures.	Strong – social and distributional coverage is extensive and explicit, including health, income, housing, work, safety, participation and equality.
Ecological coverage	Strong – ecological issues are clearly addressed through planning, environmental assessment, climate, biodiversity, water and renewable energy provisions, but not through an integrated ecological ceilings framework.	Strong – ecological concerns are central and reflected in targets and actions on waste, materials, food waste, packaging, biowaste, construction and climate-related circularity.	Moderate – environmental indicators are present through the Environment, Climate and Biodiversity dimension and sustainability-tagged indicators, but they function as performance measures rather than as ecological limits.
Treatment of trade-offs	Moderate – trade-offs between growth, infrastructure capacity and environmental protection are recognised and partly managed through planning and appraisal processes, but there is no integrated cross-sector mechanism.	Moderate – trade-offs are recognised through proportionality, phased implementation, competitiveness safeguards and regulatory impact assessment, but not through a single integrated arbitration framework.	Limited – tensions between indicators are explicitly acknowledged but are described rather than governed. No formal mechanism exists to manage competing objectives.
Relevance to bioeconomy governance	Indirect – not bioeconomy specific but materially shapes the conditions within which bioeconomy sectors develop through land use, infrastructure, energy, water and regional development.	Direct – explicitly relevant to the bioeconomy through the dedicated bioeconomy chapter, bio-based material flows, biowaste and related actions and targets.	Contextual – not bioeconomy specific but provides useful social, distributional and selected environmental indicators that may inform wider assessment of bioeconomy outcomes.

NDP, National Development Plan; NPF, National Planning Framework.

opportunities depend on the reuse and valorisation of biological resources and by-products. Reflecting this, the EU's 2018 Bioeconomy Strategy also emphasises circularity as a core principle (European Commission, 2018).

The circular economy is commonly defined as a shift away from linear production and consumption systems towards models that retain value in materials through reuse, repair and recycling (Geissdoerfer *et al.*, 2017; Kirchherr *et al.*, 2017). In policy terms, it prioritises

reducing waste and improving resource productivity across systems.

However, it does not constitute a complete sustainability framework. Monitoring tends to focus on materials, waste and circularity indicators, rather than wider ecological limits or social outcomes. As a result, improvements in resource efficiency do not necessarily ensure that environmental pressures remain within sustainable limits, and rebound effects may still occur (Zink and Geyer, 2017).

In Ireland, this lens is operationalised through the Whole-of-Government Circular Economy Strategy 2026–2028, which frames circularity as a whole-of-government priority and includes one of the more developed monitoring architectures among the frameworks reviewed, including a Circular Material Use Rate target, annual progress reporting and a planned public dashboard (OECD, 2022; Government of Ireland, 2026). The strategy is directly relevant to the bioeconomy through its dedicated bioeconomy chapter and actions on biomass flows, bio-based materials, biowaste and food waste. However, its scope remains partial in the context of the Doughnut Economics framework: social and distributional dimensions are recognised but less fully operationalised, and ecological considerations are framed mainly through resource efficiency rather than explicit environmental limits. Overall, the strategy is directly relevant and comparatively strong in monitoring terms, but, again, does not provide a complete framework for integrated sustainability assessment.

3.3 Well-being Economy as an Alternative Governance Lens

Well-being frameworks provide a further lens by broadening the assessment of national progress beyond economic output. They focus on quality of life, distributional outcomes and long-term sustainability, and are particularly useful for making social dimensions more visible (Stiglitz *et al.*, 2009; Llana-Nozal *et al.*, 2019; Palahí *et al.*, 2020). However, they are not in themselves comprehensive environmental governance models. While they may include environmental indicators, they do not typically establish ecological limits or binding thresholds. Their role is therefore to widen the scope of assessment rather than to direct policy in a prescriptive way.

In Ireland, this approach is implemented through Understanding Life in Ireland: The Well-Being Framework 2025, which tracks performance across 35 indicators and 11 dimensions with explicit equality and sustainability lenses (Government of Ireland, 2025c). It is strongest in its treatment of social and distributional outcomes, including health, income, housing, work, safety and participation, and is linked to policy processes through annual contributions to the Budget and the Central Statistics Office (CSO)

Well-being Information Hub. However, its relevance to bioeconomy governance is contextual rather than direct: environmental indicators are included but function as performance measures rather than as ecological limits, trade-offs are acknowledged but not governed through formal mechanisms, and the framework does not include sector-specific bioeconomy indicators or implementation pathways.

3.4 Ecological Economics, Bioeconomy Visions and Doughnut Economics as the Conceptual Reference Point

The preceding sections show that Ireland's governance architecture contains important but partial elements of sustainability, without a single framework integrating economic, ecological and social dimensions. This subsection introduces Doughnut Economics as the conceptual reference point used later in the report.

Recent JRC work argues that the bioeconomy should not be understood only as a technical or sectoral policy agenda, but as a field shaped by competing visions of what a sustainable bioeconomy is for, what outcomes it should prioritise and what kinds of policy choices it makes visible (Giuntoli *et al.*, 2023). This matters for monitoring because indicators do not simply measure progress; they reflect assumptions about which outcomes, trade-offs and development pathways are considered important.

Current bioeconomy policy is largely aligned with a green growth perspective, emphasising innovation, output and substitution of fossil resources, while social, justice and sufficiency-oriented perspectives are less developed (Giuntoli *et al.*, 2023). The purpose here is not to resolve debates about growth or decoupling, but to highlight that dominant policy assumptions may not fully address ecological limits or distributional outcomes in decision-making.

Ecological economics provides a broader conceptual foundation, treating the economy as embedded within society and the biosphere and therefore constrained by biophysical limits (Daly, 1996; Daly and Farley, 2011). This perspective is reflected in the EU Bioeconomy Strategy's emphasis on ecological boundaries. Doughnut Economics builds on this by combining a social foundation with an ecological

ceiling to define a space for development that meets social needs while respecting ecological limits (Raworth, 2017). In the bioeconomy context, this is relevant because it brings ecological constraints and

social outcomes into a single analytical structure, addressing a key limitation of existing governance systems, where these dimensions are typically considered separately.

4 Purpose and Scope of the Doughnut Economics Feasibility Assessment

This chapter assesses whether a Doughnut Economics-style framework could provide a practical organising structure and decision support for monitoring Ireland's bioeconomy. The emphasis is on feasibility rather than performance. The objective is not to construct a full national Doughnut Economics assessment or to define final ecological and social thresholds, but to examine whether the framework could help organise existing policy objectives, indicators and monitoring systems in a way that makes social and ecological dimensions easier to interpret together. It also considers whether such a structure could support decision-making by identifying gaps, framing trade-offs and organising evidence more effectively.

Building on Chapters 1–3, the analysis considers whether the Doughnut Economics framework can be translated into a form that is meaningful in the Irish bioeconomy context; whether the domains identified

earlier can be linked to existing indicators and data sources; and whether such a structure could add value without duplicating existing work. It also considers practical constraints, including scale, threshold-setting, attribution and governance ownership. The central issue is therefore not simply whether more indicators are needed, but whether existing policy and monitoring material can be organised and used more effectively within current governance arrangements. Box 4.1 summarises how the framework is and is not used in this assessment.

4.1 Conceptual Foundations of the Doughnut Economics Framework

Doughnut Economics draws on ecological economics, which treats the economy as embedded within society and the biosphere and therefore constrained by biophysical limits (Daly, 1996; Daly and Farley, 2011).

Box 4.1. How the framework is and is not used in this report

This report assesses the Doughnut Economics framework as a way to organise and interpret existing evidence. It does not present a finished monitoring system or a quantified assessment of Ireland's bioeconomy.

How the framework is used in this report

1. To bring social foundations and ecological ceilings into the same discussion.
2. To help interpret existing indicators, policy objectives and governance issues together.
3. To identify where current policy and indicator coverage is well developed, partial or weak.
4. To make trade-offs, synergies and possible unintended consequences more visible.
5. To connect evidence from sectoral policy, EU monitoring systems and Irish initiatives such as INFORMBIO, BIO-INSIGHT, BioValue and the proposed bioeconomy observatory.

How the framework is not used in this report

1. As a stand-alone statutory monitoring system.
2. As a replacement for sectoral indicators, departmental reporting or existing monitoring systems.
3. As a complete national bioeconomy dashboard.
4. As a fully quantified threshold-based assessment of Ireland's bioeconomy.
5. As a measure of sustainability performance, ecological overshoot, social shortfall or distance from agreed thresholds.

This is particularly relevant to the bioeconomy, where production depends directly on land, water, biomass, ecosystems and labour, and where economic opportunity is closely tied to ecological sustainability and social distribution (European Commission, 2025a).

Its ecological dimension draws on planetary boundaries research, including climate change, biosphere integrity, land-system change, freshwater change and biogeochemical flows (Richardson *et al.*, 2023). Its social dimension reflects minimum conditions for human well-being, including food, water, health, education, income, housing, energy, equity and participation (Raworth, 2017). Together, these define a space in which human needs can be met while respecting planetary limits (Raworth, 2017).

The framework also continues to evolve. As Raworth (2025) notes, its dimensions, quantification and visualisation have developed over time as science, social commitments and indicators have advanced. In this report, it is therefore treated as an organising and interpretive structure rather than as a fixed dashboard. This is consistent with the feasibility focus of the assessment, which considers practical relevance rather than proposing a finished operational model.

4.2 Relevance of the Doughnut Economics Framework to Current Monitoring Arrangements

Chapters 1–3 show that Ireland’s bioeconomy is already associated with a substantial body of policy objectives, indicators and monitoring activity, but these remain distributed across documents, institutions and reporting systems. At the national level, the Bioeconomy Action Plan 2023–2025 (Government of Ireland, 2023) points towards a bioeconomy observatory and broader environmental, social and economic monitoring, while related work under INFORMBIO and Teagasc was at prototype stage at the time of the research (April 2026), with key outputs then expected in August 2026. At the EU level, the Bioeconomy Monitoring System continues to expand its indicator base and analytical scope, including social indicators (Government of Ireland, 2023; Patani *et al.*, 2024). However, these developments do not yet amount to a single coherent framework for monitoring bioeconomy development across social, ecological and economic dimensions.

Chapter 2 reinforces this point. Across agriculture, food, forestry and the marine sector, some Doughnut Economics domains are already strongly reflected in policy and monitoring, particularly Income and Work, Climate Change and Biosphere Integrity, while others remain partially addressed or weakly represented. In some cases, this reflects sector-specific relevance rather than policy omission. Even where formal indicators exist, they are unevenly distributed across domains and are generally designed for sector management, compliance or programme delivery rather than for integrated sustainability assessment (Government of Ireland, 2021b,c; Department of Agriculture, Food and the Marine, 2022, 2023a). The current system therefore contains many relevant indicators but lacks a common structure for interpreting them together.

Chapter 3 shows a similar pattern at the institutional level. Project Ireland 2040, the Circular Economy Strategy and the Well-being Framework each monitor important elements of sustainability, but they do so for different purposes and through different governance logics. Together, they do not yet provide a single structure for relating economic development, social foundations and ecological constraints in the bioeconomy context (Government of Ireland, 2025a,b,c, 2026)

In this context, Doughnut Economics is relevant because it offers a way to organise existing information rather than introducing a wholly new set of indicators. It provides a structured lens through which existing policy indicators, sector priorities and governance concerns can be interpreted together, particularly where interactions and trade-offs are difficult to see. Existing economic measurement approaches, especially input–output and national accounting methods, remain important for estimating the scale and structure of the bioeconomy, including value added, employment and inter-sectoral linkages (Leavy *et al.*, 2024). However, while these tools are valuable for measuring economic activity, they do not in themselves provide an integrated way of relating that activity to social foundations and ecological ceilings. The added value of the doughnut therefore lies less in replacing existing monitoring and more in supporting a more integrated reading of existing evidence for policymaking and decision-making.

4.3 Interpreting the Bioeconomy through Raworth's Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist

Raworth's Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist describes seven shifts in economic thinking that inform the Doughnut Economics framework, including how goals are defined, how systems are understood, and how value, distribution and growth are interpreted (Raworth, 2017). In this section, they are used as a conceptual lens for considering what a Doughnut Economics perspective may add to current understandings of the bioeconomy. Drawing on the transferability approach used by Hartman and Heslinga (2023), the exercise is exploratory and interpretive rather than operational: it does not introduce a second analytical framework or a new set of indicators. Instead, it clarifies the kinds of questions a Doughnut Economics perspective raises for Irish bioeconomy monitoring (Table 4.1).

4.3.1 Use and limitations in this report

This mapping is intentionally high-level and interpretive. It does not translate the seven ways into formal indicators, thresholds or sector scores, nor does it claim that the full implications of each principle have been tested in the Irish context. As Hartman and Heslinga (2023) note, the value of this kind of transferability exercise lies in raising new questions, while fuller application requires empirical work. For this report, the seven ways help clarify how a Doughnut Economics perspective may alter the interpretation of existing monitoring questions without overstating what can be concluded at this stage.

4.4 Examples of Doughnut Economics Applications in Practice

The preceding section considered how a Doughnut Economics perspective may alter the interpretation of the bioeconomy. It did not, however, resolve a number of practical design questions, including how domains

Table 4.1. Interpreting the bioeconomy through Raworth's (2017) seven ways

Raworth's seven ways	Interpretation for the bioeconomy and relevance to this report
Change the goal	A Doughnut Economics perspective encourages the bioeconomy to be interpreted for wider public purposes rather than as an end defined by output alone. Current reporting still gives strong prominence to value added, employment and innovation, but this framing asks whether bioeconomy development also contributes to sustainable food systems, climate action, ecological resilience and social well-being.
See the big picture	The bioeconomy is not a discrete sector. It spans agriculture, forestry, marine resources, waste streams, processing technologies, infrastructure, services and policy systems, consistent with the evidence in Chapters 1–3 that bioeconomy governance in Ireland is cross-sectoral and institutionally distributed.
Nurture human nature	Bioeconomy transition depends not only on technologies and markets, but also on awareness, participation, trust, skills and willingness to adopt new practices. Practical barriers may include limited awareness, fragmented stakeholders and high investment costs.
Get savvy with systems	Bioeconomy pathways are systemic. Changes in land use, feedstocks, waste valorisation, infrastructure or regulation can generate effects elsewhere, including on biodiversity, water quality, carbon storage and rural livelihoods.
Design to distribute	A Doughnut Economics interpretation raises the question of who benefits from bioeconomy development and who bears the costs. Irish policy frequently links the bioeconomy to rural development, regional opportunity and local jobs, but these distributional effects are not always as visible in monitoring as output, productivity or innovation.
Create to regenerate	A bioeconomy is not automatically regenerative. Biological substitution can remain extractive if it intensifies pressure on land, water, nutrients or biodiversity. A Doughnut Economics lens therefore draws attention to the distinction between a bioeconomy that merely replaces inputs and one that restores ecological capacity.
Be agnostic about growth	This shift does not require rejection of economic activity, but it does encourage caution about treating growth in output, value added or innovation as sufficient evidence of progress. It also raises the question of whether sufficiency-oriented pathways merit consideration alongside growth-oriented ones. Recent research reinforces this caution by showing how bioeconomy growth promises are often constrained by economic, political and biophysical realities (Eversberg <i>et al.</i> , 2023).

Source: Authors' interpretation based on key relevant sources, including Raworth (2017), Eversberg *et al.* (2023), Giuntoli *et al.* (2023), Hartman and Heslinga (2023), O'Connor *et al.* (2023) and Lasarte-López and M'Barek (2025).

are adapted, how indicators and thresholds are selected, how findings are interpreted, and how the framework connects to governance processes. This section therefore reviews a small number of external applications in order to identify operational lessons relevant to the present feasibility assessment. These examples are not treated as models to be replicated directly. Rather, they are used to clarify the kinds of design choices that would need to be made if a Doughnut Economics-style approach were to be used to support Irish bioeconomy monitoring (Table 4.2).

4.4.1 Interpretation for the present study

These examples show that Doughnut Economics applications are not standardised. They vary by scale, purpose and degree of quantification, and require explicit choices on domains, indicators, thresholds or proxies, participation and governance arrangements. They also show that Doughnut Economics approaches often function less as fixed monitoring dashboards and more as policy-facing interpretive tools linked

to existing strategies, institutional processes and stakeholder discussion.

For the purposes of this report, these cases suggest four practical points. First, any Irish bioeconomy application would need to be selective and transparent in how domains, indicators and proxies are chosen. Second, governance and participation matter, particularly where the framework is intended to support interpretation, legitimacy and policy use rather than description alone. Third, applications at local, sectoral or thematic scale require careful handling of adaptation, downscaling and target-setting, and these choices need to be made explicit. Fourth, a staged approach is more realistic than attempting to construct a fully quantified framework from the outset. Overall, the case material supports the view that a Doughnut Economics-style approach is feasible as an organising and interpretive structure for existing and emerging monitoring work, but only if applied proportionately and with clear recognition of its methodological and governance limits.

Table 4.2. Lessons from selected Doughnut Economics applications

Application type	Examples reviewed	Main operational lesson	Relevance to Irish bioeconomy monitoring
National policy-facing assessment	Scotland	National applications require explicit choices on domains, indicators, social thresholds, ecological ceilings and proxies. They can provide an integrated policy-facing snapshot but should not be treated as definitive scientific assessments.	Supports the use of an Irish bioeconomy doughnut as an indicative policy-coverage and interpretation tool, rather than a final performance assessment.
City portrait and participatory approaches	Amsterdam, Barcelona and Glasgow	City applications often use participatory processes, four-lens portraits, systems thinking and action-oriented pathways. They connect the doughnut to existing strategies and stakeholder discussion rather than using it only as a dashboard.	Highlights the importance of participation, practical use cases and linking any Irish application to existing governance and strategy processes.
Local, regional and institutional adaptation	Greater Geneva, University of Lausanne and Tomelilla	Local applications require adaptation to context, careful treatment of indicators and target values, and recognition that operationalisation is gradual and selective.	Reinforces the need for transparent methodological choices and staged development rather than immediate full operationalisation.
Thematic Irish application	NESC Energy Systems Doughnut	The doughnut can be used thematically as an integrative framing device to organise systems analysis and recommendations, even without a full indicator-and-threshold architecture.	Provides an Irish example of using the doughnut as a decision-support and systems-framing tool rather than a complete monitoring system.

The full case-study table and interpretation, including operational approach, domains, indicators, thresholds, governance arrangements and policy interface, is provided in Appendix 5.

NESC, National Economic and Social Council.

Source: Authors' synthesis based on key relevant sources, including Tomelilla Municipality (n.d.), Sayers *et al.* (2014), Doughnut Economics Action Lab *et al.* (2020), Hjelmskog *et al.* (2023), Bergh (2025), Cattaneo *et al.* (2025), Recordon *et al.* (2025), Sykes (2025) and National Economic and Social Council (2026).

4.5 Applying a Doughnut Economics-based Structure to the Irish Bioeconomy

Chapter 4 has shown that Doughnut Economics is relevant as an interpretive and organising framework, but that any practical application would require explicit choices about domains, indicators, scale and governance. This section considers how such a structure might be translated into the Irish bioeconomy in operational terms. Consistent with the scope of the report, it does not seek to construct a full national Doughnut Economics dashboard or to define final thresholds for each domain. Rather, it examines whether the doughnut could function as an organising structure for indicators and datasets that already exist, or are emerging, within Irish and EU monitoring systems.

Consultation with the INFORMBIO and Teagasc monitoring team reinforces the need to keep this exercise proportionate. Feedback from Professor David Styles, University of Galway, who leads the BIO-INSIGHT project, suggests that activity indicators are insufficient for judging whether bioeconomy development is sustainable and that top-down indicator approaches may need to be complemented over time by bottom-up modelling, life cycle assessment, foresight and value-chain analysis.

The indicative bioeconomy policy-coverage doughnut presented in Chapter 2 provides a first visual demonstration of how the method could be applied at the bioeconomy level. It summarises the findings from the four policy anchors reviewed in this study and should therefore be read as a first-stage policy-coverage summary rather than as a complete national bioeconomy dashboard. Its value for the feasibility assessment lies in showing how existing policy indicators could be grouped, where coverage remains uneven, and where extension to additional bioeconomy areas, value chains and monitoring sources would be required.

4.5.1 Possible structure for an Irish bioeconomy doughnut

For the purposes of this assessment, one possible approach would be to retain the full conceptual structure used in Chapters 2 and 4, namely 12 social

foundations and 9 ecological ceilings. This would preserve continuity with the sectoral screening undertaken in Chapter 2 and the selected mapping examples in Appendix 3. It would also avoid narrowing the framework too early to only those areas that are already well monitored. Part of the value of the doughnut in this report lies in making visible where current monitoring is strong and where it is partial and where important dimensions remain weak or absent.

At the same time, any Irish bioeconomy doughnut would need to be operationalised unevenly, as not all domains are equally present in sector policy or equally measurable with current indicators. A more workable interpretation may therefore be a layered structure: a core set of domains already reflected in sectoral policy and monitoring, a second set that are relevant but would require cross-cutting national or EU datasets, and a third set that remain aspirational at this stage and would require further indicator development. This is broadly consistent with the EU Bioeconomy Monitoring System, which uses a hierarchical framework that is designed to evolve as data gaps are addressed (Table 4.3).

Under this interpretation, an Irish bioeconomy doughnut is best understood as a possible organising architecture for indicators drawn from sectoral policy, cross-cutting national frameworks and EU monitoring systems. Its longer-term value will depend on whether current gaps can be addressed through observatory development, improved datasets and future work by initiatives such as INFORMBIO and the projects identified in section 1.6.

4.5.2 Linking Doughnut Economics domains to existing indicators

Chapter 2 and Appendix 3 show that a substantial number of indicators in the selected Irish policy documents can already be related to Doughnut Economics domains. The CAP Strategic Plan provides direct mappings for climate, biodiversity, water, nutrient pressures, farm viability, education, networks, social equity and health (Department of Agriculture, Food and the Marine, 2022), while Food Vision 2030 adds a broader food-system layer, covering emissions, water quality, biodiversity, farm income, education, isolation risk and health and safety (Government of Ireland, 2021b). Together, these findings suggest

Table 4.3. Possible operational structure for an Irish bioeconomy doughnut

Layer of the framework	Main purpose	Indicative domains	Main source types
Core sectoral monitoring domains	Domains already strongly reflected in Irish sector policy and likely to support immediate indicator mapping.	Climate Change, Biosphere Integrity, Freshwater Use, Biogeochemical Flows, Land-System Change, Novel Entities, Food, Income and Work, Education, Networks, Health, Social Equity	Ireland's CAP Strategic Plan 2023–2027 (Department of Agriculture, Food and the Marine, 2022), Food Vision 2030 (Government of Ireland, 2021b), forestry and marine policy indicators, existing sector monitoring
Cross-cutting contextual domains	Domains relevant to bioeconomy sustainability but not usually embedded in sector policy as direct bioeconomy indicators.	Water, Energy, Housing, Political Voice, Peace and Justice, Gender Equality	Well-being Framework, CSO datasets, EU Bioeconomy Monitoring System, other national social and environmental datasets
System and transition metrics	Metrics needed to interpret bioeconomy development as a wider socio-economic transition rather than as a sector output measure alone.	Employment, value added, turnover, research and innovation, trade, resource competition, biomass flows	EU Bioeconomy Monitoring System, existing national statistical sources, emerging INFORMBIO/Teagasc observatory work, input–output and related economic accounts

Source: Chapter 2 policy screening and Appendices 1–3 summary indicator evidence and mapping; Chapter 4 feasibility assessment; EU Bioeconomy Monitoring System structure and objectives; and Irish monitoring initiatives identified in section 1.6, including INFORMBIO/Teagasc, BIO-INSIGHT and BioValue.

that any Irish bioeconomy doughnut could begin with existing policy indicators while identifying where supplementary indicators or further development may be needed. This should be understood as a first-round mapping exercise based on the four documents reviewed in Chapter 2 rather than as a complete inventory of all indicators that may later become relevant.

The EU Bioeconomy Monitoring System is particularly relevant because it provides a second layer of indicators that may help address gaps in sector documents. As of December 2023, the system contained 154 indicators organised within a hierarchical framework, covering economic, environmental and social dimensions. Relevant examples include agricultural factor income per annual work unit, government support to agricultural research and development, biochemical oxygen demand in rivers, nitrate in groundwater, share of organic farming, livestock density, bird and butterfly indices, net greenhouse gas emissions from agriculture, water exploitation, value added and employment. The system has also been extended to include social indicators, although coverage remains incomplete and some indicators are still classified as gaps, available, developing or unknown. This is useful because it shows that some weakly represented Doughnut

Economics domains may be partially supported through supplementary sources, even where they are not strongly embedded in sector policy documents.

Consultation with INFORMBIO and Teagasc monitoring team also suggests that future Irish monitoring work is likely to rely heavily on existing sources, particularly CSO and EU-derived datasets, together with indicators selected against the structure of the Bioeconomy Action Plan. This supports a Doughnut Economics-based approach that builds from existing policy frameworks and data sources, while identifying where supplementary indicators, proxies or further development may be needed. At the time of the research (April 2026), some relevant Irish observatory-related outputs were not yet finalised and therefore could not be fully integrated into this assessment; prototype outputs were then expected in August 2026. It is also important to note that some bioeconomy-specific transition metrics, for example industrial symbiosis, cascading biomass use or feedstock flows to biorefineries, are not the main focus of this first-round mapping and would require further methodological and data development. Fuller treatment of substitution effects, value-chain outcomes and wider system implications would also require complementary analytical approaches beyond indicator mapping alone (Table 4.4).

Table 4.4. Indicative mapping of Doughnut Economics domains/clusters to existing indicator sources

Doughnut Economics domain/cluster ^a	Indicators already identified in Irish policy documents	Supplementary indicators from EU BMS	Indicative status ^b within this assessment
Climate Change	CAP R.12, R.14, R.16; ^c Food Vision methane and emissions targets	Net GHG emissions from agriculture; net GHG emissions from LULUCF	Directly identifiable
Freshwater Use (with related water-quality evidence)	CAP R.21; Food Vision water quality target	Biochemical oxygen demand in rivers; phosphate in rivers; nitrate in groundwater; Water Exploitation Index	Directly identifiable/potentially adaptable
Biogeochemical Flows/ Atmospheric Aerosol Loading/ Novel Entities	CAP R.20, R.22, R.24; Food Vision nutrient loss, air quality and related pressure indicators	Selected pressure indicators on intensification, nutrient pressures and air pollution	Directly identifiable/potentially adaptable
Biosphere Integrity/Land-System Change	CAP C.19, R.19, R.29, R.31–R.34; Food Vision biodiversity, organic farming, afforestation	Share of farmland of high nature value; share of organic farming; livestock density; bird and butterfly indices; Natura 2000 coverage	Directly identifiable/potentially adaptable
Income and Work	CAP C.12, R.36, R.37, R.39; Food Vision family farm income and sector output	Agricultural factor income per AWU; persons employed in bioeconomy sectors; value added measures	Directly identifiable/potentially adaptable
Education/Innovation	CAP R.1, R.2, R.3, R.28; Food Vision education and skills indicators	Government support to agricultural research and development	Directly identifiable/potentially adaptable
Networks/Social Equity/Health	CAP C.01, C.01b, R.38–R.44; Food Vision isolation risk and health and safety	Food purchasing power; selected social indicators where appropriate	Potentially adaptable/proxy-dependent
Food	Food Vision safe, nutritious and trusted food objectives; selected food-system and food waste measures	Selected food-system, consumption or purchasing-power indicators where relevant	Potentially adaptable/proxy-dependent
Water as a social foundation, Energy, Housing, Political Voice, Peace and Justice, Gender Equality	Weak, indirect or unevenly represented in current sectoral policy indicator sets	Wider national social datasets, CSO sources, Well-being Framework indicators, and future observatory development would be required	Requires further development

^aEach row refers to a group of related domains, for readability. Innovation is treated as an enabling theme, while water-quality indicators provide related contextual evidence but are not direct measures of freshwater abstraction or consumption; the Water Exploitation Index is the direct water-use pressure indicator listed here. These groupings do not redefine the domains listed in Table 2.1 or imply that the indicators are interchangeable.

^bThe status labels are indicative and are used only for the purposes of this feasibility assessment. They reflect the extent to which relevant indicators were identifiable in the selected policy documents and supplementary sources reviewed in this study. They do not constitute a full data readiness or implementation assessment. For the purposes of this report, a proxy indicator refers to a stand-in measure used where no direct indicator is available for a given Doughnut Economics domain, but where a related indicator can still provide partial insight. “Requires further development” refers to domains for which relevant indicators may be conceptually identifiable, but where suitable Irish data, agreed measurement approaches or observatory-ready monitoring arrangements are not yet in place.

^cCAP codes beginning with “R” refer to result indicators; those beginning with “C” refer to context indicators. The identifiers are consistent with the version of Ireland’s CAP Strategic Plan 2023–2027 used in this review.

AWU, annual work unit; BMS, Bioeconomy Monitoring System; GHG, greenhouse gas; LULUCF, land use, land-use change and forestry.

Source: Appendix 2 summary indicator evidence and Appendix 3 selected indicator mapping; EU Bioeconomy Monitoring System conceptual framework and annex indicator lists.

4.5.3 Governance and monitoring integration

At this stage, the main relevance of a Doughnut Economics-based structure lies in its potential to sit alongside existing governance and monitoring

arrangements rather than in replacing them. The evidence reviewed in Chapters 1–3 suggests that, in Ireland, its most plausible role would be as an integrating layer linking indicators from sectoral

policy, cross-cutting national frameworks and emerging observatory work. This points to a possible relationship with a future bioeconomy observatory or monitoring platform.

A Doughnut Economics-based approach should therefore build on emerging Irish monitoring infrastructure rather than duplicate it. Initiatives such as INFORMBIO, BIO-INSIGHT and BioValue can provide data, methods, indicators and sector-specific evidence, while the Doughnut Economics framework can provide a structure for interpretation, communication and policy discussion.

Discussion with the INFORMBIO and Teagasc monitoring team also suggests that Irish observatory development remains incremental, with prototype tools, dashboard design and indicator selection still under refinement, and with longer-term questions of ownership, hosting and maintenance unresolved. The methodology proposed here could be extended as further observatory work and policy documents, including the Bioeconomy Action Plan, are added. The governance implications are considered further in section 4.6.

4.5.4 *Indicative steps towards operationalisation*

International research, together with discussion with the INFORMBIO team, suggests that operationalising a national bioeconomy monitoring framework is a substantial task. Current Irish work is also proceeding

pragmatically from policy priorities, available CSO datasets and prototype dashboard development, rather than from a complete predefined indicator system. In that context, the purpose of this report is not to construct an exhaustive index of indicators or a full readiness assessment across all possible domains. Rather, it is to outline a practical pathway through which a Doughnut Economics-style framework might later be tested or refined. Workshop feedback suggests that any such role is likely to depend on clear use cases, identifiable users within the policy system, and a governance home capable of supporting stewardship, coordination and practical application (Table 4.5).

Chapter 2 provides a simplified illustration of this approach through the agriculture analysis. The CAP Strategic Plan contains a comparatively strong indicator base across climate, water, biodiversity, nutrients, farm viability, education and rural development, making agriculture a useful initial test case (Department of Agriculture, Food and the Marine, 2022). At the same time, the analysis also shows that some domains remain only partly covered or dependent on proxies. This illustrates both the usefulness and the limits of the staged approach outlined here. The report does not present a finished monitoring model; its immediate contribution is to clarify where existing indicators provide a usable starting point, where supplementary sources may be needed, and where future observatory or monitoring work may help to fill current gaps.

Table 4.5. Indicative steps towards operationalising a Doughnut Economics-style framework for Irish bioeconomy monitoring

Step	Indicative action
1	Start with existing sector and cross-cutting policy documents to identify objectives, indicators and gaps. In agriculture, this would mean working first from the CAP Strategic Plan indicators already linked to climate, water, biodiversity, nutrients, farm viability, education and rural development.
2	Extend the mapping beyond sector policy to higher-level frameworks, including the Bioeconomy Action Plan and observatory-related work, so that sector indicators can be interpreted in relation to wider national bioeconomy priorities.
3	Use established supplementary sources, including the EU Bioeconomy Monitoring System and national statistical CSO datasets, to strengthen weak or missing areas. In agriculture, this could include adding indicators such as agricultural factor income per annual work unit, nitrate in groundwater, biochemical oxygen demand in rivers, share of organic farming, livestock density, bird and butterfly indices, and net greenhouse gas emissions.
4	Distinguish between indicators that are already directly identifiable, those that may require proxy use and those that still need further development. In agriculture, climate, water, biodiversity and income are more immediately usable, while social dimensions such as Political Voice or Peace and Justice remain weakly represented and may require wider national datasets or proxies.
5	Test the draft mapping, governance fit and practical use case through stakeholder discussion, including whether the proposed structure is proportionate, whether key gaps have been correctly identified, and how it might align with observatory or departmental monitoring work already under way.

4.6 Governance Fit and Practical Application

The practical relevance of a Doughnut Economics-based approach depends not only on whether domains and indicators can be identified, but also on whether the framework could be used within existing Irish governance arrangements. Rather than replacing current monitoring systems, Doughnut Economics may be better understood as an additional organising layer for interpreting existing information across policy and monitoring systems. What is currently absent is a mechanism through which these different elements can be read together without creating unnecessary duplication.

In practical terms, the approach could be tested through a small number of defined policy uses. These could include supporting the forthcoming National Bioeconomy Strategy (2026–2030) by reviewing proposed actions against social and ecological considerations; informing the proposed bioeconomy observatory by helping to group and interpret existing indicators; supporting High-Level Bioeconomy Implementation and Development Group discussion of trade-offs across sectors and policy areas, including agriculture, food, forestry, the marine sector, circular economy and climate policy; and stress-testing selected bioeconomy actions for gaps, synergies and possible unintended consequences. For example, this could help identify where increased biomass use, land-use change, nutrient recycling, bioenergy development or growth in bio-based sectors may create pressures or benefits across biodiversity, water quality, food-first principles and social outcomes. This would test whether the framework adds value as an interpretive and decision-support tool across existing systems.

The proposed bioeconomy observatory appears to be the most likely institutional setting within which such an approach could be tested further. A Doughnut Economics-based structure could add value to such a platform by providing a clearer logic for grouping and interpreting indicators, particularly where trade-offs arise between sector growth, environmental limits and distributional outcomes. Initial testing through clearly defined use cases would help establish whether it adds value within the policy system without imposing a parallel reporting burden (Table 4.6).

4.7 Stakeholder Workshop Findings

4.7.1 Workshop overview

On 19 March 2026, a structured stakeholder workshop was held as part of the review of existing and expected indicators, tools and metrics relevant to Ireland's bioeconomy. The workshop was explicitly framed as a feasibility exercise rather than as an endorsement of a finished framework or the finalisation of indicators or thresholds. Participants rotated through three breakout rooms, covering methodology and indicator mapping, Raworth's (2017) "seven ways" as an interpretive lens, and governance fit and practical application. Each room had a facilitator and dedicated note-taker, and key points were captured through the Miro board and supplementary workshop notes.

4.7.2 Methodology, indicator mapping and interpretive framing

Workshop discussions on methodology, indicator mapping and the "seven ways" lens were broadly supportive, while also pointing to areas requiring

Table 4.6. Governance fit and practical application of a Doughnut Economics-based monitoring approach in the Irish context

Practical question	Answer
Where could such a framework sit institutionally?	Most plausibly alongside an emerging bioeconomy observatory or monitoring platform, rather than as a separate statutory system.
How could such a framework relate to existing governance structures?	It could complement the High-Level Bioeconomy Implementation and Development Group, sector departments and existing monitoring systems linked to agriculture, forestry, the marine sector, climate and circular economy policy.
How could such a framework relate to INFORMBIO, EU monitoring and other initiatives?	It could draw on outputs from INFORMBIO, BIO-INSIGHT, BioValue, the EU Bioeconomy Monitoring System and related research initiatives as indicator sources and methodological support, while recognising that some Irish prototype outputs are still under development.
What could such a framework be used for in practice?	To organise indicators, identify gaps, make trade-offs more visible, and support communication and policy coherence across social, environmental and economic dimensions.
What would be needed for implementation?	Clear ownership, leadership, stewardship, hosting, maintenance, updating arrangements, and agreement on how findings would be reviewed and used across departments and agencies.

clearer explanation and proportionate framing. In relation to the qualitative document analysis and first-round indicator mapping, participants generally viewed the policy-led approach as a useful starting point for identifying what is visible, weakly covered or missing across selected sectoral policy documents. The main suggestions were to clarify coding rules and indicator terminology further; to strengthen the social dimension where possible; and to retain the explicit point that, at this stage, mapping existing indicators is more realistic than attempting to design a wholly new monitoring architecture. These points support the continued presentation of the work in Chapter 2 as an iterative mapping exercise rather than as a finished monitoring model.

Discussion on Raworth's "seven ways" suggested that this framing added value primarily as an interpretive lens. Participants saw it as helpful in moving discussion beyond gross domestic product or output alone, and in bringing into view public purpose, systems effects, trade-offs, synergies, distribution, regeneration and unintended consequences. At the same time, the main request was for clearer practical examples, particularly Irish examples, and for the report to remain clear that the "seven ways" are exploratory and interpretive rather than a second methodology or an alternative indicator framework (Raworth, 2017). This supports retaining section 4.3 as a conceptual lens, while sharpening its practical illustration.

4.7.3 Governance fit and practical application

The most detailed and policy-relevant discussion emerged from the breakout session on governance fit and practical application. Participants broadly supported the interpretation advanced in section 4.6: that the doughnut is more plausible as an organising and decision-support layer within existing governance arrangements than as a separate statutory monitoring system.

A consistent theme was the need to avoid duplication. Participants noted that relevant indicators, datasets and reporting processes already exist across sectoral systems, EU monitoring, departmental processes and emerging observatory-related initiatives. The challenge was therefore framed less as a lack of information than as one of coordination, interpretation and institutional fit.

Participants also emphasised the implementation conditions needed for credibility, including clear purpose, leadership, institutional responsibility, capacity-building and realistic use cases. Pilot testing or limited practical use was viewed as more proportionate than immediate broader roll-out. Participants also highlighted the need for stronger treatment of social indicators, community involvement and wider governance alignment, particularly where the bioeconomy intersects with just transition, well-being and food security concerns.

This discussion does not alter the central feasibility conclusion of the report, but it sharpens it. Future development should focus first on institutional fit, use cases, observatory alignment and implementation capacity.

The workshop findings reinforce the view that the practical relevance of a Doughnut Economics-based approach depends less on creating a wholly new monitoring structure and more on institutional fit, alignment with existing systems, clear use cases and identifiable governance arrangements (Table 4.7).

4.7.4 Post-workshop discussion and implications

The subsequent discussion with the project Steering Group broadly endorsed the workshop findings and reinforced the centrality of governance to any future development of a Doughnut Economics-based approach. The discussion recognised the report as a strong and proportionate foundation, but returned to where such a framework would sit, how it would be taken forward, and how it might gain traction within the policy system. Governance therefore emerged not as a peripheral implementation issue, but as a main determinant of longer-term relevance.

A recurring theme was the need to identify practical use cases and policy demand. The discussion noted that indicator-based initiatives often struggle to progress where there is no clear institutional user base, no agreed governance home, or no clear demonstration of added value. In this respect, the doughnut was seen as having potential where it helps organise existing information, frame trade-offs more clearly, and support decision-making or communication in ways that current systems do not.

Table 4.7. Main findings from the workshop discussion on governance fit and practical application

Workshop question	Main points raised in discussion
Where could a Doughnut Economics-style approach most realistically sit within existing Irish governance and monitoring arrangements?	Participants suggested that it would sit most plausibly at a high level in government, or alongside an emerging observatory or monitoring platform, rather than as a separate statutory system. There was also support for linking it to existing coordination structures rather than creating a wholly new framework.
How could a Doughnut Economics-style approach relate to existing systems and initiatives without creating duplication?	Discussion emphasised building from existing departmental data, sectoral monitoring, EU monitoring, observatory-related work and related frameworks, such as well-being, just transition and blue bioeconomy initiatives. Synergies were prioritised over new reporting burdens.
What practical value could such a Doughnut Economics-style approach add?	The main value identified was as a decision-support, communication and policy-framing tool. Participants noted its potential to organise indicators, identify gaps, make trade-offs more visible, and support policy review at the national or local levels.
What would need to be in place for a Doughnut Economics-style approach to be credible and usable in practice?	Participants emphasised the need for a clear purpose, identifiable leadership, defined responsibilities, capacity-building, training, realistic implementation steps and, potentially, pilot testing. Better attention to social indicators and social implications was also seen as necessary.
Which existing bodies or initiatives would need to be involved from the outset?	Discussion pointed to the need for involvement from core departments (DAFM, DCEE), CSO, Teagasc, observatory-related initiatives, sectoral bodies and specialist actors, with repeated support for a central coordinating lead and broader stakeholder involvement.

DAFM, Department of Agriculture, Food and the Marine; DCEE, Department of Climate, Energy and the Environment.

The discussion also highlighted the forthcoming National Bioeconomy Strategy (2026–2030) and future observatory development as possible routes through which this work could gain practical traction. At the same time, the framework is unlikely to progress if treated as a wholly separate scheme or as an additional reporting burden without a clear purpose, user base or institutional lead. The post-workshop discussion therefore reinforced the view that any next phase should focus on governance fit, use cases, observatory alignment and practical implementation

conditions rather than attempting to construct a completely new framework in the abstract.

4.8 Limits, Risks and Methodological Constraints

The feasibility assessment presented in this chapter remains subject to important methodological and practical constraints. These should be made explicit in order to avoid overstating what can be concluded from the present study (Table 4.8).

Table 4.8. Main limits, risks and methodological constraints

Issue	Main limitation or risk
Threshold-setting and downscaling	National ecological ceilings and social foundations are difficult to define, justify and apply consistently across sectors.
Data gaps and proxy dependence	Some domains are weakly covered by current indicators and may require indirect or cross-cutting proxies.
Attribution and cross-sector overlap	Many observed outcomes reflect multiple sectors, policies and external drivers rather than one intervention or framework.
Scale mismatch	Global planetary boundaries, EU indicators, national frameworks and sectoral policy metrics do not align neatly.
Snapshot vs recurring monitoring	Much of the current exercise is based on policy screening and initial indicator mapping and not on a settled system for repeated reporting over time.
Governance and implementation risk	Lack of clear ownership, coordination or capacity could limit practical use even where indicators exist.
Communication risk	The visual clarity of the doughnut may create an impression of completeness or precision that the underlying evidence does not yet support.
Maturity of emerging monitoring systems	Some of the most relevant Irish monitoring initiatives and prototype dashboards are themselves still under development.

These constraints shape how the findings should be interpreted. At this stage, the main value of a Doughnut Economics-based framework lies in structuring information, identifying gaps and supporting more integrated interpretation across existing systems. This is consistent with wider food-systems governance research, which highlights the difficulty of managing trade-offs and integrating objectives, narratives and policies across diverse stakeholders, sectors and knowledge communities (Vignola and

Oosterveer, 2025). It is also consistent with recent work by FAO on systems approaches, which emphasises the need to move beyond fragmentation through joined-up governance, systems knowledge and continuous learning (FAO, 2025). More ambitious applications, such as setting fixed thresholds across all domains or establishing a recurring cross-government dashboard, would require further methodological development, clearer governance arrangements and stronger agreement on indicator selection and interpretation.

5 Conclusions and Recommendations for Framework Development

5.1 Main Conclusions

This research assessed whether Doughnut Economics could support the development and monitoring of Ireland's bioeconomy in line with the Bioeconomy Action Plan and wider environmental and social objectives, while helping to identify gaps in policy coverage and potential unintended consequences, including cross-sector trade-offs such as those between biomass use and biodiversity, climate objectives and water quality, and economic growth and social outcomes. The evidence supports a clear but cautious conclusion: Doughnut Economics in its current form has value as an organising, interpretive and decision-support framework, but not as a complete monitoring system.

The analysis shows that Ireland does not lack policy objectives, indicators or monitoring systems relevant to the bioeconomy. These are well developed across sectoral strategies, national frameworks and emerging observatory work. However, they remain dispersed across policy domains and institutions. No single structure currently brings economic development, ecological constraints and social outcomes together in a way that supports integrated interpretation. The value of a Doughnut Economics-based approach therefore lies not only in bringing indicators together, but in helping to frame public purpose, trade-offs, synergies and wider system effects more clearly.

Within this context, the most credible contribution of Doughnut Economics is the provision of an organising structure through which existing indicators and priorities can be interpreted together to support decision-making and policy framing, rather than replacing existing systems. The sectoral review and indicator mapping demonstrate that many relevant indicators already exist and can, in many cases, be aligned with the social foundations and ecological ceilings of the framework. However, coverage remains uneven, with some domains weakly represented or dependent on proxies. In part, this reflects differences in sectoral relevance, but it also points to gaps in how environmental, social and cross-cutting issues are

addressed within current policy frameworks. A more complete operational model would require further work on indicator selection, data integration and governance. Workshop feedback reinforces that future value will depend on institutional fit, clearly defined use cases, alignment with emerging observatory work and the presence of identifiable users within the policy system, rather than the creation of a new reporting architecture.

The analysis also highlights important limits. At this stage, Doughnut Economics is not well suited to functioning as a fully quantified, threshold-based dashboard or as a stand-alone statutory monitoring system. Full cross-domain coverage is not yet available, there is no agreed basis for defining ecological ceilings and social foundations in the Irish context, and key questions remain regarding demand, governance ownership, data stewardship and long-term institutional use, including leadership, coordination, hosting and maintenance.

5.2 Recommendations and Staged Pathway for Framework Development

The following recommendations reflect the report findings and input from stakeholders, the Steering Group and experts. They are framed as practical next steps if the framework is to be taken forward, including through future work on bioeconomy monitoring and indicator development.

1. Agree the purpose, users and governance of the framework.

The first step should be to clarify what the framework is intended to do, who would use it and where it would sit institutionally. The findings of this report suggest that its primary role should be as an organising and decision-support layer and not as a separate monitoring system. Governance arrangements should therefore identify the intended users, the policy processes it is expected to support and the responsibilities for ownership,

stewardship, hosting, maintenance and review.

Early engagement with intended users would help ensure that any further development responds to practical policy needs rather than remaining a separate analytical exercise.

2. Build from existing policy and monitoring systems.

Further development should draw directly on indicators already embedded in sectoral strategies, the Bioeconomy Action Plan, and Irish and EU monitoring systems, including emerging observatory work and related initiatives such as INFORMBIO, BIO-INSIGHT and BioValue. This would help ensure alignment with current governance structures, implementation priorities and reporting requirements, while avoiding duplication.

3. Select a small initial set of policy-relevant indicators.

Indicator coverage is currently uneven across the doughnut structure. A practical next step is to identify a smaller set of indicators that are already well established, policy relevant and capable of being linked to the social foundations and ecological ceilings. This step should include making explicit choices on proxies, detailing assumptions and identifying remaining gaps. The purpose would not be to create a complete dashboard at the outset, but rather to test whether a focused indicator set can support clearer interpretation.

4. Pilot the approach on defined policy uses.

The framework should be tested through one or two defined use cases before any broader roll-out is considered. Possible early uses include supporting the forthcoming National Bioeconomy Strategy (2026–2030), supporting the development of the proposed bioeconomy observatory, or stress-testing selected bioeconomy actions against social and ecological considerations. Where indicator mapping alone is insufficient – particularly for value-chain effects, substitution effects or wider system impacts – complementary methods such as life cycle assessment, modelling or scenario analysis could also be considered.

5. Review usefulness before considering broader application.

Any pilot application should be reviewed with policymakers, data holders and relevant stakeholders to assess whether the framework improves interpretation, reveals gaps, supports discussion of trade-offs and adds value to existing monitoring processes. A broader dashboard, recurring assessment or more formalised monitoring role should only be considered if this initial testing demonstrates practical value and if governance, data and update arrangements are clear.

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Appendix 1 Descriptive Note on Chapter 2 Tables

This appendix explains the basis for the classifications used in Chapter 2. These classifications provide the evidence base for the sector doughnut diagrams (Figures 2.1–2.4) and for the indicative overall bioeconomy policy-coverage doughnut (Figure 2.5). The overall doughnut summarises policy coverage across the four selected policy anchors reviewed in this study: agriculture, food, forestry and the marine sector. It should be read as a policy-coverage summary only, and not as an assessment of sector performance, ecological overshoot, social shortfall or distance from quantified thresholds. This appendix provides the fuller basis for the classification approach summarised in Table 2.2 of the main report, including the definitions of primary, secondary, peripheral and not covered, and the rationale for the main sector classifications across the four policy anchors.

A1.1 Table 2.1: Doughnut Economics Dimensions Applied in Sectoral Classification

The categories used in Table 2.1 follow the social and ecological dimensions of the Doughnut Economics framework developed by Raworth (2017). These categories are applied qualitatively rather than through quantitative thresholds or performance scores. The analysis examines whether the selected policy documents explicitly reference, prioritise or operationalise the relevant social foundations and ecological ceilings. This provides a structured basis for identifying areas of policy alignment, omission and imbalance.

A1.2 Table 2.2: Documentary Basis

The four primary policy documents identified in Table 2.2 provide the core documentary basis for the sectoral review in Chapter 2. They allow for comparison of how Irish sectoral policy frameworks

articulate social objectives, recognise ecological pressures, and support monitoring and accountability arrangements. The four documents reviewed are detailed in Table A1.1.

Table A1.1. Four selected policy documents

Sector	Primary policy document
Agriculture	Ireland's CAP Strategic Plan 2023–2027 (Department of Agriculture, Food and the Marine, 2022)
Food	Food Vision 2030: A World Leader in Sustainable Food Systems (Government of Ireland, 2021b)
Forestry	Ireland's Forest Strategy 2023–2030 (Department of Agriculture, Food and the Marine, 2023a)
Marine	National Marine Planning Framework (Government of Ireland, 2021c)

A1.2.1 Classification categories used in Table 2.2

To distinguish the prominence of each Doughnut Economics dimension within the selected policy documents, coded references were classified as primary, secondary, peripheral or not covered.

Primary dimensions are those clearly prioritised in the policy text and linked to explicit objectives, targets, indicators or monitoring arrangements. Secondary dimensions are recognised as relevant but are less fully operationalised or less central to the policy framework. Peripheral dimensions are mentioned only indirectly, briefly or through cross-referencing rather than as substantive commitments. Not covered refers to dimensions that are reviewed but not substantively addressed in the selected primary policy document.

These classifications refer to policy salience and operationalisation. They do not assess actual sustainability performance, scientific weighting or whether a sector is operating within ecological ceilings or above social foundations (Table A1.2).

Table A1.2. Summary basis for sector classifications

Sector	Main basis for classification
Agriculture	Ireland's CAP Strategic Plan 2023–2027 (Department of Agriculture, Food and the Marine, 2022) links agriculture to viable farm incomes, food security, rural development and environmental management. Food and Income and Work are therefore treated as primary social foundations. Climate Change, Freshwater Use, Biogeochemical Flows and Biosphere Integrity are primary ecological ceilings because the plan prioritises greenhouse gas reduction, water quality, soil health, nutrient management and biodiversity, including farmland birds and pollinators. Education, Gender Equality, Networks and Social Equity are classified as secondary because the plan contains meaningful but largely enabling measures on knowledge transfer, women farmers, the LEADER (Liaison entre actions de développement de l'économie rurale) programme and redistribution.
Food	Food Vision 2030: A World Leader in Sustainable Food Systems (Government of Ireland, 2021b) adopts a food-systems approach and is organised around environmental sustainability, producer viability and well-being, safe and nutritious food, and innovation. Food, Health and Income and Work are primary because the strategy includes indicators relating to family farm income, economic sustainability, food safety, health and safety, animal welfare, value added and exports. Climate Change, Biosphere Integrity, Freshwater Use and Biogeochemical Flows are also primary because Mission 1 explicitly covers emissions reduction, carbon sequestration, biodiversity, water quality and nutrient losses. Education, Gender Equality, Networks and Social Equity are secondary because they are present through supporting actions on skills, well-being, women's participation and social sustainability.
Forestry	Ireland's Forest Strategy 2023–2030 (Department of Agriculture, Food and the Marine, 2023a) links forests to climate action, biodiversity, wood production, housing, recreation, well-being, rural employment and the wider economy. Income and Work and Health are primary because the strategy repeatedly connects forestry to rural jobs, forest-based economic activity, recreation and physical and mental well-being. Climate Change, Biosphere Integrity and Land-System Change are primary because the strategy presents forestry as a land-based climate mitigation measure, prioritises biodiversity and native forest expansion, and focuses on expanding and reshaping the national forest estate. Housing, Education and Networks are secondary because the strategy addresses timber in housing, forests as outdoor classrooms, skills and integrated land-use approaches, but these are not the dominant organising goals.
Marine	The National Marine Planning Framework (Government of Ireland, 2021c) is organised around Environmental Ocean Health, Economic Thriving Maritime Economy, and Social Engagement with the Sea. Income and Work and Networks are primary because the framework includes marine employment, economic activity and rural coastal and island communities. Biosphere Integrity and Climate Change are primary because the environmental pillar is strongly linked to biodiversity, protected marine sites, water quality, air quality, climate change and Good Environmental Status. Food and Health are secondary because the marine area is described as productive and food-rich, and access to the sea is linked to health and well-being, but the framework is not primarily a food or public health strategy. Freshwater Use, Biogeochemical Flows, Novel Entities and Atmospheric Aerosol Loading are secondary because they are addressed through water quality, marine litter, air quality and related environmental policy groupings.

Appendix 2 Summary Indicator Evidence by Sector

This appendix summarises the indicator evidence used to support the sectoral mapping in Chapter 2 of the main report. The purpose is not to reproduce every indicator contained in the selected policy documents, but to show the source basis for the mapping and the types of indicators that informed the Doughnut Economics domain classifications (Table A2.1).

For each of the four policy anchors, indicators and monitoring measures were identified from the formal monitoring, implementation, target or evidence sections of the selected document. Where an indicator clearly related to a social foundation or ecological ceiling, it was mapped to the closest Doughnut Economics domain. Where an indicator operated mainly as a governance, market, implementation, enabling or cross-cutting measure, and could not be assigned to a single Doughnut Economics domain without distortion, it was treated as cross-cutting.

This summary should therefore be read as an indicator evidence appendix rather than as a full data readiness assessment or final monitoring framework. The examples listed below are representative of the mapping decisions used in the main report and in Appendix 3.

A2.1 Expanded Interpretation of the Indicator Evidence

The four sectoral policy documents differ substantially in the maturity and formality of their monitoring arrangements. Ireland's CAP Strategic Plan 2023–2027 provides the most formal indicator architecture, with context and result indicators linked to the EU CAP monitoring framework (Department of Agriculture, Food and the Marine, 2022). Food Vision 2030: A World Leader in Sustainable Food Systems contains a broader food-systems set

of indicators and progress measures, combining quantitative targets with qualitative implementation goals (Government of Ireland, 2021b). Ireland's Forest Strategy 2023–2030 contains important baseline metrics, ambitions and monitoring commitments, but does not itself contain a fully developed indicator framework (Department of Agriculture, Food and the Marine, 2023a). A separate Forest Strategy KPI set was published in December 2024 (Department of Agriculture, Food and the Marine, 2024). The National Marine Planning Framework contains a mixed monitoring architecture, combining binding environmental targets under the Marine Strategy Framework Directive with economic, social, sectoral and planning-related measures (Government of Ireland, 2021c).

These differences matter for interpretation. Some indicators map clearly to a single Doughnut Economics domain, such as climate commitments, biodiversity measures, nutrient-management indicators, income measures or employment indicators. Others are better treated as cross-cutting because they relate to implementation, governance, investment, innovation, market organisation or several ecological pressures at once. Keeping this distinction explicit avoids overstating the degree of fit between existing sectoral monitoring and the Doughnut Economics framework.

The indicator evidence therefore supports three conclusions presented in the main report. First, a significant number of existing indicators can be related to Doughnut Economics domains. Second, coverage is uneven across sectors and domains. Third, an Irish bioeconomy doughnut would need to build from existing policy and monitoring systems while using supplementary sources, proxies or further indicator development where current coverage is weak.

Table A2.1. Summary indicator evidence by sector

Sector	Source document and indicator basis	Main Doughnut Economics domains supported by indicator evidence	Selected examples of indicators or measures
Agriculture	Ireland's CAP Strategic Plan 2023–2027 (Department of Agriculture, Food and the Marine, 2022). Indicators were identified from the context-indicator section, the CAP Targets Plan and the Performance Monitoring and Evaluation Framework result indicators linked to specific objectives. Common output indicators were not included, as the review focused on monitored policy indicators rather than implementation volumes.	Strongest coverage is found for Climate Change, Biosphere Integrity, Freshwater Use, Biogeochemical Flows, Novel Entities, Land-System Change, Income and Work, Education, Networks, Social Equity and Health. Some indicators are cross-cutting, particularly those relating to farm modernisation, market organisation, risk management and broad environmental performance.	Climate-related examples include supported commitments for climate adaptation, carbon storage in soils and biomass, and CAP investment support contributing to mitigation and adaptation. Water, nutrients and pollution are represented through indicators on waterbody quality, nutrient management, reduced pesticide use and reduced ammonia emissions. Biodiversity-related indicators include Natura 2000 areas, supported commitments for biodiversity conservation or restoration, biodiversity investment and landscape features. Social and economic examples include total number of farms, income support subject to conditionality, young farmers supported, jobs in rural areas, rural businesses including bioeconomy businesses, LEADER programme coverage, smart-village strategies, social inclusion projects, advice and training, and actions relating to antimicrobial use and animal welfare.
Food	Food Vision 2030: A World Leader in Sustainable Food Systems (Government of Ireland, 2021b). Indicators were identified from the strategy's implementation and oversight section and from the mission-level "Key indicators" and "Progress by 2030" statements. The strategy uses a mixed indicator structure, including quantitative indicators, qualitative goals and progress measures.	Strongest coverage is found for Food, Health, Income and Work, Education, Networks, Climate Change, Biosphere Integrity, Freshwater Use, Biogeochemical Flows and Land-System Change. Several indicators are cross-cutting, particularly those relating to governance, innovation, market transparency, research and programme implementation.	Ecological examples include biogenic methane reduction, ammonia and nitrous oxide emissions, nutrient losses to water, biodiversity on land and sea, afforestation levels, organic farming and food waste reduction. Social and economic examples include family farm income, economic sustainability of farm businesses, economic return to land, seafood-sector economic performance, total primary output, formal agricultural education, age profile, new entrants, number of farm families, isolation risk, health and safety statistics, food safety, animal health and welfare, value added and exports. Cross-cutting examples include the enhanced Origin Green programme, market transparency, private R&D, public policy supports and implementation of innovation recommendations.
Forestry	Ireland's Forest Strategy 2023–2030 (Department of Agriculture, Food and the Marine, 2023a). Indicators and metrics were identified from explicit baseline metrics, numeric targets or ambitions, and monitoring or review commitments stated in the strategy. The 2023 strategy did not itself contain a settled indicator framework; a separate Forest Strategy KPI set was published in December 2024 (Department of Agriculture, Food and the Marine, 2024).	Strongest coverage is found for Climate Change, Biosphere Integrity, Land-System Change, Income and Work, Health and Networks. Some measures are cross-cutting, particularly those relating to ownership, certification, wood supply, market structure and implementation milestones.	Ecological examples include forest area, forest cover, EU average forest-cover comparison, forest composition, forest carbon stock, afforestation ambition, native or broadleaf establishment, forest-cover ambition and emissions reduction potential from greater timber use in construction. Social and economic examples include number of forest owners, employment supported by the forest and wood products sector, contribution to the economy, value of wood products exported, forests open to the public and visits to Irish forests. Cross-cutting examples include ownership structure, average parcel size, potential annual roundwood supply, certification goals and the 2023 strategy's commitment to identify and develop high-level indicators.

Table A2.1. Continued

Sector	Source document and indicator basis	Main Doughnut Economics domains supported by indicator evidence	Selected examples of indicators or measures
Marine	National Marine Planning Framework (Government of Ireland, 2021c). Indicators and measures were identified from the framework's formal environmental target tables, quantified social and economic baseline tables, and implementation and monitoring text. The framework is a spatial planning framework rather than a single indicator dashboard and so the review combines binding environmental targets with planning-relevant quantified measures.	Strongest coverage is found for Biosphere Integrity, Biogeochemical Flows, Novel Entities, Freshwater Use, Health, Food, Income and Work and Networks. Some measures are cross-cutting, including those relating to hydrographical change, underwater noise, ports and monitoring cycles.	Environmental examples include Marine Strategy Framework Directive targets on species by-catch, population abundance, species distribution, habitat condition, non-indigenous species, fishing mortality, spawning stock biomass, trophic guilds, seabed loss and disturbance, nutrient concentrations, chlorophyll, dissolved oxygen, contaminants, acute pollution events, marine litter and underwater noise. Social and economic examples include ocean-economy turnover, direct GVA, employment, seafood-sector contribution, aquaculture value, seafood exports, employment in seafood and aquaculture, inshore fleet employment, coastal electoral districts, coastal counties, water-based recreation and aquaculture output. Water-related examples include bathing-water quality, shellfish waters, untreated wastewater discharges and River Basin Management Plan cycles.

GVA, gross value added; R&D, research and development.

Appendix 3 Summary Mapping of Selected Indicators to Raworth's Doughnut Economics Framework

The indicator mapping in this appendix (Table A3.1) supports the sector doughnut diagrams (Figures 2.1–2.4) and the indicative overall bioeconomy policy-coverage doughnut presented in the main report (Figure 2.5). It provides selected examples of the indicators mapped to each Doughnut Economics domain across the four selected policy documents but does not reproduce the full working inventory used during the analysis.

The mapping should therefore be read as a summary of policy-based indicator coverage and not as a full data readiness assessment, performance dashboard or final monitoring framework. Blank cells in Table A3.1 indicate that no direct indicator was identified in the selected policy document for that domain. In some cases, a domain may still appear in the policy-screening classification in the main report because it is present in policy objectives or commitments, even where no formal indicator was identified.

A3.1 Interpretation of the Mapping

The mapping shows that existing policy indicators are unevenly distributed across the doughnut structure. Indicator coverage is strongest for domains linked to economic viability, employment, climate, biodiversity, land use, water quality and nutrient pressures. This reflects the monitoring priorities already embedded in the CAP Strategic Plan, Food Vision 2030, Ireland's Forest Strategy 2023–2030 and the National Marine Planning Framework (Government of Ireland, 2021b,c; Department of Agriculture, Food and the Marine, 2022, 2023a).

Several social foundations are less strongly supported by formal indicators in the selected documents. These include Water as a social foundation, Peace

and Justice, Political Voice, Gender Equality and Housing. Some of these domains are mentioned in policy objectives or wider commitments but are not supported by direct indicators in the selected primary documents. This distinction is important because the sector doughnut diagrams (Figures 2.1–2.4) in the main report are based on policy salience and operationalisation, while this appendix focuses specifically on mapped indicators.

The ecological domains also vary in coverage. Climate Change, Biosphere Integrity, Land-System Change, Freshwater Use, Biogeochemical Flows, Novel Entities and Atmospheric Aerosol Loading are all supported by at least some indicators across the four documents. By contrast, Ocean Acidification and Ozone Layer Depletion are not directly represented by formal indicators in the selected policy documents. This does not mean that these domains are irrelevant to the wider bioeconomy, but, instead, that they are not substantively visible in the indicator material reviewed for this first-round policy mapping exercise.

Overall, the mapping supports the main report's conclusion that an Irish bioeconomy doughnut could draw on existing indicators, but that coverage remains uneven. Any future operational framework would therefore need to combine existing sector indicators with supplementary national datasets, EU monitoring sources, future observatory outputs and, where appropriate, proxy indicators or further indicator development.

The same mapping approach could be extended in future to additional bioeconomy-relevant areas, including bio-based materials, organic waste and by-product valorisation, bioenergy, bio-based chemicals, construction materials and specific value chains, as new datasets, observatory outputs and sector-specific indicators become available.

Table A3.1. Summary mapping of selected indicators to Doughnut Economics domains

Doughnut Economics domain	Agriculture – Ireland's CAP Strategic Plan 2023–2027 (Department of Agriculture, Food and the Marine, 2022)	Food – Food Vision 2030: A World Leader in Sustainable Food Systems (Government of Ireland, 2021b)	Forestry – Ireland's Forest Strategy 2023–2030 (Department of Agriculture, Food and the Marine, 2023a)	Marine – National Marine Planning Framework (Government of Ireland, 2021c)
Social foundations				
Water				
Food		Food, health and nutrition initiatives; food and nutrition security; sustainable food systems		Aquaculture output
Health	Actions to limit antimicrobial use; animal welfare actions	Health and safety statistics; food safety; animal health and welfare	Visits to Irish forests per annum	Contaminants in fish and shellfish for human consumption
Income and Work	Total number of farms; young farmers supported; rural jobs and bioeconomy businesses supported	Family farm income; economic sustainability of farm businesses; value added and exports	Forest owners; forest-sector employment; contribution to the economy	Ocean economy GVA and employment; seafood-sector contribution; inshore employment
Education	Advice, training and knowledge exchange; AKIS support; digital farming technology	Formal agricultural education; education, skills and talent strategy		
Peace and Justice				
Political Voice				
Social Equity	Redistributive payments; support for areas with higher needs; social inclusion projects			
Gender Equality				
Housing				
Networks	LEADER programme population coverage; smart-village strategies; access to rural services and infrastructure	Number of farm families; isolation risk	Coillte properties open to the public	Coastal electoral districts; coastal counties; domestic water-based recreation
Energy	Supported renewable energy production capacity, including bio-based sources			
Ecological ceilings				
Climate Change	Supported commitments for climate adaptation; carbon storage in soils and biomass; climate-related investment support	Biogenic methane; ammonia and nitrous oxide emissions	Forest carbon stock; avoided emissions from wood use; afforestation for sink capacity	
Biosphere Integrity	Natura 2000 agricultural and forest area; biodiversity conservation or restoration commitments; landscape features	Biodiversity on land and sea	Forest composition; native or broadleaf establishment ambition	By-catch targets; species abundance and habitat condition; seabed loss and disturbance targets

Table A3.1. Continued

Doughnut Economics domain	Agriculture – Ireland's CAP Strategic Plan 2023–2027 (Department of Agriculture, Food and the Marine, 2022)	Food – Food Vision 2030: A World Leader in Sustainable Food Systems (Government of Ireland, 2021b)	Forestry – Ireland's Forest Strategy 2023–2030 (Department of Agriculture, Food and the Marine, 2023a)	Marine – National Marine Planning Framework (Government of Ireland, 2021c)
Land-System Change	Total forest area and utilised agricultural area; soil management commitments; organic farming	Afforestation level; organic farming	Forest area; forest cover; forest-cover target	
Freshwater Use	Commitments for waterbody quality	Water quality		Bathing-water quality; shellfish waters; untreated wastewater discharges
Biogeochemical Flows	Nutrient management commitments	Nutrient-loss reduction target		Nutrient concentrations; chlorophyll concentrations; dissolved oxygen targets
Novel Entities	Sustainable and reduced pesticide use			Contaminants in coastal and marine waters; marine litter; prohibited single-use plastic beach litter
Atmospheric Aerosol Loading	Commitments to reduce ammonia emissions	Ammonia and nitrous oxide emissions		
Ocean Acidification				
Ozone Layer Depletion				

AKIS, Agricultural Knowledge and Innovation Systems; GVA, gross value added.

Appendix 4 Comparative Coding Approach and Summary Coding for Chapter 3

Each policy document reviewed in Chapter 3 was assessed against a common set of comparative criteria to identify its contribution to Irish bioeconomy governance and its limitations for integrated sustainability monitoring. Coding was based only on explicit policy content in the selected document, including stated objectives, governance mechanisms, implementation arrangements, indicators, targets, dashboards, reporting provisions and institutional responsibilities. This appendix provides the fuller coding basis for the compressed comparison presented in Table 3.1 of the main report.

General or aspirational language was not treated as evidence of operational governance unless it was linked to a clear mechanism, monitoring provision, reporting process or institutional responsibility. This approach was intended to support comparative governance analysis rather than a full theory review. Its purpose was to identify which governance and monitoring functions are already present in Irish policy and which gaps remain relevant to the assessment of Doughnut Economics as a potential organising and interpretive framework.

The documents reviewed for this part of the analysis were:

- Project Ireland 2040, comprising the National Planning Framework: First Revision (Government of Ireland, 2025a) and the National Development Plan Review 2025 (Government of Ireland, 2025b);
- Whole of Government Circular Economy Strategy 2026–2028 (Government of Ireland, 2026);
- Understanding Life in Ireland: The Well-Being Framework 2025 (Government of Ireland, 2025c).

A4.1 Comparative Criteria Used

The following criteria were applied to each framework:

- Governance focus: The primary governance function performed by the framework within the wider policy system.

- Main policy objective: The central strategic purpose or policy ambition of the framework.
- Indicator and monitoring focus: The extent and character of the monitoring architecture, including indicators, targets, dashboards, reporting cycles, review mechanisms or implementation oversight.
- Social coverage: The extent to which social and distributional outcomes are recognised and addressed.
- Ecological coverage: The extent to which environmental sustainability, ecological constraints or environmental limits are recognised and addressed.
- Treatment of trade-offs: Whether competing objectives, constraints or unintended consequences are explicitly recognised, and whether any mechanism exists to manage them.
- Relevance to bioeconomy governance: Whether the framework is directly or indirectly relevant to bioeconomy sectors and their governance.
- Main limitation for integrated monitoring: The principal gap or constraint that limits the framework's contribution to integrated bioeconomy sustainability monitoring.

A4.2 Coding Scales

For social coverage, ecological coverage and treatment of trade-offs, the following strength scale was used:

- None: Not explicitly addressed in the document.
- Limited: Mentioned but not structured or operationalised.
- Moderate: Addressed through policy objectives or guidance, but with limited monitoring or weak implementation mechanisms.
- Strong: Addressed through explicit objectives together with indicators, targets, statutory requirements or identifiable governance mechanisms.

For relevance to bioeconomy governance, the following scale was used:

- Direct: The framework explicitly addresses the bioeconomy or bioeconomy sectors as a core focus.
- Indirect: The framework is not bioeconomy specific but materially shapes the governance conditions within which bioeconomy development occurs.
- Contextual: The framework provides useful background or reference material but has limited operational relevance to bioeconomy governance.

A4.3 Summary Comparative Coding

The summary coding for Chapter 3 is presented in Table A4.1.

A4.4 Interpretation

The comparative coding shows that the three governance frameworks make different but partial contributions to Irish bioeconomy governance. Project Ireland 2040 provides planning authority, investment logic and delivery capacity (Government of Ireland, 2025a,b). The Circular Economy Strategy provides the strongest resource efficiency and material flow logic and is directly relevant to the bioeconomy (Government of Ireland, 2026). The Well-being Framework provides the strongest coverage of social and distributional outcomes (Government of Ireland, 2025c).

However, none of the reviewed frameworks integrate economic development, ecological constraints and social foundations within a single monitoring structure. This supports the conclusion in Chapter 3 that Doughnut Economics may have value as an additional organising and interpretive layer, provided that it is used to connect existing policy and monitoring systems rather than replace them.

Table A4.1. Summary comparative coding

Criterion	Project Ireland 2040: National Planning Framework: First Revision (Government of Ireland, 2025a) and National Development Plan Review 2025 (Government of Ireland, 2025b)	Whole of Government Circular Economy Strategy 2026–2028 (Government of Ireland, 2026)	Understanding Life in Ireland: The Well-Being Framework 2025 (Government of Ireland, 2025c)
Governance focus	National spatial planning and capital investment framework. The NPF provides the spatial planning hierarchy and the NDP provides the capital investment and infrastructure-delivery framework.	Whole-of-government circular economy governance framework focused on resource efficiency, circularity, waste prevention, material productivity and sectoral transition.	National multidimensional well-being monitoring framework. It functions primarily as an annual analytical and reporting instrument tracking economic, social and environmental outcomes.
Main policy objective	To shape national development to 2040 through spatial planning, infrastructure alignment, balanced regional development and public investment. The NDP Review supports delivery through capital allocations and investment priorities.	To accelerate Ireland's transition to a more resilient, resource-efficient and innovation-driven economy by increasing circularity, reducing dependency on virgin materials, supporting competitiveness and embedding circular practices.	To provide a high-level overview of how Ireland is doing economically, environmentally and socially, and to inform Government priorities through a well-being lens with explicit attention to equality and sustainability.
Indicator/monitoring focus	Monitoring is strongest in relation to statutory planning, capital allocation, project appraisal, delivery oversight and environmental assessment. It does not provide a unified socio-ecological monitoring dashboard.	Comparatively developed monitoring architecture. The strategy includes a Circular Material Use Rate target, sectoral actions and targets, annual progress reporting to the Oireachtas and a commitment to a national circularity dashboard.	Centred on 35 indicators across 11 dimensions, supported by the CSO dashboard, trend analysis, international comparison, equality analysis and sustainability tagging. It reports outcomes but does not set targets or compliance obligations.
Social coverage	Moderate. Social and distributional objectives are present through housing, regional development, community infrastructure, public services and just transition language, but without a dedicated social indicator architecture.	Moderate. Social equity, household benefits, local action, jobs, skills and just transition are recognised, but are less fully operationalised than resource and waste measures.	Strong. Social and distributional coverage is extensive, including health, income, housing, work, safety, community, participation and civic engagement, supported by an equality lens.
Ecological coverage	Strong. Ecological issues are addressed through climate transition, renewable energy planning, environmental assessment, biodiversity, water policy and references to development within environmental limits. However, this is not organised as an integrated ecological ceilings framework.	Strong. Ecological concerns are central to the strategy through waste prevention, resource use, recycling, food waste, packaging, biowaste, construction emissions, circular bioeconomy and climate links.	Moderate. Environmental indicators are included through the Environment, Climate and Biodiversity dimension and sustainability-tagged indicators, but these are performance measures rather than ecological ceilings or binding limits.
Treatment of trade-offs	Moderate. Trade-offs between growth, infrastructure capacity, environmental protection, regional development and delivery constraints are recognised and partly managed through planning hierarchy, appraisal, environmental assessment and prioritisation processes. There is no integrated cross-sector arbitration mechanism.	Moderate. Trade-offs are recognised through proportionality, phased implementation, competitiveness safeguards, cost and regulatory impact assessment, SME capacity and housing delivery considerations. There is no single integrated mechanism for resolving trade-offs across sectors.	Limited. The framework acknowledges tensions between indicators, including between environmental and economic performance, but describes rather than governs these tensions. It does not provide a formal mechanism for resolving competing objectives.
Relevance to bioeconomy governance	Indirect. The framework is not bioeconomy specific, but shapes the enabling conditions for bioeconomy development through land use, rural development, water infrastructure, energy, marine planning, public investment and research infrastructure.	Direct. The strategy contains a dedicated bioeconomy chapter, identifies biomass and biological material flows as important to national circularity, and includes bioeconomy-related actions and targets.	Contextual. The framework is not bioeconomy specific, but provides useful social, distributional and selected environmental outcome indicators that may inform wider assessment of bioeconomy development.

Table A4.1. Continued

Criterion	Project Ireland 2040: National Planning Framework: First Revision (Government of Ireland, 2025a) and National Development Plan Review 2025 (Government of Ireland, 2025b)	Whole of Government Circular Economy Strategy 2026–2028 (Government of Ireland, 2026)	Understanding Life in Ireland: The Well-Being Framework 2025 (Government of Ireland, 2025c)
Main limitation for integrated monitoring	Strong delivery authority, but no unified structure combining economic development, ecological constraints and social outcomes for bioeconomy monitoring.	Strong resource and circularity logic, but weaker social operationalisation and no explicit ecological ceilings framework.	Strong national outcomes dashboard, but not a sectoral governance tool and not linked to bioeconomy implementation mechanisms.

NDP, National Development Plan; NPF, National Planning Framework; SME, small and medium-sized enterprises.

Appendix 5 Doughnut Economics Applications in Practice

This appendix provides further case-study evidence to that summarised in Table 4.2 of the main report. The examples are used to identify practical lessons for the feasibility assessment, including how Doughnut Economics applications have adapted domains, selected indicators and thresholds, incorporated participation, and connected outputs to policy or governance processes (Table A5.1).

A5.1 Interpretation of the Case-Study Evidence

The case-study evidence shows that Doughnut Economics applications are not standardised. They vary by scale, purpose and degree of quantification, and require explicit choices on domains, indicators, thresholds or proxies, and governance arrangements (Tomelilla Municipality, n.d.; Sayers *et al.*, 2014; Doughnut Economics Action Lab *et al.*, 2020; Bergh, 2025; Cattaneo *et al.*, 2025; Recordon *et al.*, 2025; Sykes, 2025). They also show that

Doughnut Economics approaches often function less as fixed monitoring dashboards and more as policy-facing interpretive tools linked to existing strategies, institutional processes and stakeholder discussion (Tomelilla Municipality, n.d.; Sayers *et al.*, 2014; Doughnut Economics Action Lab *et al.*, 2020; Hjelmkog *et al.*, 2023; Bergh, 2025; Sykes, 2025; National Economic and Social Council, 2026).

This is evident in the national snapshot approach used in Scotland (Sayers *et al.*, 2014), the city portrait and action-oriented approaches in Amsterdam and Barcelona (Doughnut Economics Action Lab *et al.*, 2020; Cattaneo *et al.*, 2025), the local and institutional adaptation challenges identified in Switzerland (Recordon *et al.*, 2025), the municipality-led application in Tomelilla (Tomelilla Municipality, n.d.; Bergh, 2025; Sykes, 2025), the participatory whole-systems work in Glasgow (Hjelmkog *et al.*, 2023), and the thematic integrative framing used by the National Economic and Social Council in the Irish energy context (National Economic and Social Council, 2026).

Table A5.1. Full case-study comparison of selected Doughnut Economics applications

Case (scale)	Operational approach	Domains, indicators and thresholds	Governance/ participation	Outputs and policy interface
Scotland (national)	National snapshot assessment of social and environmental conditions using a Doughnut Economics framing.	Adapted domains to national context and explicitly framed the Doughnut Economics application in terms of domains, indicators and thresholds. Social thresholds were proposed using existing evidence; environmental ceilings drew, where possible, on existing approaches, with alternative proxies used where necessary.	Positioned as a policy-facing exercise rather than as a definitive scientific assessment. It drew on existing evidence and recognised that social foundations should remain open to debate and revision.	Produced an integrated national picture and was explicitly linked to public policy debate, including possible relevance to Scotland's National Performance Framework.
Amsterdam (city)	City Portrait using four lenses: local social, local ecological, global ecological and global social. Presented as a holistic snapshot and starting point for action rather than a comprehensive assessment.	The four-lens structure broadens analysis beyond local outcomes alone. The first version was based largely on publicly available data and reports, creating a "public portrait" that could later become a more developed city "selfie".	Developed with wide involvement of city staff and supported by workshops in seven neighbourhoods. The approach emphasised co-creation, cross-departmental collaboration and networks of changemakers.	Used as a tool for transformative action and linked to existing city strategies, including the Amsterdam Circular Strategy 2020–2025 and the Roadmap to Climate Neutrality 2050.
Barcelona (city)	Three-phase process: (1) City Portrait, combining a quantitative data portrait and qualitative community portrait; (2) awareness raising; and (3) steps to action.	Applied the four-lens City Portrait. Local indicators were drawn from Barcelona strategies with actual and target values; global indicators used state-level sources and Exiobase, with downscaling through $I = P \times A \times T$, where I is environmental impact, P is population, A is affluence (consumption per person) and T is environmental impact per unit of consumption.	Steered by a follow-up commission including associations, trade unions, academia and social movements. Participatory workshops fed into the community portrait and later action design.	Created a pathway from assessment to action: 49 actions were grouped into 16 collaborative ideas and then into 7 project areas that fed into the next citizens' commitment period.
Switzerland (regional/ institutional local applications)	Doughnut Unrolled and Data Portrait applied in two Swiss cases: the Greater Geneva area and the University of Lausanne. Used as a compass for local ecological transition and strategy development rather than as a fixed dashboard.	Local application required adaptation of the original framework and difficult choices on local indicators, target values and downscaling. The review stresses that maintaining the integrity of the framework at the local scale is challenging and that local applications depend on explicit normative choices and methodological trade-offs.	Mixed practice-based and action-research approach. Greater Geneva included some consultation with local population and economic stakeholders; the University of Lausanne used the Data Portrait to support a participatory transition process.	In Greater Geneva, the work informed political discussion and a quantified ecological transition commitment. At the University of Lausanne, the Doughnut Economics framework and its quantified version became guiding frameworks for institutional transition strategy.

Table A5.1. Continued

Case (scale)	Operational approach	Domains, indicators and thresholds	Governance/ participation	Outputs and policy interface
Tomelilla, Sweden (municipal/local government)	Doughnut Economics has been integrated into municipal planning, monitoring and evaluation since 2021. It has been used in sustainability reporting and City Portrait development, and as a guiding framework for a new school area master plan.	The model has been used to provide an overview of social, ecological and economic sustainability across the municipality. The case illustrates an evolving and selective use of Doughnut Economics principles rather than a fully quantified or settled dashboard.	The approach is municipality led and has been taken forward through internal planning, needs assessment and master-planning work. It also points to the importance of local interpretation, context and supporting analysis alongside the doughnut itself.	Outputs include sustainability reports, a first City Portrait and the incorporation of Doughnut Economics principles into school planning. The case is useful as an example of practical local application, while also illustrating that operationalisation remains gradual and context specific.
Glasgow (city/applied participatory case)	Pilot application of the City Portrait methodology developed through the Thriving Cities Initiative. Combined desk-based research and policy review with participatory workshops.	Used the Doughnut Economics framework to structure socio-ecological well-being and develop pluralistic definitions of “thriving” across the framework’s social and ecological dimensions. Worked more as a whole-system organising tool than as a finalised dashboard.	Five participatory workshops involving about 130 stakeholders, including civil servants, politicians, scientists, community representatives, private sector and third-sector actors, and social enterprises.	Produced a shared holistic vision for Glasgow as a thriving city and widened stakeholders’ perspectives through systems thinking, cross-sector discussion and collaboration.
NESC Energy Systems Doughnut (Ireland/thematic)	Not a full Doughnut Economics dashboard. Used an energy doughnut to organise systems analysis and frame integrated recommendations for Ireland’s energy transition.	Functioned primarily as an integrative framing device summarising social, economic and environmental objectives, rather than as a full indicator-and-threshold architecture.	Built on systems analysis and stakeholder participation.	Fed directly into recommendations, including a proposed Cross-Government Energy Framework integrating heat, transport and electricity alongside wider social, economic and environmental aims.

NESC, National Economic and Social Council.

Source: Authors’ synthesis, based on key relevant sources, including Tomelilla Municipality (n.d.), Sayers *et al.* (2014), Doughnut Economics Action Lab *et al.* (2020), Hjelmkog *et al.* (2023), Bergh (2025), Cattaneo *et al.* (2025), Recordon *et al.* (2025), Sykes (2025) and National Economic and Social Council (2026).

Abbreviations

BIO-INSIGHT	Bioeconomy Indicators for Foresight
CAP	Common Agricultural Policy
CSO	Central Statistics Office
FAO	Food and Agriculture Organization of the United Nations
INFORMBIO	Integrated Framework for Mapping, Modelling and Monitoring Ireland's Bioeconomy
JRC	Joint Research Centre
JustACE	Just Transition for Agriculture in the Circular Bioeconomy
LEADER	Liaison entre actions de développement de l'économie rurale

An Ghníomhaireacht Um Chaomhnú Comhshaoil

Tá an GCC freagrach as an gcomhshaol a chosaint agus a fheabhsú, mar shócmhainn luachmhar do mhuintir na hÉireann. Táimid tiomanta do dhaoine agus don chomhshaol a chosaint ar thionchar díobhálach na radaíochta agus an truaillithe.

Is féidir obair na Gníomhaireachta a roinnt ina trí phríomhréimse:

Rialáil: Rialáil agus córais chomhlíonta comhshaoil éifeachtacha a chur i bhfeidhm, chun dea-thorthaí comhshaoil a bhaint amach agus díriú orthu siúd nach mbíonn ag cloí leo.

Eolas: Sonraí, eolas agus measúnú ardchaighdeán, spriocdhírthe agus tráthúil a chur ar fáil i leith an chomhshaoil chun bonn eolais a chur faoin gcinnteoireacht.

Abhcóideacht: Ag obair le daoine eile ar son timpeallachta glaine, táirgiúla agus dea-chosanta agus ar son cleachtas inbhuanaithe i dtaobh an chomhshaoil.

I measc ár gcuid freagrachtaí tá:

Ceadúnú

- > Gníomhaíochtaí tionscail, dramhaíola agus stórála peitрил ar scála mór;
- > Sceitheadh fuíolluisce uirbigh;
- > Úsáid shrianta agus scaoileadh rialaithe Orgánach Géinmhodhnaithe;
- > Foinsí radaíochta ianúcháin;
- > Astaíochtaí gás ceaptha teasa ó thionscal agus ón eitlíocht trí Scéim an AE um Thrádáil Astaíochtaí.

Forfheidhmiú Náisiúnta i leith Cúrsaí Comhshaoil

- > Iniúchadh agus cigireacht ar shaoráidí a bhfuil ceadúnas acu ón GCC;
- > Cur i bhfeidhm an dea-chleachtais a stiúradh i ngníomhaíochtaí agus i saoráidí rialáilte;
- > Maoirseacht a dhéanamh ar fhreagrachtaí an údaráis áitiúil as cosaint an chomhshaoil;
- > Caighdeán an uisce óil phoiblí a rialáil agus údaruithe um sceitheadh fuíolluisce uirbigh a fhorfheidhmiú
- > Caighdeán an uisce óil phoiblí agus phríobháidigh a mheasúnú agus tuairisciú air;
- > Comhordú a dhéanamh ar líonra d'eagraíochtaí seirbhíse poiblí chun tacú le gníomhú i gcoinne coireachta comhshaoil;
- > An dlí a chur orthu siúd a bhriseann dlí an chomhshaoil agus a dhéanann dochar don chomhshaol.

Bainistíocht Dramhaíola agus Ceimiceáin sa Chomhshaol

- > Rialacháin dramhaíola a chur i bhfeidhm agus a fhorfheidhmiú lena n-áirítear saincheisteanna forfheidhmithe náisiúnta;
- > Staitisticí dramhaíola náisiúnta a ullmhú agus a fhoilsiú chomh maith leis an bPlean Náisiúnta um Bainistíocht Dramhaíola Guaisí;
- > An Clár Náisiúnta um Chosc Dramhaíola a fhorbairt agus a chur i bhfeidhm;
- > Reachtaíocht ar rialú ceimiceán sa timpeallacht a chur i bhfeidhm agus tuairisciú ar an reachtaíocht sin.

Bainistíocht Uisce

- > Plé le struchtúir náisiúnta agus réigiúnacha rialachais agus oibriúcháin chun an Chreat-treoir Uisce a chur i bhfeidhm;
- > Monatóireacht, measúnú agus tuairisciú a dhéanamh ar chaighdeán aibhneacha, lochanna, uiscí idirchreasa agus cósta, uiscí snámha agus screamhuisce chomh maith le tomhas ar leibhéil uisce agus sreabhadh abhann.

Eolaíocht Aeráide & Athrú Aeráide

- > Fardail agus réamh-mheastacháin a fhoilsiú um astaíochtaí gás ceaptha teasa na hÉireann;
- > Rúnaíocht a chur ar fáil don Chomhairle Chomhairleach ar Athrú Aeráide agus tacaíocht a thabhairt don Idirphlé Náisiúnta ar Gníomhú ar son na hAeráide;

- > Tacú le gníomhaíochtaí forbartha Náisiúnta, AE agus NA um Eolaíocht agus Beartas Aeráide.

Monatóireacht & Measúnú ar an gComhshaol

- > Córais náisiúnta um monatóireacht an chomhshaoil a cheapadh agus a chur i bhfeidhm: teicneolaíocht, bainistíocht sonraí, anailís agus réamhaisnéisiú;
- > Tuairiscí ar Staid Thimpeallacht na hÉireann agus ar Tháscairí a chur ar fáil;
- > Monatóireacht a dhéanamh ar chaighdeán an aeir agus Treoir an AE i leith Aeir Ghlain don Eoraip a chur i bhfeidhm chomh maith leis an gCoinbhinsiún ar Aerthruailliú Fadraoin Trasteorann, agus an Treoir i leith na Teorann Náisiúnta Astaíochtaí;
- > Maoirseacht a dhéanamh ar chur i bhfeidhm na Treorach i leith Torainn Timpeallachta;
- > Measúnú a dhéanamh ar thionchar pleananna agus clár beartaithe ar chomhshaol na hÉireann.

Taighde agus Forbairt Comhshaoil

- > Comhordú a dhéanamh ar ghníomhaíochtaí taighde comhshaoil agus iad a mhaoiniú chun brú a aithint, bonn eolais a chur faoin mbeartas agus réitigh a chur ar fáil;
- > Comhoibriú le gníomhaíocht náisiúnta agus AE um thaighde comhshaoil.

Cosaint Raideolaíoch

- > Monatóireacht a dhéanamh ar leibhéil radaíochta agus nochtadh an phobail do radaíocht ianúcháin agus do réimsí leictreamaighnéadacha a mheas;
- > Cabhrú le pleananna náisiúnta a fhorbairt le haghaidh éigeandálaí ag eascairt as tasmí núicléacha;
- > Monatóireacht a dhéanamh ar fhorbairtí thar lear a bhaineann le saoráidí núicléacha agus leis an tsábháilteacht raideolaíochta;
- > Sainseirbhísí um chosaint ar an radaíocht a sholáthar, nó maoirsiú a dhéanamh ar sholáthar na seirbhísí sin.

Treoir, Ardú Feasachta agus Faisnéis Inrochtana

- > Tuairisciú, comhairle agus treoir neamhspleách, fianaise-bhunaithe a chur ar fáil don Rialtas, don tionscal agus don phobal ar ábhair maidir le cosaint comhshaoil agus raideolaíoch;
- > An nasc idir sláinte agus folláine, an geilleagar agus timpeallacht ghlan a chur chun cinn;
- > Feasacht comhshaoil a chur chun cinn lena n-áirítear tacú le hiompraíocht um éifeachtúlacht acmhainní agus aistriú aeráide;
- > Tástáil radóin a chur chun cinn i dtithe agus in ionaid oibre agus feabhsúchán a mholadh áit is gá.

Comhpháirtíocht agus Líonrú

- > Oibriú le gníomhaireachtaí idirnáisiúnta agus náisiúnta, údaráis réigiúnacha agus áitiúla, eagraíochtaí neamhrialtais, comhlachtaí ionadaíocha agus ranna rialtais chun cosaint comhshaoil agus raideolaíoch a chur ar fáil, chomh maith le taighde, comhordú agus cinnteoireacht bunaithe ar an eolaíocht.

Bainistíocht agus struchtúr na Gníomhaireachta um Chaomhnú Comhshaoil

Tá an GCC á bainistiú ag Bord lánaimseartha, ar a bhfuil Ard-Stiúrthóir agus cúigear Stiúrthóir. Déantar an obair ar fud cúig cinn d'Oifigí:

1. An Oifig um Inbhuanaitheacht i leith Cúrsaí Comhshaoil
2. An Oifig Forfheidhmithe i leith Cúrsaí Comhshaoil
3. An Oifig um Fhianaise agus Measúnú
4. An Oifig um Chosaint ar Radaíocht agus Monatóireacht Comhshaoil
5. An Oifig Cumarsáide agus Seirbhísí Corparáideacha

Tugann coistí comhairleacha cabhair don Ghníomhaireacht agus tagann siad le chéile go rialta le plé a dhéanamh ar ábhair imní agus le comhairle a chur ar an mBord.

Evidence Synthesis Report <Kelleher>

Doughnut Economics: A Framework for the Sustainable Development of Ireland's Bioeconomy

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