

Appendix 1: Example of Delphi survey instrument, Round 1

Welcome to BioÉire!

The BioÉire project aims to identify the most promising value chain opportunities for development in the Irish bioeconomy. As defined by [EC \(2012\)](#):

“The bioeconomy encompasses the production of renewable biological resources and their conversion into food, feed, bio-based products and bioenergy”

We are concerned with all value adding activities across the length of biological supply chains (primarily agriculture, food, marine, forestry and energy) taking into account the unique Irish resource base, available transformation technologies and the range of higher value outputs possible. A preliminary list of Irish value chain opportunities has been developed through earlier project phases. You now have the opportunity to **assess and score the 16 proposed value chains** for their commercial potential in the short-medium term.

The study should take approximately 30-40 minutes to complete. We encourage you to assess each chain to **the best of your knowledge** (even if some of them are outside of your expertise), with any **additional commentary** outlining the rationale behind your decision just as important as the final scores assigned. We also encourage you to think of each chain in the context of the wider Irish bioeconomy, including how the value chains might interact (for example, that one chain might not work in isolation but could be feasible if connected with another, or that one chain could be developed at the cost of another).

You have been specially chosen to participate in our study given your level of experience in an area relevant to the Irish bioeconomy. Funded by the Department of Agriculture, Food and the Marine, the ultimate aim of BioÉire is to **prioritise up to 8 value chains** to feed into the Department as part of efforts to develop a bioeconomy strategy for Ireland. Many thanks for taking the time to contribute to this important endeavour.



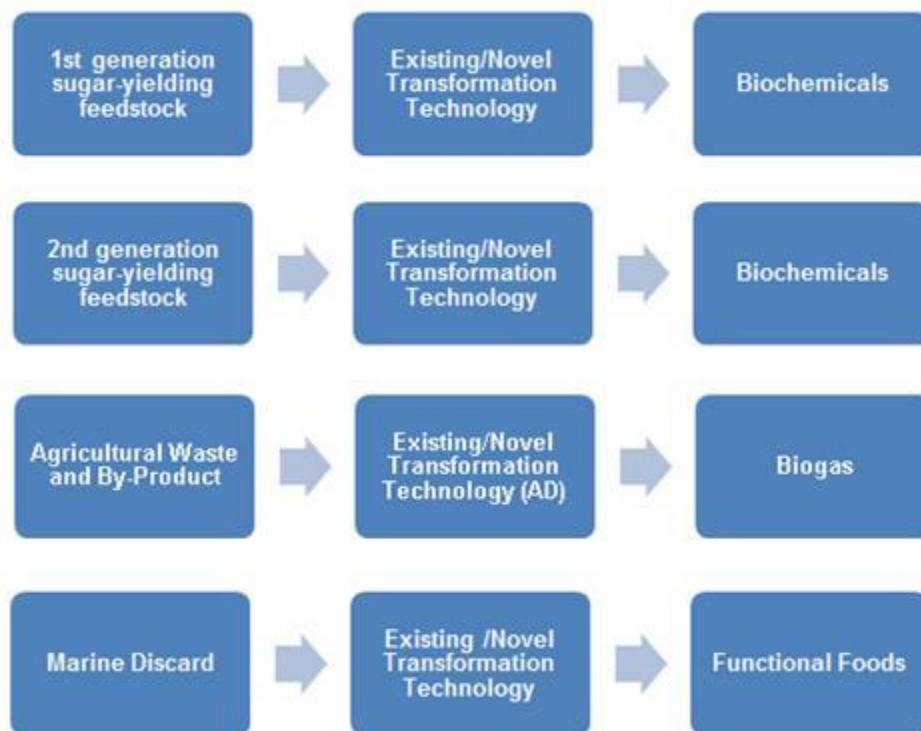
BioÉire

A Bioeconomy for Ireland

Introduction

The focus of this study is on **new** and **under-developed** value chains and so opportunities relating to the continued development of, or relatively minor changes to, existing value chains are excluded from the research. As a result, the number of value chains presented per bioeconomy sub-sector varies. Please note, the 16 presented chains are **randomised** for methodological reasons and so the numbering may not be in sequential order.

All proposed value chains are divided into **three key elements**: inputs, transformation technologies and outputs. As you move through the study you will notice some of these elements remaining static while others change to create new value chains. Examples of this approach are highlighted below, highlighting the breadth of potential bioeconomy opportunities available:



Value Chain 1

Use of first generation sugar-yielding feedstock (e.g. high quality sugar beet) for biochemical production using existing and/or novel technology e.g. acetic acid production as a building block for polyvinyl acetate with applications across medical and material industries



What is your level of familiarity with this value chain area?

Not at all Familiar

Slightly Familiar

Moderately Familiar

Very Familiar

Extremely Familiar

Value Chain 1 possesses commercial opportunity for the short-medium term in the Irish bioeconomy (i.e. opportunity within the next 7 years).

Please indicate your level of agreement with the above statement.

Strongly Disagree

Disagree

Somewhat Disagree

Neither Agree nor Disagree

Somewhat Agree

Agree

Strongly Agree

Please provide a rationale for your response.

Some issues you may wish to consider here include factors relating to supply, demand and available industrial and technological capacity.

Value Chain 2

Use of second generation sugar-yielding feedstock (e.g. straw or grass) for biochemical production using existing and/or novel technology e.g. lactic acid production as a building block for polylactic acid with applications across medical and material industries



What is your level of familiarity with this value chain area?

Not at all Familiar <input type="radio"/>	Slightly Familiar <input type="radio"/>	Moderately Familiar <input type="radio"/>	Very Familiar <input type="radio"/>	Extremely Familiar <input type="radio"/>
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Value Chain 2 possesses commercial opportunity for the short-medium term in the Irish bioeconomy (i.e. opportunity within the next 7 years).

Please indicate your level of agreement with the above statement.

Strongly Disagree <input type="radio"/>	Disagree <input type="radio"/>	Somewhat Disagree <input type="radio"/>	Neither Agree nor Disagree <input type="radio"/>	Somewhat Agree <input type="radio"/>	Agree <input type="radio"/>	Strongly Agree <input type="radio"/>
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Please provide a rationale for your response.

Some issues you may wish to consider here include factors relating to supply, demand and available industrial and technological capacity.

Value Chain 3

Use of dairy processing side streams as a feedstock for new food products using existing and/or novel technology e.g. investigating opportunities for sports nutrition beyond whey



What is your level of familiarity with this value chain area?

Not at all Familiar	Slightly Familiar	Moderately Familiar	Very Familiar	Extremely Familiar
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Value Chain 3 possesses commercial opportunity for the short-medium term in the Irish bioeconomy (i.e. opportunity within the next 7 years).

Please indicate your level of agreement with the above statement.

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please provide a rationale for your response.

Some issues you may wish to consider here include factors relating to supply, demand and available industrial and technological capacity.

Value Chain 4

Use of meat processing side streams (e.g. meat 5th quarter) as a feedstock for food using existing and/or novel technology e.g. proteins and other functional (e.g. stabilisers, gelatine) and nutritional ingredients (e.g. vitamins, minerals) derived from residues and co-products for food applications



What is your level of familiarity with this value chain area?

Not at all Familiar Slightly Familiar Moderately Familiar Very Familiar Extremely Familiar

Value Chain 4 possesses commercial opportunity for the short-medium term in the Irish bioeconomy (i.e. opportunity within the next 7 years).

Please indicate your level of agreement with the above statement.

Strongly Disagree Disagree Somewhat Disagree Neither Agree nor Disagree Somewhat Agree Agree Strongly Agree

Please provide a rationale for your response.

Some issues you may wish to consider here include factors relating to supply, demand and available industrial and technological capacity.

Value Chain 5

Use of horticultural by-products as a feedstock for biomaterials using existing and/or novel technology e.g. use of plant-derived extracts to create biocompostable packaging



What is your level of familiarity with this value chain area?

Not at all Familiar	Slightly Familiar	Moderately Familiar	Very Familiar	Extremely Familiar
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Value Chain 5 possesses commercial opportunity for the short-medium term in the Irish bioeconomy (i.e. opportunity within the next 7 years).

Please indicate your level of agreement with the above statement.

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please provide a rationale for your response.

Some issues you may wish to consider here include factors relating to supply, demand and available industrial and technological capacity.

Value Chain 6

Use of marine discard as a feedstock for animal feed using existing and/or novel technology e.g. oils and proteins for feed purposes



What is your level of familiarity with this value chain area?

Not at all Familiar	Slightly Familiar	Moderately Familiar	Very Familiar	Extremely Familiar
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Value Chain 6 possesses commercial opportunity for the short-medium term in the Irish bioeconomy (i.e. opportunity within the next 7 years).

Please indicate your level of agreement with the above statement.

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please provide a rationale for your response.

Some issues you may wish to consider here include factors relating to supply, demand and available industrial and technological capacity.

Value Chain 7

Extraction of proteins and bioactives from marine discard as a feedstock for functional food applications using existing and/or novel technology e.g. bioactives from by-product



What is your level of familiarity with this value chain area?

Not at all Familiar	Slightly Familiar	Moderately Familiar	Very Familiar	Extremely Familiar
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Value Chain 7 possesses commercial opportunity for the short-medium term in the Irish bioeconomy (i.e. opportunity within the next 7 years).

Please indicate your level of agreement with the above statement.

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please provide a rationale for your response.

Some issues you may wish to consider here include factors relating to supply, demand and available industrial and technological capacity.

Value Chain 8

Extraction of protein, minerals and chitin from marine sources as a feedstock for biochemical production using existing and/or novel technology e.g. lactic acid, propylene and chitosan for packaging and pharmaceutical applications



What is your level of familiarity with this value chain area?

Not at all Familiar <input type="radio"/>	Slightly Familiar <input type="radio"/>	Moderately Familiar <input type="radio"/>	Very Familiar <input type="radio"/>	Extremely Familiar <input type="radio"/>
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Value Chain 8 possesses commercial opportunity for the short-medium term in the Irish bioeconomy (i.e. opportunity within the next 7 years).

Please indicate your level of agreement with the above statement.

Strongly Disagree <input type="radio"/>	Disagree <input type="radio"/>	Somewhat Disagree <input type="radio"/>	Neither Agree nor Disagree <input type="radio"/>	Somewhat Agree <input type="radio"/>	Agree <input type="radio"/>	Strongly Agree <input type="radio"/>
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Please provide a rationale for your response.

Some issues you may wish to consider here include factors relating to supply, demand and available industrial and technological capacity.

Value Chain 9

Use of marine discard as a feedstock for cosmetics using existing and/or novel technology e.g. extraction of protein, collagen and gelatine for cosmetic purposes



What is your level of familiarity with this value chain area?

Not at all Familiar <input type="radio"/>	Slightly Familiar <input type="radio"/>	Moderately Familiar <input type="radio"/>	Very Familiar <input type="radio"/>	Extremely Familiar <input type="radio"/>
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Value Chain 9 possesses commercial opportunity for the short-medium term in the Irish bioeconomy (i.e. opportunity within the next 7 years).

Please indicate your level of agreement with the above statement.

Strongly Disagree <input type="radio"/>	Disagree <input type="radio"/>	Somewhat Disagree <input type="radio"/>	Neither Agree nor Disagree <input type="radio"/>	Somewhat Agree <input type="radio"/>	Agree <input type="radio"/>	Strongly Agree <input type="radio"/>
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Please provide a rationale for your response.

Some issues you may wish to consider here include factors relating to supply, demand and available industrial and technological capacity.

Value Chain 10

Use of forestry resources (particularly thinnings and brash) as a feedstock for decentralised heat generation using existing and/or novel technology e.g. pellets/chip for residential or hospitality sectors (hotels, hospitals, universities, etc.)



What is your level of familiarity with this value chain area?

Not at all Familiar	Slightly Familiar	Moderately Familiar	Very Familiar	Extremely Familiar
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Value Chain 10 possesses commercial opportunity for the short-medium term in the Irish bioeconomy (i.e. opportunity within the next 7 years).

Please indicate your level of agreement with the above statement.

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please provide a rationale for your response.

Some issues you may wish to consider here include factors relating to supply, demand and available industrial and technological capacity.

Value Chain 11

Use of forestry resources as a feedstock for new biomaterials (beyond timber and paper production) using existing and/or novel technology e.g. combining wood fibre with plastics like polypropylene to produce construction and furniture materials with enhanced durability and strength



What is your level of familiarity with this value chain area?

Not at all Familiar

Slightly Familiar

Moderately Familiar

Very Familiar

Extremely Familiar

Value Chain 11 possesses commercial opportunity for the short-medium term in the Irish bioeconomy (i.e. opportunity within the next 7 years).

Please indicate your level of agreement with the above statement.

Strongly Disagree

Disagree

Somewhat Disagree

Neither Agree nor Disagree

Somewhat Agree

Agree

Strongly Agree

Please provide a rationale for your response.

Some issues you may wish to consider here include factors relating to supply, demand and available industrial and technological capacity.

Show

Value Chain 12

Use of forestry resources as a feedstock for biochemicals using existing and/or novel technology e.g. extraction of targeted compounds from particular species for biochemical production



What is your level of familiarity with this value chain area?

Not at all Familiar Slightly Familiar Moderately Familiar Very Familiar Extremely Familiar

Value Chain 12 possesses commercial opportunity for the short-medium term in the Irish bioeconomy (i.e. opportunity within the next 7 years).

Please indicate your level of agreement with the above statement.

Strongly Disagree Disagree Somewhat Disagree Neither Agree nor Disagree Somewhat Agree Agree Strongly Agree

Please provide a rationale for your response.

Some issues you may wish to consider here include factors relating to supply, demand and available industrial and technological capacity.

Value Chain 13

Use of paper, cardboard and pulp ink side streams as a feedstock for biomaterials using existing and/or novel technology e.g. for another paper or cardboard use, bio-compostable packaging or paper crates



What is your level of familiarity with this value chain area?

Not at all Familiar	Slightly Familiar	Moderately Familiar	Very Familiar	Extremely Familiar
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Value Chain 13 possesses commercial opportunity for the short-medium term in the Irish bioeconomy (i.e. opportunity within the next 7 years).

Please indicate your level of agreement with the above statement.

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please provide a rationale for your response.

Some issues you may wish to consider here include factors relating to supply, demand and available industrial and technological capacity.

Value Chain 14

Use of agricultural waste and by-products (e.g. silage and slurry) as a supplement for bioenergy production using existing and/or technology e.g. as a supplement for biogas through anaerobic digestion



What is your level of familiarity with this value chain area?

Not at all Familiar

Slightly Familiar

Moderately Familiar

Very Familiar

Extremely Familiar

Value Chain 14 possesses commercial opportunity for the short-medium term in the Irish bioeconomy (i.e. opportunity within the next 7 years).

Please indicate your level of agreement with the above statement.

Strongly Disagree

Disagree

Somewhat Disagree

Neither Agree nor Disagree

Somewhat Agree

Agree

Strongly Agree

Please provide a rationale for your response.

Some issues you may wish to consider here include factors relating to supply, demand and available industrial and technological capacity.

Value Chain 15

Use of food residues and waste as a feedstock for bioenergy using existing and/or novel technology e.g. transforming food waste from catering and retail outlets through anaerobic digestion



What is your level of familiarity with this value chain area?

Not at all Familiar	Slightly Familiar	Moderately Familiar	Very Familiar	Extremely Familiar
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Value Chain 15 possesses commercial opportunity for the short-medium term in the Irish bioeconomy (i.e. opportunity within the next 7 years).

Please indicate your level of agreement with the above statement.

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please provide a rationale for your response.

Some issues you may wish to consider here include factors relating to supply, demand and available industrial and technological capacity.

Value Chain 16

Use of recovered vegetable oil as a feedstock for biofuels using existing and/or novel technology e.g. recovered vegetable oil from the catering sector for biodiesel production



What is your level of familiarity with this value chain area?

Not at all Familiar	Slightly Familiar	Moderately Familiar	Very Familiar	Extremely Familiar
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Value Chain 16 possesses commercial opportunity for the short-medium term in the Irish bioeconomy (i.e. opportunity within the next 7 years).

Please indicate your level of agreement with the above statement.

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please provide a rationale for your response.

Some issues you may wish to consider here include factors relating to supply, demand and available industrial and technological capacity.



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Missed Opportunity?

Finally, you are welcome to outline any additional value chain vision that you believe holds commercial potential for the short-medium term in the future Irish bioeconomy, or indeed any longer term opportunities that merit further consideration:

Short-Medium Term:

Longer Term:

And finally....

Please indicate your area of bioeconomy expertise (please tick all that apply):

- Agriculture
- Food
- Marine
- Forestry
- Energy
- Other (please specify):

I work in (please tick):

- Industry
- Policy
- Research
- Producer (e.g. farmer, forest owner, fisheries)
- Representative body
- Support organisation
- Other (please specify):



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100%

~~~~~Thank you for your participation!~~~~~

