Towards a Circular Economy: Scotland's Bioresource Flows

Annex D: Questionnaire and Roundtable Discussion Outputs

This Annex includes the synthesis and integration of the responses received to the SSAC questionnaire and roundtable discussion. The synthesis is organised according to the five questions posed to stakeholders.

The second part of this annex is an anonymised record of all individual responses.

1. Integration of responses.

Q1. Do you agree on the identified priority areas?

There was broad agreement in the responses that these are the priority areas for action on a circular bioresource sector, particularly the need for biowaste tracking and increasing connectivity between producers and users of waste.

Both here and elsewhere in the questionnaire, respondents noted several uses of digital tracking of biowaste, including: that it would provide an improved overview of the opportunities (3-1-2); is important for establishing and measuring progress against circular economy targets (3-1-4); allows management to be more situationally sensitive to locality, seasonality, different sectors or social context (3-1-2); would support strategic decisions about how to most effectively use limited resources, and where to locate infrastructure (3-1-5); allow for improved segregation, characterisation, and identification of remaining value of biowaste streams so that they can directed to the most appropriate pathways for valorisation (3-1-6, 3-1-7, 12-1-4, 13-1); and supports better communication of the issues and opportunities of biowaste, so long as the data is accompanied by messaging that is appropriate for the audience (3-1-3).

However, several challenges were also identified:

- The fundamental difficulty of moving from a petrochemical-based linear economy to a circular one where there are multiple feedstocks with variable composition, availability, and supply chain characteristics (13-1, 10-2).
- Several issues which currently make waste tracking difficult and risk 'leakage' from both data tracking and, consequently, the circular economy (5-1-1, 5-1-4, 2-1, 1-1, 6-1-3, 8-2).

- The particular difficulties of collecting data of sufficient quality on household food waste (12-1-3, 5-1-2, 3-2-8, 3-2-1, 3-2-2, 3-2-3).
- The issues surrounding 'compostables', including that they are often not suitable for composting and that it is difficult to find operators that will process them (12-1-6, 12-1-7).
- Producers of waste are facing pressures from, among other things, post-pandemic changes to the economy and consumer practices, which may affect their ability to engage with actions relating to the circular economy (10-1-1, 10-1-2).

Challenges specifically affecting innovators and circular businesses:

- Regulatory systems often lag industry and research. Research should better-inform the regulatory systems when industry develops new products or processes. (6-1-2, 12-1-6)
- A lack of reliable and predictable supply chains of, and competition for, limited feedstocks (12-1-1, 12-1-10, 12-nk-7, 13-1).
- The geographic spread and variable size of waste producers (12-nk-13), and how to decide where to locate and co-locate facilities (12-1-4).
- The perishability of biowaste and feedstocks (12-1-4).
- The difficulties of moving from successful trials to working at scale (12-nk-10).

Challenges for regulation:

- Complications from the environmental cost of waste becoming increasingly incorporated into the market cost, and the risk of exposure of regulatory compliance to market variability (3-1-9, 12-1-1).
- Limited landbank availability in Scotland and a need to ensure that there are suitable outlets for the outputs of a circular biosector; in particular, biochar, compost, and digestate (8-1).

Several recommendations were made by respondents:

- A national plan that is aligned with other national policies (including Net Zero) is needed to coordinate a network of biowaste management infrastructure and control for the number, scale, and locations that are required (7-1-2, 7-1-3, 12-1-10).
- Standardise the methods of biowaste tracking so that resulting data are in the most useful format and are comparable across the Scottish economy (12-nk-2, 12-nk-1).
- A specific focus on reducing food waste and improving segregation and valorisation of bioarisings from food is needed (4-1-1, 4-1-2).

- Local authorities need to do more to support circular goods and services in their region through procurement; for example, through purchasing of compost produced from waste collection for use on local authority land (4-1-3, 12-1-10, 12-1-9).
- Open, publicly accessible data is critical, though there is an issue of commercially sensitive data which needs to be addressed (3-1-8).
- Address non-compliance in existing systems (e.g., food collection) to improve the quality products (12-1-3).
- Actively avoid “locking into” methods of waste management which are more carbon-intensive than prevention of waste (7-1-2).
- Creation of inventories of existing assets already owned by organisations can support reuse of redundant materials inside organisations and across industries (12-1-8).
- Certification of composting materials can help householders and non-experts to better understand and therefore utilise these materials (12-1-7).

Q2. Are hard targets on circularity evidentially measurable? If not, what are the main obstacles?

There was general agreement that suitable, consistent, and accurate data is necessary to meet hard targets (13-2, 4-2), and that targets should be specific, measurable, attainable, relevant, time-bound (SMART). Targets should also be numerous enough to meet all the goals for a circular economy (5-2, 7-2, 4-2, 6-2-1).

However, respondents noted several obstacles, including some which had been mentioned in answer to questions 1, such as 'leakage' data from biowaste tracking, and the difficulties of accurately measuring and capturing household food waste.

Other challenges that were identified include:

- The risk of perverse incentives that encourage one action over another (e.g., recycling over reuse), even where the alternative is preferable (2-2).
- Insufficient expertise to carry out adequate assessments of circularity which disincline operators from carrying out such assessments (1-2).

Recommendations were made by respondents:

- Data tracking should incorporate accountability through mandatory reporting both of waste production and utilisation by the end-user (13-2).
- Close collaboration and coordination of stakeholders, and the creation and operation of cross-sector partnerships, should be used as measures of success (6-2-2).

- Companies should incorporate food waste into auditing alongside carbon or environmental auditing already being conducted (3-2-7, 13-2).
- There is a need to identify appropriate and effective incentives that could motivate different actors in the supply chain to facilitate data collection. These incentives could then be developed into business models such as the pay-as-you-throw (PAYT) scheme (3-2-4, 3-2-5).
- Create an ISO-type standard for data collection and good waste disposal practices analogous to other positive accreditations such as B-Corp, or Fairtrade (3-2-6).

Q3. How should Scotland implement digital waste tracking?

Several respondents — both here and in answer to other questions — said that for implementation to be successful, the process of designing the digital waste tracking system needs to be comprehensive and simultaneously consider targets, data requirements, reporting and validation, so that it will produce data of sufficient quality and coverage to prevent 'leakage' of material from the economy, and support infrastructure planning (5-3-2, 4-3).

Other recommendations:

- There needs to be a statutory body for the Circular Economy, with a separate body empowered for compliance (6-3, 8-3, 1-3).
- Operators and producers of waste should be closely involved in the design of waste tracking, and their responses to consultations on related schemes (e.g., the Deposit Return Scheme, and UK Waste Tracking) should be considered (5-3-1, 10-3, 1-3, 3-3-2).

Q4. How do we connect "producers" and "recyclers" of biowaste materials?

Among the challenges of connecting "producers" and "recyclers" is the wide geographical distribution and related costs of transporting materials, especially given the time-sensitivity of perishable materials (5-4-1, 10-4).

Recommendations:

- Use and support the growth of existing networks — including Renewables Energy Association Organics Recycling Group (REA ORG), Resource Management Association Scotland (RSNA), events — such as The Bioeconomy Cluster Builder, Blue Economy Cluster Builder programmes, and the annual Bioeconomy Week —and resources — including Zero Waste Scotland's Biorefinery Potential for Scotland report and IBiolC's Bioresource Mapping Tool (5-4-2, 4-4, 3-4-2, 12-4-2, 1-4, 6-4-2, 3-4-1, 13-4-3).

- Create a digital marketplace to support connections in real time — this is particularly important for perishable biowastes (12-4-2, 13-4-1, 12-4-4, 5-4-1).
- Create value for circular materials and increase the cost of virgin materials so that biowaste feedstocks are more attractive to markets (2-4, 4-4, 12-4-4).
- Extended Producer Responsibility (EPR) may encourage better "ecodesign" of products that then move more readily through the circular economy between producers, users, and "recyclers" (3-4-3).
- Address the concerns of end-users of products from biowaste materials and quality assurance schemes and include them in the conversation from early on (8-4).

Q5. Are civil planning methods fit for a circular purpose? If not, what should be done to improve them?

Some respondents suggested that existing tools and guidelines should be more strongly adhered to, including the EU Waste Framework Directive Articles 4, 13, and 16 (3-5-1), and — once it is published — the National Planning Framework 4 (8-5).

Several respondents pointed to shortfalls in current civil planning methods:

- A lack of requirements that specifically relate to the circular economy (5-5-1).
- A lack of interface between regional, inter-regional, and national planning processes (4-5).
- A need for awareness raising with local Councils and the wider public of the necessity of locating infrastructure in proximity to the conurbations which are both among the main sources and users of biowaste materials (5-5-2)

Full record of all responses

This section includes all the responses received to the SSAC questionnaire and roundtable discussion. Responses are unchanged except to remove details that identify the respondent, and division of larger paragraphs into smaller parts to make referencing individual points easier. These are organised here by respondent (anonymised) and numbered accordingly: [respondent number]- [question number]- [part number], so: 3-1-2 refers to respondent 3's answer to question 1, part 2.

Note: 12 refers to responses to the roundtable discussion, not a single respondent; rather, multiple respondents contributed, and their responses are arranged by question (where known: 'nk' where not known), and part, e.g., 12-5-1, refers to the first response to question 5 in the roundtable discussion.

Questions:

Q1. Do you agree on the identified priority areas?

Q2. Are hard targets on circularity evidentially measurable? If not, what are the main obstacles?
Q3. How should Scotland implement digital waste tracking?
Q4. How do we connect “producers” and “recyclers” of biowaste materials?
Q5. Are civil planning methods fit for a circular purpose? If not, what should be done to improve them?

Respondent 1

1-1

I agree that the priority actions identified are the correct ones. However, through conversations with food manufacturers it was made clear to me that the composition of their wastes is often unknown. This also needs to be addressed.

1-2

Sustainability and circularity assessments were widely considered not fit for purpose by bioeconomy stakeholders when discussed in 2020. I think it is unlikely that stakeholder opinion has changed in the last two years. Even if circularity has become more easily assessable, stakeholder opinion is unlikely to have changed considering the numerous associated sectors have had other priorities. Moreover, there is not currently sufficient assessment expertise available for consultation. I have been informed quite recently that this is particularly true for the farming/agriculture sector.

1-3

There are numerous sensitivities associated with commercial wastes and trust must be built over time, whoever the agent(s) responsible for waste tracking may be. Large producers of bio-derived waste should be leading this dialogue to ensure they are committed to the methods implemented. Agencies at an arm’s length from government should be responsible for such a consultation.

1-4

I would suggest this is a major missed opportunity if producers are simply connected to current ‘recyclers’ without the possibility of new technologies being developed/incorporated. This is a prime area for research to transform and accelerate a circular bioeconomy.

1-5

No comment

Respondent 2

2-1

I presume when you say “digital waste tracking” you mean the tracking of waste using digital methods rather than tracking digital waste (IT stuff)? If so, it sounds like a good idea although it is not clear at what level of detail you would track. Timber does seem to move quite well through a circular process before generally ending life being burnt as biomass. It might be possible to measure these processes at some large-scale mass level but any lower (e.g., product level) would be very challenging as bits of wood can be broken up and go in different directions.

2-2

There are recycling targets for wooden pallets e.g., the Packaging Recovery Note (PRN) System, which seems to work well. It is worth being aware that the success of this system has had some downsides in that repairable pallets are sometimes sent for recycling rather than repair and reuse. The Pallet sector has worked hard with Defra to change the PRN target to try to encourage more repair of pallets and closed loops.

2-3

Have a look at the PRN system, otherwise I am not sure.

2-4

Creating a value for the biowaste (i.e., it is not waste anymore) would be the best way and will help to drive the behaviour you are after without the need for regulation or targets. Otherwise, you will need to find a way either to make it legally enforceable to recycle or the government provides incentives to support the behaviour (or a combination of both).

Respondent 3

3-1-1

Overall, [we] are in good agreement with the priority areas as stated but would highlight the following considerations:

3-1-2

Strategic implementation of digital waste tracking and standardised methods is critical as better data is a gateway to many other opportunities including:

Clearer overview of the scale of the problem/opportunity allows it to be better understood and managed towards higher/highest value. Having finer detail will further allow for any

management to be situationally sensitive, for instance to local area, seasonality, or different sectors or social groupings.

3-1-3

Better communication of the issues/opportunities can be made. How different policy makers, businesses and social groups produce, receive, and engage with information varies wildly. Without good data, inappropriate messaging might be employed, or delivered in the wrong way. Better data also allows the conversation to be started to begin to understand how the communication might best be delivered.

3-1-4

Cost reductions and environmental savings can be more easily achieved. Furthermore, it makes it easier to measure progress against any targets and benchmarks.

3-1-5

Limited resources can be most effectively applied. With limited resources, it is not possible to tackle all problems at once. Better data allows the identification of the biggest issues, or those most easily tackled within sectors, but also between.

3-1-6

Better identification of remaining value. If the composition of food waste can be more effectively characterised and/or measured, it can be re-directed to the most appropriate pathways for valorisation, with reference to cascading systems. That valorisation may further be tailored to account for either cost, environmental, ecological, or social gains accordingly.

3-1-7

Improved arguments in support of effective segregation of different streams. Ensuring that streams are not unnecessarily contaminated, for example by animal by-products can add significant value to residuals.

3-1-8

Open data/accessibility is critical – commercial sensitivities and anonymity issues must be addressed/mitigated if the data are to be useful – for example – using the biorefining potential for Scotland/bioresource mapping tool as an example – particular operators/operations are omitted at the regional level to avoid deductive disclosure – carrots in Fife and milk waste (whey) in Dumfries would be good examples. Depending on the peripheral business base at regional level this can represent a significant proportion of the resource stream.

3-1-9

Regulatory uncertainty is going to be a perpetual issue across every sector in the economy as we incorporate more and more environmental externalities into market dynamics.

3-2-1

The household is a part of the supply chain which is notoriously hard to regulate/capture.

Household food waste is the greatest part of the total mass but is perhaps the least well understood. There is no obligation for households to measure the mass of food waste they generate, let alone what it is made of.

3-2-2

The diversity of households makes it hard to design effective interventions to either act upon food waste generation or encourage measurement. Furthermore, activities to encourage measurement food waste within the household refuse stream can sometimes be viewed suspiciously and perceived as an invasion of privacy.

3-2-3

Data collection at a household level is at the mercy of the ability for a citizen to conduct the measurements well enough. Therefore, households are one potential opportunity for AI powered technology to aid in data collection and service design. However, it was felt that such technology might be viewed cautiously by householders, especially on issues regarding what is being measured, how the data is being used, and where it might be stored etc.

Some households may have a fear of being compared to others and criticised for doing worse. Should such data be used at a level of personalised interventions to reduce food waste? Likewise, others may have an optimistic bias, believing that they generate less food waste than others, which may inadvertently reduce willingness to collect data.

3-2-4

One of the other key challenges is identifying appropriate and effective incentives that could be used across the supply chain to facilitate food waste data collection from the different actors. For example, incentives at a household level would be very different to those at an on-farm level, and every point in between. In itself, identifying effective incentives across the supply chain is a potential research opportunity.

3-2-5

Any exploration of incentives could be developed into identification of business models designed to encourage data collection. The models can either relate to a direct case based

upon the collection and use of data on-site, or from any potential exploitation of data by third parties. Research relating to the ownership, rights of use, and ethics would build upon this.

An example of a business model used in Germany was shared: pay as you throw. By paying to dispose of waste, penalties for incorrect disposal practice can be levied, encouraging good habits. Downstream this leads to a better-quality compost which has a re-sale value that can then be shared back up the supply chain. To monitor the quality of the waste streams, data collection is in effect built into the process. By contrast, it was cited that in the UK compost is often only good for landfill capping due to low quality of the incoming organic streams, and data is lacking due to low incentive to monitor quality.

3-2-6

Could an ISO-type standard be created for data collection and good food waste disposal practices analogous to other positive accreditations such as B-Corp, or Fairtrade, providing a "carrot" to adopt good practice, as opposed to the "stick" of pay as you throw. There may be opportunity for case study research in a local authority region to explore in collaboration with local businesses. Such local case studies from different local authorities might then be used to inform government policy.

3-2-7

Many companies already conduct carbon foot printing or greenhouse gas emissions as part of their annual audits. Could food waste be incorporated into such practices to align the data collection and allow the environmental impact of food waste to be highlighted more effectively.

3-2-8

Ethics and data conventions is a further consideration.

Collecting the data is not the only hurdle which must be overcome. For instance, who owns the data generated by households and/or businesses, who has the right to exploit it and who should stand to gain from it if it is used for commercial purposes?

If data is collected at very fine spatial and temporal scales, what other habits might analysis of the data reveal? For instance, is someone were on holiday and away from the residence.

There are even questions over the ownership of the food waste which is being measured. For instance, if a person purchases food from a restaurant, it theoretically belongs to them, not the restaurant. Therefore, does the restaurant have the right to measure what is left on the plate without the customers prior consent, and how would that consent be ethically sought in a hospitality setting?

3-3-1

Development of cost-effective technology to aid in food waste data measurement and understanding how to encourage deployment in different settings (especially households). Development alongside the end users being an essential part of this research.

3-3-2

Using the experience of business owners and employees to inform assisted data collection and interpretation of results. The experience of long-term employees in companies is invaluable in understanding the ebb and flow of food waste and understanding what kind of foods are most often wasted.

3-3-3

Developing the concept of food citizenship by those within the supply chain and understanding how to bring about social change away from the simple concept of people being consumers linking to understanding how to encourage an understanding of value for both the food coming into a setting, and the waste leaving it, and how that value links into circular economy concepts.

3-4-1

Scotland is ideally, and uniquely placed to target support through high impact opportunities through vehicles with particular reference to the Biorefining Potential for Scotland report, The Bioresource Mapping Tool, The Material Flow Account for Scotland, and The Circularity Gap report. These resources map to a regional level across all organic surplus so interventions and support can be targeted where it counts. Potential recyclers can effectively identify materials of interest to the molecular level at regional resolution.

3-4-2

With reference to connection, [our organisation] and partners including Scottish Enterprise and the Industrial Biotechnology Centre have forms sector and substrate specific events where sources and potential sinks can cocreate solutions. The main vehicles have been The Bioeconomy Cluster Builder, and Blue Economy Cluster Builder programmes but there are wider monthly events which look to new innovations such as biochar, vertical farming, fish processing etc. and a new annual Bioeconomy Week to galvanise actors. The events have been incredibly successful so far as active businesses are supported but future opportunities are also considered.

More support around the underlying resources and enhanced ‘matchmaking’ activity would add significant value.

3-4-3

Extended Producer Responsibility may be a key lever as EPR would both encourage better "ecodesign", and, since these costs would ideally get passed through to consumers it would theoretically reduce unnecessary consumption (dependent on application to imports and substitute products).

3-5-1

In many ways the tools already exist therefore stronger adherence to the EU Waste Framework Directive (2008/98/EC) with particular reference to:

Article 4: Waste Hierarchy

measures to encourage the options that deliver the best overall environmental outcome.

Article 13: Protection of human health and the environment

necessary measures to ensure that waste management is carried out without endangering human health, without harming the environment.

Article 16: Principles of proximity and self-sufficiency

establish an integrated and adequate network of waste disposal installations and of installations for the recovery of mixed municipal waste collected from private households, including where such collection also covers such waste from other producers, taking into account best available techniques.

3-5-2

However, new infrastructure technologies have historically needed widespread government planning intervention to introduce; although this is sometimes done under the guise of a private actor but there are some good books on why this is misleading. Beyond deployment, these infrastructures require significant government intervention to shape and preserve the market. I see waste management infrastructure as no different. That being said, much "lighter touch" tweaks to the market are almost always preferred (like EPR and accounting for & redistributing the costs of environmental damages). As far as improvements, better data for decision making is important.

3-6-1

System/systemic dynamic mapping of wider aspects of the food supply chain, and modelling of scenarios such as impact of net zero policy, waste regulations, valorisation pathways and potentials, and interventions towards a healthier Scottish food system considering socio-environmental trade-offs could inform activities/adds significant value through a more

holistic approach. This could include nutrient mapping and modelling for high value nutrient agricultural and fisheries/aquaculture production; or circular bioeconomy mapping and modelling of hotspot areas suitable for micro-urban farming for city-based supply chains. Effectively, the waste data is only part of the story.

3-6-2

Further analysis of geospatial data (resources/ location/ routing mapping) including focus on industrial symbiosis for growing or processing of bio/organic food or biofuel products to identify new opportunities in Scotland to optimise supply chains and reducing transport miles. This may link to analysis of the potential for energy crops data/biofuels production, or feed for anaerobic digestion and network of alternative energy/additional use cases in islands and highlands case studies.

Respondent 4

4-1-1

On the analysis, the focus, which is clear in the identification of issues that should be the focus for action would benefit if the term 'biowaste' was clarified. Common biowaste products (e.g., composts, digestates) are naturally and traditionally circular. There are however other biowastes where circularity is harder. These include more specialist food (and drink) waste flows and brashes (cut material including bracken – rhododendron – seaweeds and other plant clearance material). Some of these materials might have a better route to rural biofuel platforms, particularly given they are rapid rotation plants so sequester emitted carbon over short time scales. A specific focus needs to be on wasted food and food processing wastes for the recovery of valuable materials such as proteins, oil etc.

4-1-2

We also need to find ways of preserving foods that are about to become waste to maintain their role in a challenging food supply chain and to better distribute food that is about to become waste across platforms like Fare Share.

4-1-3

The priority actions are all necessary. We would add 'procurement' to the third bullet.

4-1-4

The above noted, I think the same focus needs to be on a much wider group of materials and not exclusive to biowaste.

4-2

Well set targets (SMRT) should always be measurable. Data accuracy and consistency is the biggest issue.

4-3

Harder for bio-wastes than most other wastes and not sure of the added value this would offer for this specific waste group. The targets, data required, reporting and validation all need to be considered in conjunction.

4-4

Through the waste management system using price mechanisms to drive waste from producers to the optimal treatments. Better marketing of the 'treatment' operator network.

4-5

Certainly, and sadly not. Wholly inadequate. There are too many local planning authorities, with no overlaid powers/duties to work inter-regionally or nationally making it impossible to create coherent strategic networks. This built inadequacy in the planning system delivers a fundamental failure in the ability to deliver 'whole system' solutions. Specific systems that need inter regional or national solutions should have the required statutory interface with local civil planning systems that delivers appropriately. The National Planning Framework in Scotland goes some way towards this but fails for example to identify national networks of critical infrastructures as 'National' developments. A planning rethink is necessary.

Respondent 5

5-1-1

The need to monitor and measure waste flows is acknowledged by [our organisation]. However, in responding to the recent UK consultation on waste tracking a variety of views were expressed and concern was raised regarding the practical limitations of tracking systems to effectively track from point of production to 'recovery' or other 'end of fate'. Unlike hazardous waste, non-hazardous waste, including biowaste is often transformed throughout its journey and the transformation the waste undergoes varies by site and process.

5-1-2

Regulated waste tracking systems will fail to capture total recovery with the fractions managed by home composting being excluded and unmeasurable as householders will not record what percentage food waste goes into the correct bin and is also considered to be fraught with risk of miscounting (double counting and omissions as errors are pervasive).

However, such systems are important and closed loop recovery of compost in gardens is part of the circular economy.

5-1-3

Mapping waste flows and producers should be assisted by SEPA, but their records are impacted by a recent cyber-attack and data sets have not been repopulated completely.

5-1-4

Permitted bio-resources systems will be easy to track tonnage accepted and tonnage dispatched. [We see] more difficulty in exempt sites, although these are due to be included in the digital waste tracking project, accuracy of data could be an issue, initially.

5-2

What are the “Hard targets” of circularity? What metrics are applicable? Is recovery measured in terms of carbon / nitrogen, a combination, or another metric? Consistency in approach is required and multiple metrics may be needed to ensure all aspects of circularity and nutrient recovery are accounted for.

5-3-1

Is this question focused on biowaste only and if so, is the suggestion that a separate system or special requirements are required for the bio-waste stream? If the question relates to a system for all wastes, then the responses received by industry in relation to the UK waste tracking consultation should be taken into account.

5-3-2

Although there are derogations on biowaste for commercial operations, [we do] not believe this can be the case for waste tracking, the whole of the mainland needs to understand what waste arisings it has and where they ultimately end up. Without comprehensive data, planning or organising waste management and achieving circular economy will not be fulfilled. The idea of circular economy is to limit leakage out of the process, not monitoring with data to a critical level will mean there is more leakage than necessary and vital resources could be lost.

5-4-1

There is a well-established and defined relationship between producers and recyclers as there is a commercial benefit to both. Connection of each party without influencing the market or acting as a broker may be difficult. The issue is often the location of each party and the difficulties (and costs) associated with transport.

5-4-2

There is already a well-established relationship of producers and recyclers of biowaste materials through organisations like REA ORG – which is the organic arm of the Renewables Energy Association (which incorporated The Composting Association). [We have] contacted their Head of Organics to ensure they can respond to this important questionnaire.

5-5-1

The planning system is open to multiple interventions, system requirements that meet the needs of the circular economy are not specifically identified or accounted for. Changes to planning requirements which take account of the circular economy are required.

5-5-2

[We] suggest it is important that the public, who rightly so are involved in planning applications, understand the need for facilities to be close to the source of input (feedstock) or sources for output materials. If there is to be support for circular economy there has to be a full understanding of the need to place and operate systems to reduce transport (carbon emissions), increase collection (close proximity to producers) as well as benefit from using outputs (heat, energy, and materials).

Respondent 6

6-1-1

The use of the word 'waste' is a barrier to resource recovery and the circular economy. Waste stays waste until a full recovery process has been developed. This is key for dealing with resource recovered from wastewaters for example, but no doubt applies across sectors.

6-1-2

There is latency between regulation and the need to delivery on the CE. A key requirement is likely to be the demonstration of market value and demand for the product.

6-1-3

The circular economy must consider all resources required for it work. Currently a key aspect that is not being explicitly referenced is the water and wastewater system. Water is a resource, and the wastewater system has great potential for the capture of a range of resources and reuse.

6-2-1

There are two sides of the balance sheet – how much is being recovered for the circular economy and how much of the recovered resource is being used in product development. Digital tagging/tracking may well be a useful mechanism for measuring success.

6-2-2

A sustainable and efficient circular economy is a complex matrix of legislation, technology, communities, businesses etc. and it can only be achieved by close collaboration and coordination of the different parties. Therefore, the creation and operation of cross-sector partnerships would be a measure of success for delivering tangible outcomes and developing a circular behaviour approach.

6-3

The CE bill suggested the establishment of a dedicated circular economy statutory body, which in our opinion should have responsibility for:

Developing Circular Economy monitoring approaches and targets

Monitoring progress on Circular Economy targets

Reporting on progress

Suggesting improvements to the Circular Economy route map and bill.

Commissioning and/or production of progressive and leading research that will support and inform the strategic direction of Circular Economy policy in Scotland.

Somewhere in the statutory system there may need to be a body responsible for enforcing compliance with targets (this might, however, align better with the role of SEPA).

6-4-1

Demonstrations of the art-of-the-possible. For example, nutrient recovery from wastewater and application to farmland as an alternative source of nutrients.

6-4-2

Safe space around regulation, commercial opportunities, and wider stakeholders. Transparency and collaboration around data and around sharing the outcomes.

6-5

It’s not clear what is being asked here?

Respondent 7

7-1-1

[We] support plans to improve commercial recovery of biowaste in Scotland as part of the Scottish Government ambition to create a circular economy.

7-1-2

In keeping with the principles of a circular economy, the first objective should be to minimise commercial biowaste as much as possible. Remaining waste should be disposed of in a safe and sustainable way. This may require a national plan developed by the Scottish Government to ensure the network of biowaste management facilities in Scotland matches requirements for these activities in number, scale, and location. Lock-in to unnecessary waste management technology (which, compared to prevent activity, is a high-carbon approach) should be guarded against and avoided1.

7-1-3

It is vital that a plan to improve commercial biowaste recovery should align with the ambitions of Scotland's Net Zero Climate targets, to reduce emissions to net zero by 2045. Direct emissions should be reduced as much and as quickly as possible. This plan should also align with the Scottish Government Route Map to a circular economy2, recently consulted on, and the Scottish Government's incineration policy including the moratorium on new incinerators.

7-1-4

The Scottish Government should consider the work Zero Waste Scotland is currently undertaking to understand the role that bio stabilisation could play in the disposal of biowaste. The carbon intensity of bio stabilisation be measured in a way which allows it to be compared to alternative waste management technologies. This should include the consideration of biogenic carbon stored in landfill, which is erroneously excluded from the Zero Waste Scotland incineration report on the carbon impacts of incineration.

7-2

[We] believe that targets to measure circularity are measurable and are most supportive of progress towards policy goals if they are binding and based on science. Targets for commercial biowaste should align with the Circular Economy Route Map. For more details on [our] position on targets for a circular economy, see our response to the Route Map consultation.

7-3

No comment.

7-4

Workers and their unions should be involved in consideration of how to transform biowaste management. Workers have detailed knowledge and understand of how the current system is performing and may have valuable suggestions on how to improve it. Also, transition support mechanisms are required to ensure workers in Scotland's commercial biowaste sector are supported as their industry shifts to a more circular economy model.

Respondent 8

8-1

We would add another consideration to this list of priority action areas: land bank availability is required for the digestate/compost/biochar etc arising from the bioenergy/resource industry. This is a forgotten part of the supply chain and in fact could be the most significant barrier which needs to be considered from the outset. Looking at the waste potential, site capacity and energy output alone will lead to either failure as there is no route for the "by product"/" waste" (digestate/compost etc) or leads to inappropriate spreading/disposal. Further evidence is needed on whether the beneficial use of bio-resources on land is creating other long term pollution issues (plastic, harmful chemicals etc).

8-2

Need to clearly define what is being measured - e.g., waste and by-products which both have legal definitions and lots of case law. Once something has ceased to be waste it will be very difficult to record its movement and use. One key obstacle would be leakage from systems.

8-3

[We] and the Scottish Government are working with the other UK administrators and regulators to develop a mandatory digital waste tracking system for movements of non-hazardous, hazardous, and green list (non-hazardous exports) waste - Mandatory digital waste tracking - GOV.UK (www.gov.uk).

Targets and associated assessment are still to be determined but both the DEFRA consultation (now closed) on mandatory digital waste tracking (Introduction of mandatory digital waste tracking - Defra - Citizen Space) and the associated Scottish Government 'Introduction of a UK-wide Digital Waste Tracking System, Business and Regulatory Impact Assessment (BRIA)' (Introduction of a UK - wide digital waste tracking system: partial business regulatory impact assessment - gov.scot (www.gov.scot)) provide more detail on the proposed system, and some high level areas in which tracking will support work to tackle climate change and the move towards a circular economy.

8-4

Getting the waste producers and waste users together continues to be challenging. A successful recent example of this type of work, which required significant effort by all partners, is the use of the co-digestion of sewage sludge and distillery/brewery residues at Nigg.

We should also never forget the end users of the products. Quality assurance schemes can be incredibly risk averse and it's not always a position they have got to through consideration of scientific evidence. Early engagement is key. There are also other regulators involved if the products are to be used in the food chain, such as Food Standards Scotland, Animal and Plant Health Agency.

8-5

We assume this is referring to wider civil planning mechanisms that include, but also go beyond, land use planning. In relation to land use planning the policy environment is changing significantly with the draft National Planning Framework 4 which is likely to be presented to Parliament in its final form in 'late autumn'. This will be key to determining the process for considering circular economy aspirations. A couple of areas to highlight which could help drive this change: (1) There are proposals for a new 'national development' for Circular Economy Materials Management Facilities (page 50) which aims to support the development of facilities required to achieve a circular economy. This is quite general and there is no specific mention of biowaste facilities although there is no reason to believe that such facilities are not included in the scope of the ND. (2) There is also new policy around Zero Waste which promotes identification of locations for circular economy facilities and the segregation/storage and collection systems for waste in new developments. Again, doesn't specifically mention biowaste. This new policy context should help but mechanisms to support delivery will be key and it is unclear how they intend to do this at the moment, although there will be a delivery programme published alongside the final NPF4.

Respondent 9

9-1-1

Yes. [We have] identified the collection and verification of data along the seafood supply chain as a priority for profitable and sustainable businesses. In collaboration with a range of partners including the Scottish Nephrops Working Group and Seafood Scotland, [we are] piloting the sharing of data along haddock and nephrops supply chains. This includes key data elements related to fuel use to identify further efficiencies, and to begin to capture waste material provenance and quantities. This work is in its early stages, but we hope it could help inform new supply chains for waste products from wild capture seafood. Our stakeholders are interested in progress by the Iceland Ocean Cluster [1] to harness full

utilisation of fish catches, with its mission “to create value and growth in the blue bioeconomy through connection”.

One aim of [our] digitalisation pilot is to provide proof of concept for businesses becoming ‘GDST ready’ – referring to the Global Dialogue on Seafood Traceability. This is the standard for data exchange in seafood supply chains and is already being integrated into the sourcing policies of major retailers, foodservice and seafood companies.

9-1-2

While circular economy issues are not, currently, fully incorporated into seafood standards and other improvement drivers, we expect this to change and wish to support our seafood industry to prepare for this change. Our pilot aims to establish the value proposition of data sharing for a wide group of stakeholders, gather accurate data to protect and position the industry for the future, and test this is in a low-cost, risk-free manner, with stakeholder knowledge built into every stage. I hope our experience can help inform the SSAC circular economy discussion.

Respondent 10

10-1-1

Is this going to be a cost that is passed onto the producer? How successful is this going to be when many food & drink producers are already struggling with the post-pandemic changes to the economy and consumer behaviours.

10-1-2

Also, breweries are already looking down the barrel of the deposit return scheme and the pressures this will put on even the smallest producers. Could this be a step too far. I would suggest engaging with SIBA etc.

10-2

Will you be looking to record volumes that have been moved from one process to another? Could be challenging to record accurately. Again, an example from brewing, as that is one of my fields, brewers’ spent grains (BSG) you would not typically be able to accurately quantify the amount of BSG coming out of the brewery. But what they would be able to do is back calculate an approximate volume from the original grain bill used – especially is there was a proscribed rule(s) of thumb to be used. This would also be the case for distillers spent grains (draff) when it comes to whisky production.

10-3

No comment as not an area of my expertise, but again would suggest looking to the DRS and areas of concern that have already been highlighted by the drinks industry even before this has been rolled out to learn any lessons around the execution of such projects.

10-4

Interesting question and work is needed in this area – for example urban breweries can struggle with getting their spent grains to an appropriate destination as the traditional route is to farmers as cattle feed that is collected on a regular basis. BSG can show visible signs of surface mould and bacterial growth within 48 hours of production. I often see requests from brewers appearing on social media platforms asking if anyone has contacts in a particular geographical area that could take spent grains off their hands at short notice, often because their usual farmer has not been able to collect. Although sending BSG for anaerobic digestion can be an efficient model for more urban sites, there is the additional factor of the regularity of collection and security of the storage system such that it is not attracting vermin.

10-5

No comment as no experience in the area of civil planning.

Respondent 11

11-1-1

Yes, these are priority action areas.

11-1-2

For point II. Connectivity between biowaste producers is also important. This can help ensure recovered products from biowastes can be co-produced/treated to generate products at the scale required.

11-1-3

Additional action areas could include:

Circular Procurement support

Treatment / recovery technology development

Market support for biowaste circular products.

11-2-1

[We are] supportive of the move to a Circular Economy. This is embedded in our Strategic Plan to ensure we can deliver a sustainable service for our customers, now and in the future.

11-2-2

Given that [our] activities are intrinsically linked to Circular Economy principles, we need to ensure that asset investment, particularly around biosolids recycling and resource recovery, are aligned with government ambitions. Moving towards a Circular Economy also needs clear policy signals to ensure that markets adjust, and the supply chain adapts to operate in a Circular Economy.

11-2-3

We would welcome an ambition for common metrics for the Circular Economy across Scotland and how industries and organisations can work together to identify Circular Economy opportunities. No one industry can deliver a Circular Economy in isolation and all sectors need clear incentives to ensure the economy develops at the correct pace. Targets are evidentially measurable however there are no common agreed Circular Economy metrics across Scotland or what good looks like.

11-2-4

[We] would welcome a review of Scottish Government policies which define recycling activities as only those which produce PAS100 or PAS110 materials and which, therefore, prevent non-PAS compliant material from being counted towards recycling targets.

This is potentially limiting opportunities, particularly in rural areas where PAS-compliant organic waste volumes might not support a viable treatment process or where existing facilities might not be maximising energy yields. Co-treatment with non-PAS100/110 material (e.g., wastewater bioresource) could deliver an output with a life-cycle environmental benefit that is equivalent to that from a 'high quality' output and make rural treatment more cost effective and reduce transport costs and carbon. Where evidence supports this, Government policy should be flexible enough to allow this material to be counted towards recycling targets.

11-2-5

Our recent work on co-digestion with SEPA and Chivas Brothers is a good example of how we can maximise the value of this type of waste.

11-3-1

DEFRA's consultation on the Introduction of Mandatory Digital Waste Tracking (Apr 22), set out proposals for a UK-wide waste tracking service which would provide a seamless system across the UK. [We recognise] the benefits of this approach and is broadly supportive of the proposals.

11-3-2

In our response to DEFRA's consultation: DEFRA consultation on Introduction of Mandatory Digital Waste Tracking – April 2022 – [we] noted areas that need more clarity and focus. These particularly relate to the scope of any tracking system and key definitions that would determine the eligibility of wastes and waste journeys that need to be recorded in the system. We also noted that to be effective, any digital system needs to be practical and aspects that need to be considered before implementation include data quality (impacts real-time recording), data quantity (impacts resource needs), data availability (3rd party data impacts) and connectivity (impacts access in remote/rural areas). We also noted concern about the publication of data that we consider to be sensitive information (e.g., details of recipients of biosolids).

11-3-3

It is our understanding that SEPA is working with DEFRA and the other environmental regulators to develop the digital waste tracking service. As SEPA is currently responsible for reporting Scottish waste statistics, it seems appropriate for SEPA to be the responsible agent for any digital waste tracking system. This could also include assessment of progress against targets.

11-4-1

There are links here with the Circular Economy Bill and the Scottish Programme for reuse of construction materials and assets.

11-4-2

Aligning with the EU could allow trade in circular products outside the UK, increasing their value.

11-4-3

[We] have managed to connect in with recyclers Brewster Brothers regarding reuse of grit materials collected at our wastewater treatment works and we are actively engaging now with Carbogenics around the development of biochar technology for our wastewater screening and digested sludge cake materials. We are also developing ammonia and phosphorus product recovery trials for example. Incentivising the market to use these

biowaste circular products and supporting recyclers develop their technology will help ensure a recycler can remain connected through improved financial viability.

11-5-1

Taking into account and promoting working with nature opportunities could support civil planning methods have a more circular purpose.

11-5-2

A database of recycled construction materials would be helpful. An example of this is the Circular Material Library.

Roundtable responses (12)

12-1-1

Who carries the risks and what risks are we carrying? Example of anaerobic digestion plants - no control over how many and where they were being built, and what feedstock used – this leads to competition. If the market for a thing disappears, we still need to achieve compliance - that exposes compliance to market variability.

12-1-2

It's important we don't forget about the unintended outputs. Chasing expensive, high value compounds is one thing, but remember what you have left. We don't want to be left with a bigger problem, e.g., digestate, which has issues - you can harvest a lot out of it, but what do you do with what's left? Keep in mind when thinking of process flows – think about how to manage these other wastes. Don't assume you can apply it all to land. There is a very limited land bank in Scotland, and that is under a lot of pressure already. Get things higher up the use chain and make sure what does go to land is the right material, at the right place and time.

12-1-3

Our members support circular economy but think that there is a lot of scope to do better with existing systems – there is a lot of non-compliance in existing food collection. Need to improve the collections that we have. Good work going on to get better value, but need to collect it in the first place and this process needs improvement. Not all existing systems are at capacity - how to better use them? The organics sector been recycling materials for many years…

Agree about issues with quality. [We] know the problems, but not how to solve them. Want to collect highest quality material because that's what is needed for high quality outputs.

12-1-4

How to maximise valorisation?

There are confidentiality issues… Better data on inputs would help evaluations of the robustness of markets and identify waste streams.

An IBiolC project (in collaboration with ZWS and several SMEs) looked at a cascade approach to whisky. It was a great pilot, but threw up issues such as how do you co-locate facilities, where and when to remove fractions, perishability issues… On paper it makes sense, but there are hurdles to commercialise that approach.

12-1-5

One of the key things is data: a shift from petrochemical based society to a bio-based one is a shift from something that is well-understood in terms of what and where resources are and their characterisation; but we know less about, for example, perishability of bioresources.

12-1-6

On limitations – the regulatory system doesn't keep pace with research and industry. In organic farming we want to do good things with digestates, but that isn't always possible with regulation. SEPA seems to be more dynamic and pragmatic than their equivalents in England, but... for compostables there is a collection and processing gap – I am regularly contacted by people that want to make compostable stuff ("If I make this, would you use it?"), but my members set-up to process food waste mainly, not compostables. I'm in favour of anything that reduces contamination in food waste, for example, sauce packets, but members don't expect to use much packaging in their composting.

12-1-7

Taking an NHS perspective on food waste - significant amounts of food waste and there is a struggle to reduce this because of the requirement to feed patients and not knowing whether it will be eaten. Working with RMES to put out to tender contracts for collection of waste, but the availability of sites is very limited. Where sites are isn't necessarily where the NHS needs them. A day does not go by when someone doesn't try to sell something that is compostable, but there is no means of getting it to a composting facility in an NHS setting. How do we deal with compostable bioplastic claims? It's a greenwash, and it causes a lot of problems because we don't have infrastructure to deal with them.

Another participant agrees and says they support use of compostables, but only in some scenarios where they are likely to get to a composting site and where they will solve a problem e.g., contamination of food wastes. Jenny says we need to think about material

that is actually certified, but says it is difficult for householders or non-experts to know what that means. Lots of good intentions, but...

12-1-8

On circular procurement…

[We] are not experts in circular procurement, we have just started journey, but starting to build it into the supply chain of infrastructure so that they can re-utilise existing material on-site. Frameworks are being adapted for replacing infrastructure by working with the supply chain to see if it's possible to incorporate the CE principle of using what already exists. On surplus assets, the participant says they are trying to find alternative uses for these, for example, redundant sludge presses which can be repurposed to other industries. Try to identify whether there is kit within our own assets that is no longer needed, that can be reassigned. Control panels etc. In a big organisation that spends a lot there are a lot of assets that can be added to an inventory so that they know what they already have before buying new.

12-1-9

A participant gives an example of the failure of local authorities to buy back compost made from waste that has been taken from them. The participant says that her members take food and garden waste from LAs, but LAs do not always buy back the resulting products. Where park and landscaping departments are buying in soil from some members this creates a nice story and works well, but there can be a lot of reluctance from LAs to close that loop. Seems like an easy win if LAs were more invested in quality when taking back material. Some LAs landscaping teams are driving use of soils. So yes, more to do on the procurement side.

12-1-10

Participant says what he is about to say takes us on to the next question: how far out into other policy areas do you have to go to achieve the objective of CE? Refers to others' earlier points – we might have had informal market for reusing products which then gets superseded by someone who can get more precise things out of feeds, but that also causes disruption to people who then have to source alternative feed. All want to pull in the same direction, but there are any number of disruptions. On procurement - in absence of the obligation to use resulting products, then you're not fully participating in the circular economy revolution. This leads directly to policy.

12-4-1

A participant says that, broadly speaking, we talk about connecting and supporting emerging technologies, but we don't talk about that biophysical reality that a recycled

material is not as competitive [as virgin material] - it takes more energy, [mentions several other things I don't manage to note]. At some point we need to tax the most damaging materials to account for the cost of the damage they cause (says that's economics). This is challenging, but regulation needs to address this. Various technologies have had support to develop, but they are then undermined by market changes – the pandemic has affected a number of materials.

12-4-2

A participant says that the focus has been on the cost of materials, but there needs to be something on supply chain resilience. [We] are thinking about this when looking at recovery of things. If you can recover and utilise what already exists so that it offsets other materials and protects the supply chain - from Brexit etc. - where single sources introduce precarity. Participant gives an example of the rationing of chemicals because of issues in the supply chain. Participant says we need some form of matchmaking and gives the example of the national industrial symbiosis programme which used to be in place before it was stopped under unknown circumstances and says we need something like that. Participant says he appreciates that SEPA have data and commercial sensitivities, but we need to know who has what and who needs what in order to make the connections. We need some form of platform for matchmaking for people who have a material that is currently a waste stream and would like to find someone who can use it. Help to decide how you co-locate things would be even better.

12-4-3

A participant says that we need to think about the wider chain: quality assurance schemes are very risk averse - farmers are often happy to accept waste-derived fertilisers, but places accepting the produce that is grown from it aren't. There is no consideration of the science - just media hype. Have to engage with not just the producer and user, but groups that are risk-averse, even when science says it's safe. Have to engage early.

12-4-4

A participant says they want to echo what others were saying about markets and resilience - some sort of digital marketplace is the way forward. How else to link users with producer in real time? This is particularly crucial because of perishability. At [their organisation], the focus on the 'carrot', but there need to be a 'stick' to encourage use at a policy level.

12-5-1

A participant says the key thing is having a mechanism for identifying research needs and how to bring new solutions into the market. Refers back to a previous point — once you begin to use materials, that gives lots of avenues for research on how to break these things

down. How do you build a link between research needs and the moving front of the digital market that is being created?

12-5-2

A participant says there is a lot of research, but it moves faster than the other factors. There might be a lot of work in the lab and pilots, but not much on trials and in a real-world setting. It is necessary to break barriers, but not sure how to jump from research to testing in long-term real environments.

12-nk-1

Common ground needed - need to use the same methodology. Supermarkets example e.g., Tesco good at reporting waste M&S not so much.

12-nk-2

Need common standards so comparable and measurable. New area so we will be learning from doing things for the first time. Should be a priority to build examples to learn.

12-nk-3

Word of caution - Trying to digitalise supply chains low starting point. Tricky to implement. Need key data elements everyone needs to collect.

12-nk-4

Waste should be seen as an opportunity not a problem.

12-nk-5

Digital waste tracking system getting set up by SG. Data will be from Special Waste Consignment Note and LA waste data flow. Recorded on transactional level. To help with safely managing waste. Data that will be useful for CE uses might not be captured here.

12-nk-6

Digital tracking welcome - Ease of access to data and ease of reporting. Three areas of potential additional focus - quarry waste, food waste insect proteins, plastic contamination within waste sector.

12-nk-7

High competition for food waste.

12-nk-8

Work underway to capture waste coming out of a distillery. Lots of opps for other examples.

12-nk-9

Co-digestion example in Aberdeen.

12-nk-10

Barrier to new technology - Proving it works at scale. Need first demonstrator at a smaller scale first, less risk.

12-nk-11

Advantage in Scotland - SG own farmland and Scottish Water. We need examples of technology working.

12-nk-12

No waste in Forestry. What is the definition of waste? Recycled wood with preservatives is the issue for forestry. Circular economy e.g., pallets re-used and recycling. PRN system is an issue with this though.

12-nk-13

Issue of geographic spread and size e.g., brewer on Shetland might not have same opportunities.

12-nk-14

Technologies are becoming democratised and spreading throughout country. Need communities to step up and take advantage.

12-nk-15

SEPA can only enforce what is in legislation and definitions within.

12-nk-16

Waste = human hazard, if not then it shouldn't be waste

Respondent 13

13-1

Transitioning from a linear economy based on petrochemical feedstocks to a circular one using bioresources would currently mean switching from an economy based on a single well understood feedstock, reliant on highly developed, sound infrastructure and supply chains,

to one drawing on several disparate feedstocks each with distinct composition, availability, and supply chain characteristics.

Petrochemical supply chains are highly established with clear routes for end users to access the market for their feedstock. Furthermore, its composition and performance profile are well understood and documented. There are lots of data available to support the development of robust value chains based around oil.

Currently, the data available for bio-based waste feedstocks are poor. They're fragmented, siloed, and lack currency. In many instances, innovators know how to transform a particular substrate into a high value product, but without clear and reliable supply chains it's extremely challenging to develop a commercially viable value chain (KTN, 2022).

The three priority areas highlighted in the questionnaire are core to addressing these challenges. Digital tracking, connectivity across the supply chains and attendant infrastructure will close the data gap between petrochemical and bio-based value chains.

13-2

It seems that hard targets are meaningless without access to the data mentioned above. This would appear to hold true for all stakeholders – regulators, producers, and end users alike.

To build the necessary data ecosystem to tackle accountability and measurability challenges, it's suggested that several factors are addressed; introduction of producer responsibility for waste measurement and reporting (initial data source); create physical and digital infrastructure (data nodes across supply chain); mandatory reporting of feedstock utilisation by end user.

Agreed standards for life cycle assessment and carbon accounting are obstacles to measuring circularity.

13-3-1

Explore opportunities to extend producer responsibility and create digital passports for waste materials. It seems there are opportunities here to build requirements for this into forthcoming circular economy legislation (Scottish Government, 2022).

13-3-2

It is suggested that an exemplar feedstock and set of end users are identified for development of a trial. Whisky co-products are a strong candidate. Choosing a mature, well-resourced industry with highly characterised, consistent by-product streams and an engaged set of end users seem key to the success of any digital waste tracking trial. Stakeholders

along this value chain recently completed a successful pilot project considering the serial utilisation of whisky co-products (Zero Waste Scotland, 2022).

13-3-3

Further suggested trial feedstocks include dairy waste, seafood processing waste and forestry waste. Researchers at the James Hutton Institute are currently participating in an EU wide project to address food waste across the value chain. Their work focuses on fish supply chains and draws on work in Germany to create a digital marketplace for fish waste (LOWINFOOD, 2022).

13-4-1

By creating a digital marketplace for bioresources, i.e., an eBay for bio-based waste. Platforms already exist for inorganic waste (Topolytics, 2022). Such a system becomes particularly powerful when applied to organic feedstocks given their inherent perishability and periodicity.

13-4-2

Returning to the point made above, it is suggested a trial feedstock is identified to demonstrate effectiveness and applicability.

13-4-3

Additional functionality might be considered using data sets on historical arisings to predict likely future locations and availability of feedstocks. Several pertinent data sets are contained within an existing Bioresource Mapping Tool (IBioIC, 2022).