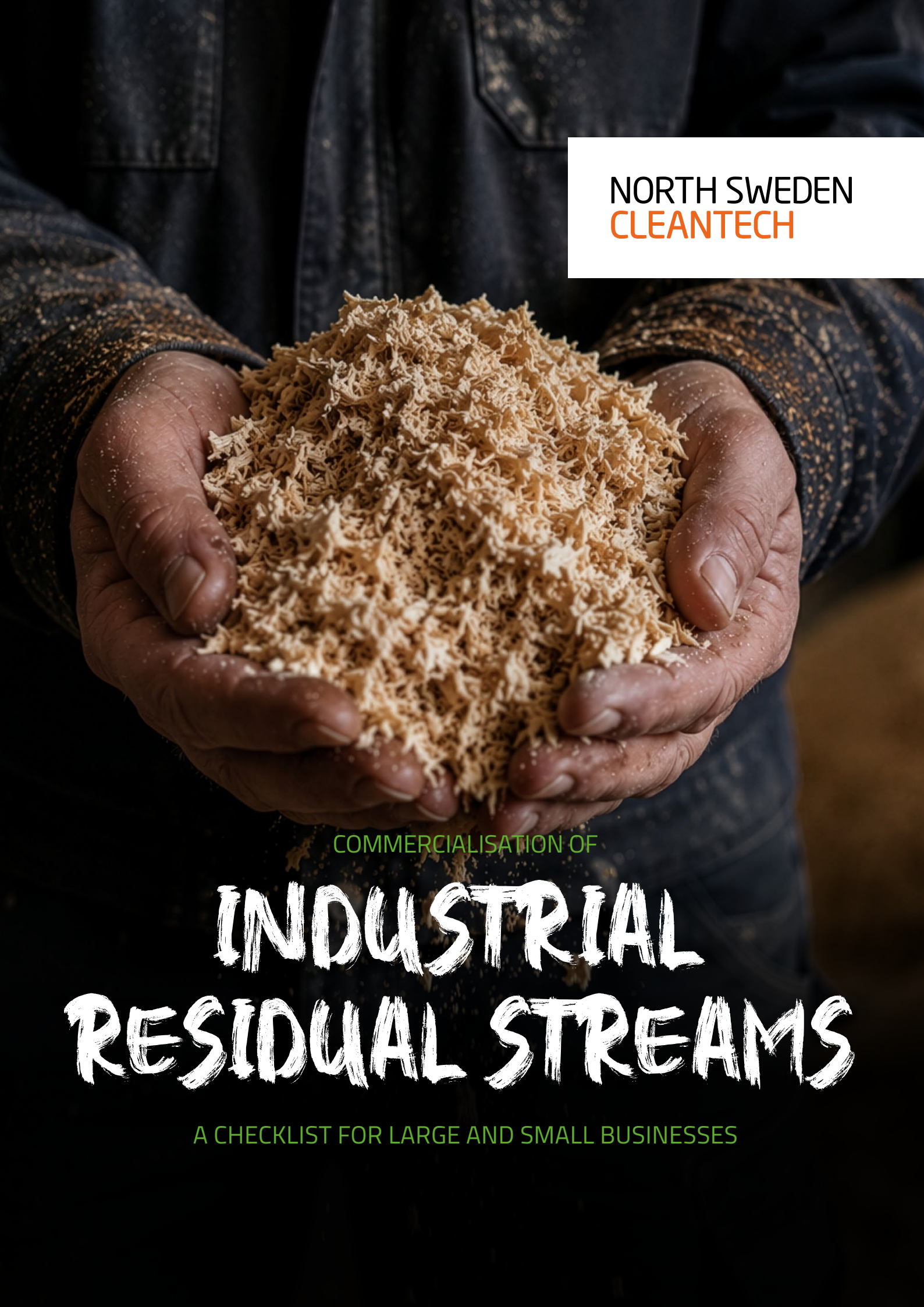


A close-up photograph of a person's hands, wearing a dark blue denim jacket, holding a large, overflowing pile of light-colored wood shavings. The shavings are finely textured and appear to be a byproduct of industrial wood processing. The background is dark and out of focus.

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COMMERCIALISATION OF

INDUSTRIAL RESIDUAL STREAMS

A CHECKLIST FOR LARGE AND SMALL BUSINESSES

What are residual streams – and which ones can be found in Sweden?

Industrial residual streams are materials, energy or by-products that arise during a production process, but are not the primary purpose of that production. They can range from physical materials to heat flows. A residual stream only acquires value when it is put to use in a different context.

In Sweden, residual streams are particularly common in large-scale process industries, such as the paper, steel and chemical sectors, where production takes place in continuous processes. For example, the forestry industry generates bark, branches, sawdust and black liquor from pulp and paper production, while the paper industry also produces various types of sludge, fibre residues and chemical by-products. In the chemical industry, the streams might include glycerol and other chemical residues, while the steel and metal industries generate slag, dust and oxide residues.

Another important residual stream in Sweden is waste heat. Although Sweden already makes extensive use of waste heat – including for district heating for homes and industries – there is still significant untapped potential in the industrial sector.

Historically, these residual streams have often been regarded as waste, which has either been sent to landfill or incinerated. Today, however, they are increasingly being viewed as a potential raw material, which can be used to create new products, business models and value chains.

When used properly, residual streams can contribute with:



New business opportunities for both start-ups and established companies.



Improved sustainability through increased resource efficiency and reduced environmental impact.



Greater societal resilience – increased local production and consumption can reduce dependence on imports of certain critical resources.

A crucial turning point occurs when a residual stream goes from being seen as a problem to being recognised as a resource. However, this does not happen on its own. The material needs to be characterised, quality-assured and linked to a specific use or application. In some cases, established companies can manage this process themselves. Often, however, there is a need for external expertise and ideas from smaller, start-up companies that can identify opportunities and business potential that large, established companies overlook.

Examples of residual streams



The forestry industry

- Bark
- Branches
- Sawdust
- Black liquor



The paper industry

- Sludge
- Fibre residues
- Chemical by-products



The steel industry

- Slag
- Dust
- Oxide residues



The chemical industry

- Glycerol
- Chemical residues
- Other by-products



Energy/Heat

- Waste heat
- Heat flows



Why are small businesses necessary?

Small businesses and start-ups play a crucial role in the commercialisation of residual streams. They often bring a combination of creativity, flexibility and willingness to take risks, enabling them to identify opportunities in residual streams that larger, established companies may overlook.

Large process manufacturing companies are optimised for the stable production of their core products. Residual streams are therefore often viewed as something to be managed as cost-effectively as possible, rather than as a new business opportunity.

Small businesses, on the other hand, are able to develop new technologies and areas of application, test alternative uses and build sustainable business models around materials that have previously been ignored, incinerated or sent to landfill.

At the same time, small businesses and start-ups are dependent on large industrial companies for access to the material or residual stream. Despite this, small businesses are likely to become even more important in the future, in line with increasing regulatory requirements and market pressures to manage residual streams in an environmentally and commercially sound manner.

Collaboration is essential but challenging

Collaboration between small businesses and large process manufacturing companies is essential in order to commercialise residual streams, but it can also present significant challenges. Start-ups are often reliant on industrial companies for their raw materials, while the residual stream is not always critical for the industry.

In addition, cultural differences can create problems. Large companies often operate in a structured, formalised and risk-averse manner, while small companies are more agile and experimental.

Communication and decision-making processes are often perceived as slow and bureaucratic in large companies, while small companies may be perceived as too fast-paced and unstructured. This difference in corporate cultures often risks giving rise to frustration on both sides.

There may also be significant differences in opinions regarding a potential cooperation. For a start-up, the collaboration may be critical to the development of the business, while for a large industrial company it may be just one of many initiatives under consideration.

Finally, the collaboration may be affected by purely technical factors, as residual streams vary in quality and accessibility.

Common challenges and barriers



One of the main barriers is that residual streams often vary in terms of their quality and composition, which can make them difficult to use.



A lack of data is another challenge, as many companies lack basic, detailed information about their residual streams.



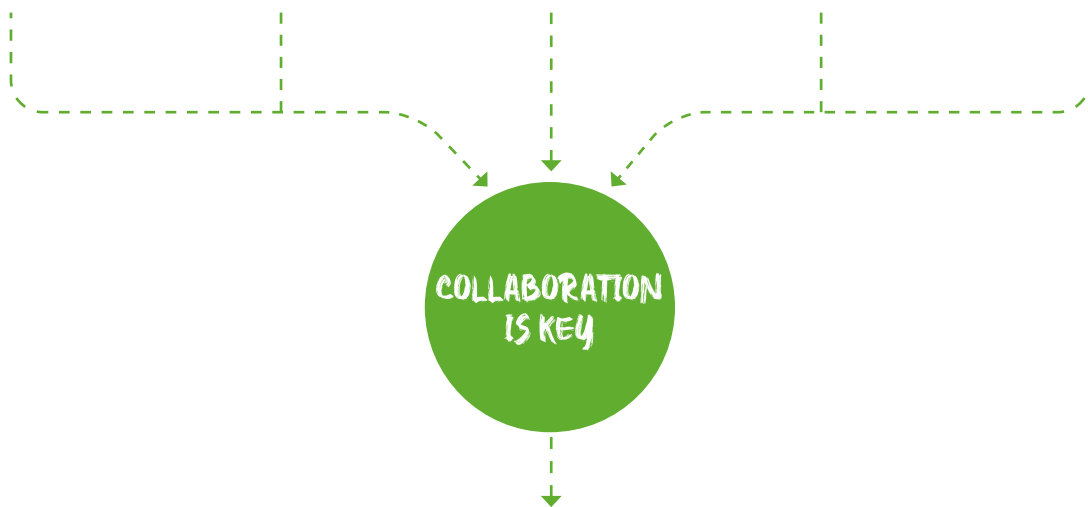
Regulatory uncertainty can also hinder commercialisation, especially when it comes to classification. It is sometimes unclear from a purely legal standpoint whether a residual stream is a by-product or waste.



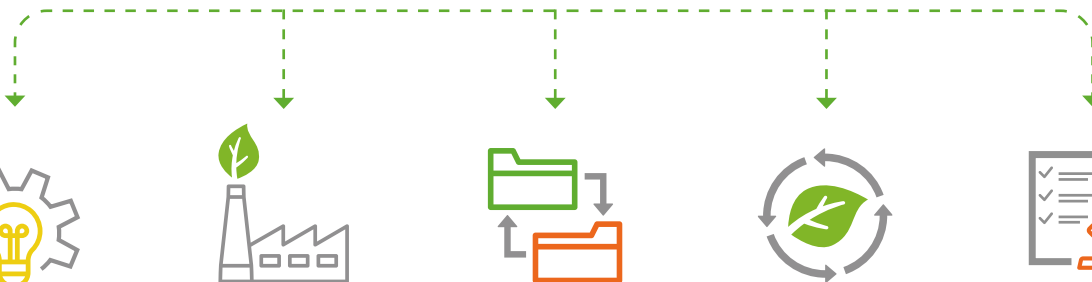
In addition, collaboration issues stemming from power imbalances and unclear roles, for example, may be common.



Scaling up is another challenge, as solutions that work on a small scale do not always work after scaling up.



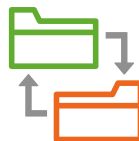
What do the parties need to do?



Small businesses can contribute with innovation, technical expertise and flexibility, as well as complementary resources and capabilities.



Process manufacturing companies provide access to residual streams, infrastructure and technical process expertise.



Together, the parties need to share data with each other, try out new solutions and work together to solve technical problems.

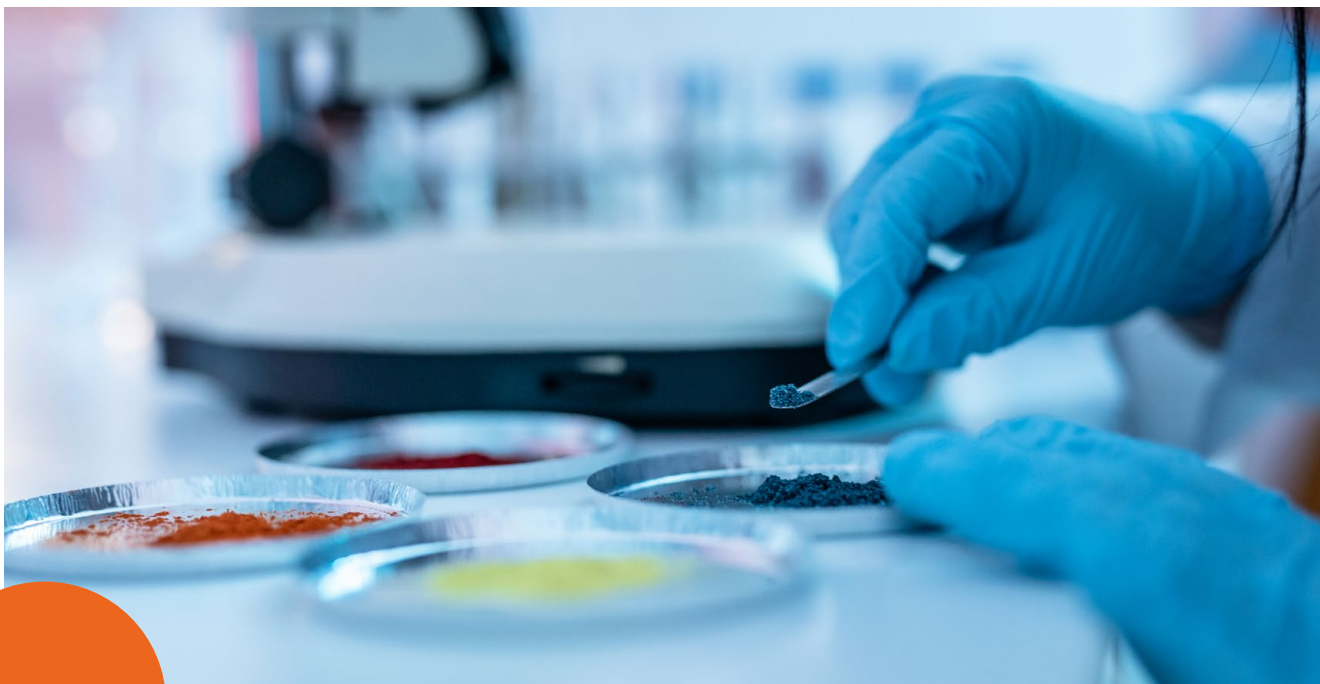


A well-functioning ecosystem of various stakeholders is also important. For example, research institutes and other stakeholders can contribute with test environments, expertise and contacts.



External factors such as regulations, financing and the market naturally have a significant impact on how a business opportunity involving a residual stream can be realised in practice.

WHEN ALL THESE ELEMENTS WORK TOGETHER, THE CONDITIONS ARE IN PLACE TO BUILD A SUCCESSFUL BUSINESS.



CHECKLIST

An analytical tool for the commercialisation of residual streams

The following pages present a practical analytical tool structured around five dimensions. It is designed to help companies – both start-ups and process industries – to systematically review each area and assess their maturity, risk level and development needs.

1

UNDERSTANDING THE MATERIAL

How well do we understand the residual stream?

This is fundamental, because the rest of the business is too risky without in-depth and detailed knowledge of the material.



Analysis questions:

- Does our company possess detailed knowledge about the composition of the residual stream?
- How does the quality vary over time, for example seasonally or during changes in production?
- Does our company have access to reliable data regarding volumes and flows?
- Is the residual stream standardised, or does it vary from batch to batch?
- Is it technically feasible to use the residual stream in a different process or application without extensive modifications?



Interpretation:

A lack of understanding of materials → high technical and commercial risk.

A deep understanding of materials → potential to build a more stable business.

2

BUSINESS LOGIC

Is there true customer value?

Many initiatives relating to residual streams are driven by sustainability considerations. While these are important, there also needs to be a sound business case. The challenge is to develop a business that delivers both sustainability benefits and financial value.

**Analysis questions:**

- What specific customer problem does the residual stream solve in its new application?
- Will it be cheaper, better or more sustainable than existing alternatives?
- Who is the intended paying customer – and why would they pay?
- Is the customer value linked to cost savings, revenue or regulatory requirements?
- How sensitive is the business to price changes, such as energy and raw material costs?

**Interpretation:**

If the value is unclear → the project risks becoming stuck in the concept or pilot phase.

If the value is clear and measurable → scaling up and ultimately a profitable business are possible

3

COLLABORATION STRUCTURE

How well does the collaboration work?

The way in which the collaboration is structured can often determine whether an initiative involving a residual stream succeeds in the long term.

**Analysis questions:**

- Are the roles and responsibilities clearly defined between the parties?
- Are there sufficient incentives for the process manufacturing company to prioritise the collaboration?
- Does the small business or start-up have the capacity and resources to sustain the collaboration over time?
- Are there established communication channels and decision-making processes?
- Is there sufficient trust and transparency around data management and how potential problems will be addressed?

**Interpretation:**

Imbalance + lack of clarity → high risk of the project or initiative stalling.

Clarity + shared incentives → preconditions for the project or initiative to succeed in the long term.

4

FEASIBILITY

Can we test it and scale it up?

Many promising ideas and concepts for residual streams fall by the wayside at this stage, somewhere between the pilot stage and industrial reality.

**Analysis questions:**

- Does our company have access to test environments or pilot facilities?
- Can the solution be integrated into an existing industrial process?
- What is required in order to scale up? (investments, permits, etc.)
- Are there any technical bottlenecks that have yet to be resolved?
- How will the industrial partner's existing operations be affected?

**Interpretation:**

If the project or initiative disrupts the core process → low probability of success.

If the solution can be integrated seamlessly → higher probability of success.

5

CONTEXT AND THE WIDER WORLD

Is the timing right?

Even good solutions can fail if the environment is not ready.

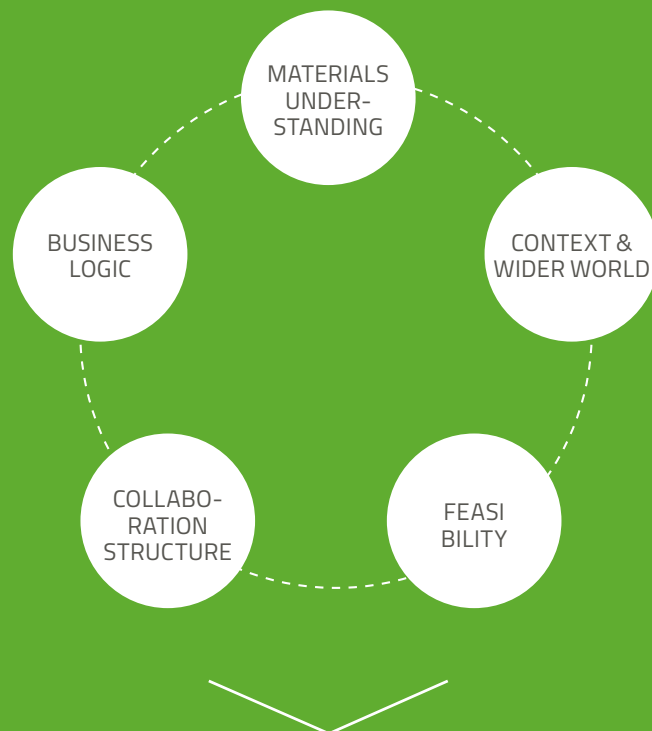
**Analysis questions:**

- What are the current regulations (waste vs by-product)?
- Are there sufficient political or economic incentives?
- How is the market for circular materials developing?
- Is funding available (grants/investors)?
- How is the business affected by external factors such as energy prices and climate-related requirements?

**Interpretation:**

"Headwinds" in the wider world → requires stronger business logic.

"Tailwinds" in the wider world → can significantly increase the likelihood of success.



How the tool is used in practice

This is not a checklist to be ticked off, but rather a way of identifying weaknesses in an initiative or project where the goal is to create a new business concept from residual streams.

A simple approach:

1. Go through each dimension in a workshop
2. Rate each question (e.g. low–medium–high)
3. Identify the greatest risks
4. Prioritise actions where uncertainty is greatest

Key insight

Perhaps the most important conclusion from the analysis is that most of the challenges regarding the commercialisation of residual streams are not just related to technology, but to the interplay between materials, business and collaboration.

A project is only likely to succeed when all five dimensions are sufficiently strong at the same time.



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