The Table & Swirl Method

A Quick Visualization Method for Aspects of Circular Material Streams

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Summary

This document describes the Table & Swirl method, which is a quick visualization method for aspects of circular material streams.

Use the method to structure and visualize information to understand and share aspects of material streams in a circular economy. It is a time efficient way to start interesting discussions on any topic related to a circular material stream.

The method is built around the Table, a tool to in a structured way gather information and the Swirl, which provides quick visualization.

The feedback from our test workshops and end-users were:

• "An eye opener!"
• "First, I thought the model was too simple, then I realized how quickly we got into interesting discussions."

This method was developed in the year 2023 by the Research Institute of Sweden (RISE) and Luleå University of Technology (LTU) in the joint project "Feasibility study: Five circular material streams for batteries“, which was financed by Energimyndigheten, the Swedish Energy Agency.
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1 Introduction

The method described in this document was developed in 2023 by the Research Institute of Sweden (RISE) and Luleå University of Technology (LTU) in the joint project Feasibility study: Five circular material streams for batteries, which was financed by Energimyndigheten, the Swedish Energy Agency.

The project aimed to find and test an easy-to-use method for visualization of circular material streams, but we did not find such method. It was easy to find descriptions and assessments of parts of specific material streams, but in our literature study, we could not find a generic method where all the material phases were included, nor with a circular approach.

Instead, we developed this method, which in our opinion fills the gap.

When we tested the method, we got positive feedback like:

• "An eye opener!"
• "First I thought the model was too simple, then I realized how quickly we got into interesting discussions."

Now - it is your turn! Please go ahead and use the Table & Swirl method as a time efficient way to widen your knowledge and deepen your discussions about your material streams.

2 When to use?

See this method as one of the tools in your toolbox when you have a circular material stream you would like to discuss. Below you find the method’s characteristics and its suitable use and audience.

2.1 Method characteristics

The method has the following characteristics:

• Includes the full material stream from finding the raw material to its use and recycling or in other words: includes all phases from exploration, mining, manufacturing to use and recycling.
• Circular
• Suitable for visualizing different properties and scenarios
• Possible to apply for any material
• Easy to understand
• Easy to work with

2.2 Typical occasion, audience

The typical occasion to use the Table & Swirl method is when you have a question and need to structure and visualize information to understand the full and often complex
material stream. With a circular approach this means from searching for the primary material to when it enters its first circular lap as a secondary material.

It is a simple but powerful tool to get people with different knowledge backgrounds on common grounds for further discussions. It can be seen as a “Chapter 1” in a book, where the area is described and the focus for further discussion, investigation or research may be pointed out.

When you have identified the topic of interest, there may be other more specific and suitable methods to further describe and visualize your topic within a particular context.

3 Method

In this chapter you find information about the method and how to use it.

3.1 Description of method

The method was developed inspired by the work done by Weimer, L., Braun, T., & vom Hemdt, A. [1] and EIT Raw Material [2] and is a combination of an information overview table and a visualization swirl.

![The table and swirl](image)

**Figure 1:** The table and swirl

The two models are used in combination – first information is collected and systematized into the table, then the collected information is translated and visualized in the swirl where the length and/or width of each individual phase reflects its proportion compared to the other phases.

3.1.1 Description of phases

To understand the method and be able to work with it, it is important to know the meaning and activities performed in each of the nine phases. Please see below for very brief descriptions of the phases.

All phases may of course be described in more detail and all of them also include rules & regulations, permit processes, safety concerns, digitalization, business models etc. etc.
Brief descriptions of the phases:

- **Exploration**
  To study the potential raw material resource in such a way that an ore reserve can be defined in terms of volume, grade, geology etc. and evaluate if it is worth mining with respect to available technique and raw material price. It starts with desktop studies and is followed by fieldwork like sampling, geophysical surveying and core drilling.

- **Mining**
  Extract the ore from the ground and produce an ore concentrate through crushing, grinding, sieving and/or concentration using chemical or physical methods like flotation or gravimetric methods.

- **Processing**
  Extraction of an element or purification of mineral from an ore concentrate through metallurgical processes to produce a purer metal, intermediate alloy or upgraded mineral.

- **Raw material**
  Refining or preparation of a metal, intermediate alloy or upgraded mineral, to achieve the purity and form that suit the manufacturing process.

- **Design**
  The drawing, construction and selection of properties and the suitable material for the product.

- **Production**
  The manufacturing process for the product in focus, often (but not limited to) the end user product. It includes everything from preparation, assembly to final polish.

- **Use, Reuse**
  The first end user utilization and second (or any thereafter) utilization in the same or in another application.

- **Collection**
  The pickup and gathering of products when they have reached end-of-life.

- **Recycling**
  The product is disassembled and the material is through various techniques made reusable again.

3.1.2 **What is a theme?**

A theme can be anything material related you would like to discuss and visualize, like a property or a certain scenario.

To give you some ideas - we tried these themes when we developed the method: the amount of the material in each phase for a passenger car lithium ion battery, the amount of waste in each phase for such battery, country of origin of materials used,
digitalization possibilities, health and safety, social acceptance, emerging technologies and material value.

Your theme is then applied to the material/s you like to focus on. You can work with one theme for several materials or different themes for one single material. When developing the method, we tried the method with different materials important to the lithium-ion battery value chain.

It is up to your imagination what themes you would like to explore and which materials you would like to apply them to.

3.2 The method’s four steps

The method work process includes four steps:

1. Select theme.
   Choose if you would like to do one theme for several materials or different themes for one material.

2. Gather overview information into the table.
   Complement with separate text for more detailed information, references and assumptions you have made.

3. Visualize outcome in the adapted value chain using the swirl.
   Adapt the swirl so the length and/or width of each individual phase reflects its proportion compared to the other phases.

4. Draw conclusions.

**Figure 2:** The four steps of the method work process.
3.3 Workshop plan and execution

This is a proposal for how to execute a workshop, based on the method.

A plan for a three-hour live workshop is found below. If you plan for a digital workshop, you should probably make it shorter and ensure that you have digital tools for collaboration available to support the work.

Plan for a three-hour live workshop:

- **Hour 1**
  - Introduction of participants and their expectations.
  - Presentation of your project/problem/why you have gathered the group/team.
  - Presentation of the method.
  - Walk through an easy example together so all participants get familiar with the method. Select a theme that all participants can easily relate to, for example the time a material spends in each phase.

- **Hour 2**
  - Break

  - Do your first “real” work using an interesting theme and based on the participants' knowledge in the room or by a presentation of already prepared filled-in tables and swirls – adjustments? ...and correlating discussions and conclusions.

  This work can be done all together or in smaller teams.

- **Hour 3**
  - Present the outcomes of the work and give time for discussions.
  - Decide how to bring further questions or conclusions forward.
  - Feedback on working with the method.
  - Follow-up on expectations and conclusion of the meeting.

Empty, unfilled templates of the Table and Swirl that may be used in the workshop are found in the appendix to this report.

![Empty templates for workshop participants to fill in by hand.](image)

**Figure 3:** Empty templates for workshop participants to fill in by hand.
3.4 Examples of using the method

Here are two examples of how the method has been used.

3.4.1 Filled in by hand in a workshop

Below are two pictures from a workshop where we brainstormed information by filling in the table and then visualizing it using the swirl. The knowledge from everyone present was used when brainstorming together.

The theme was time for the material in a lithium-ion battery to stay in each phase.

![Figure 4: Example of usage in a live workshop](image)

3.4.2 Preprepared and used as a basis for discussion

Below is an example of social acceptance in Sweden of the value stream of the materials used in a lithium ion battery for a passenger car. The information in the table was gathered through Internet searches.

The theme was social acceptance of the materials in a lithium-ion battery.

![Figure 5: Example of method usage when prepared as a basis for further discussion](image)
3.5 Tips & Tricks

Please find below a few tips and tricks which may become valuable when using the method:

- When using and explaining the method, do spend some time on what the phases mean and which activities they include. It provides extra clarity and avoids confusion later in your discussions.

- Avoid traps:
  - Too much detail
    It is easy to fall into the trap that too detailed information gets into the table. Remember that the table is there to provide an overview of your theme and that any supporting information can be given on the side in text.
  - Go astray from theme
    Another trap is to go astray from your theme, as there is so much interesting information available. Try to stay focused!
    A workaround is to start on another table with a complementary theme.
  - Question your conclusions
    Even if you are the smartest of people using the best of methods, you may draw the wrong conclusions. Always question your decisions and find more information supporting your choices.

- Use a different colour for your starting point
  If you start gathering the information with the material amount necessary for a certain product, then it may be smart to give that table column a different colour to indicate it as your starting point.

- Design phase
  The design phase is different from the other phases as no material is actually flowing through the phase. Even though its logic is different it is important to have the Design phase as part of the method as it is where important decisions for which material to use are taken. With the difference in logic comes that for some themes the Design phase may have to be treated differently compared to the other phases.

- Don’t stick to the method, if there is a smarter available
  When you have identified issues that you would like to investigate further, please check if this method is the best tool in your toolbox to continue – it may be that there are other, smarter ways and tools to be used for your specific topic.

4 References


5 Appendix

5.1 Template - Table

Single row template:

![Single row template diagram]

Multirow template:

![Multirow template diagram]
5.2 Template - Swirl

Coloured swirl with phases:

![Coloured Swirl Diagram](image)

Black & white empty swirl:

![Black & White Swirl](image)