AI-based decision support for managing fluctuating scrap supply at Swedish Foundries

Lennart Elmquist, PhD
Senior Researcher

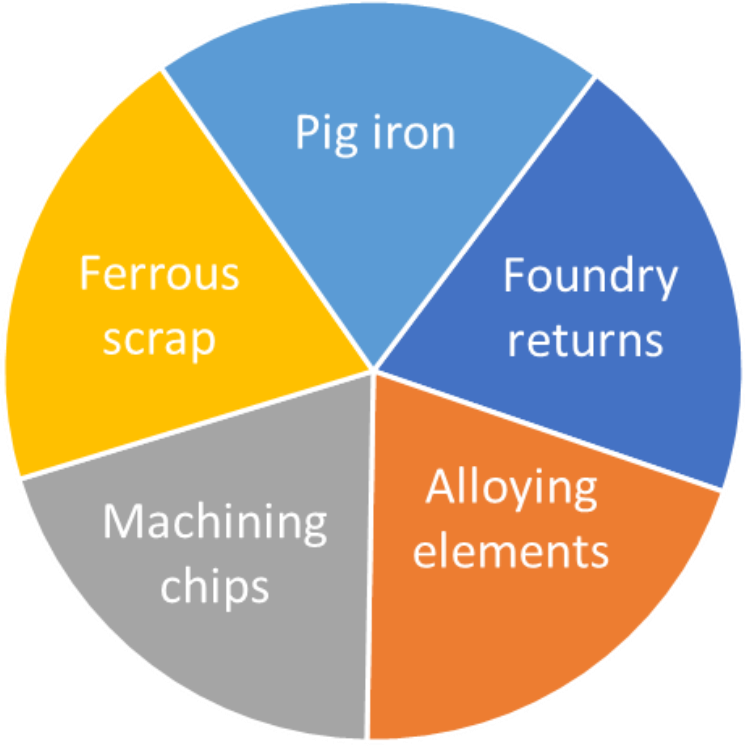
Swedish Manufacturing Conference 2026, Södertälje, May 20-21.

Project financed by Sweden´s Innovation Agency, Vinnova, within the program Advanced digitalization

Content

- Background and Research Questions
- Feasibility Study
- Project Portfolio
- Current Status
- Summary

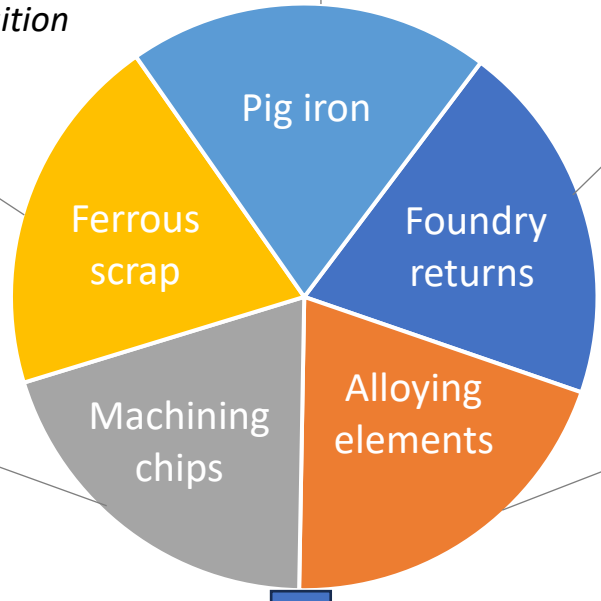
Cast iron melting until now



Varying scrap availability

Greater variation in both availability and composition

The main driver is minimizing primary material use → Need to increase scrap usage



Reduced returns:
- Lower scrap/rejection rates
- Improved and optimized gating systems
- Improved yield

→ Need to increase scrap usage

Reduced availability/higher variability:
- Increased competition for scrap

Near-net-shape:
- Reduced machining
- Aims to minimize material removal

Chip handling is costly

→ Need to increase scrap usage

Growing competition for certain alloying elements → Need to increase scrap usage

Need to obtain alloying materials via scrap

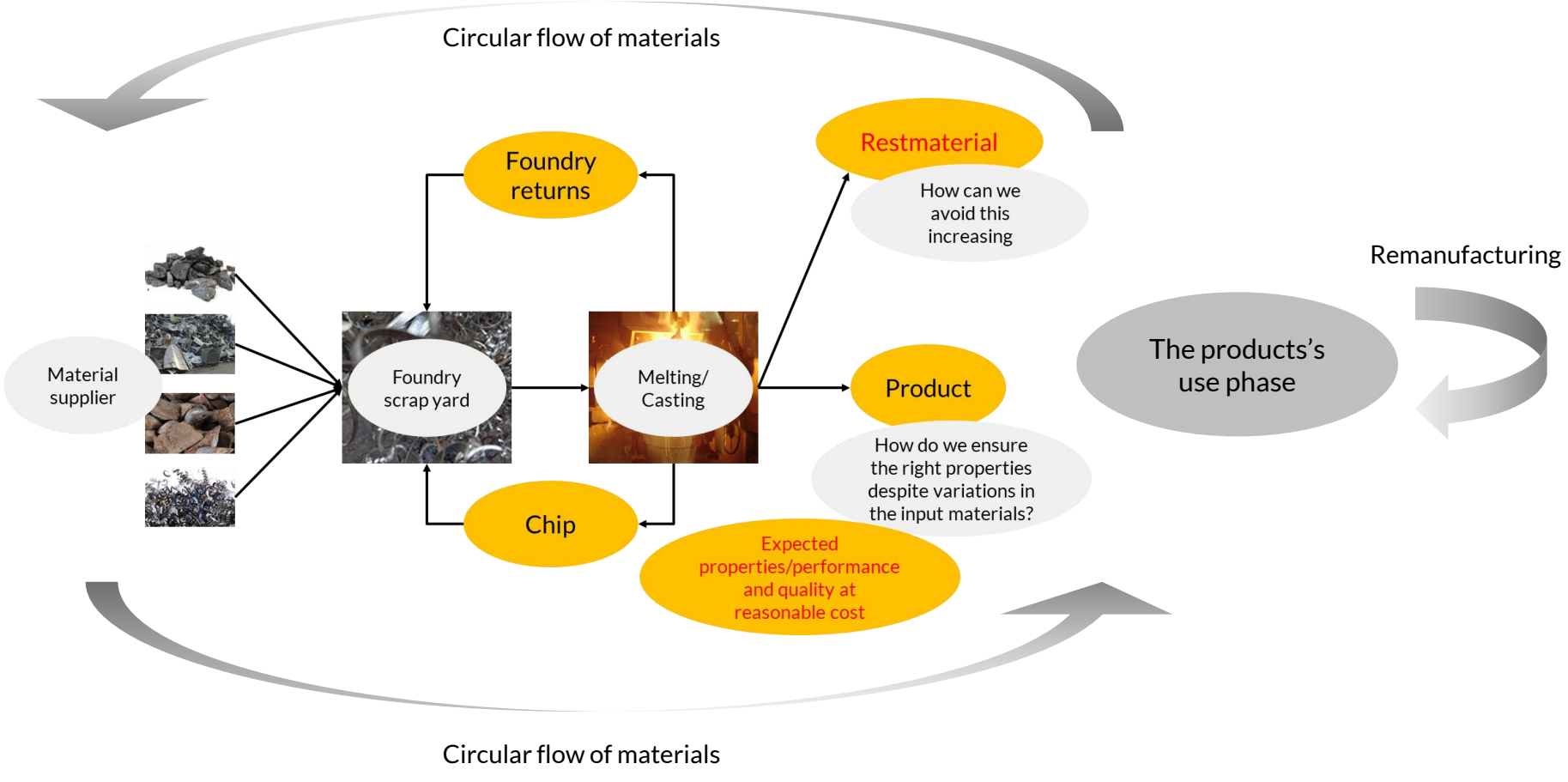
Must at the same time remain cost-efficient!

Process impact
- Energy consumption during melting
- Furnace and ladle wear
- More difficult to control the melting process to achieve desired properties

Quality issues
- Increase
- Vary
- Quality deviations later in the value chain (e.g. during machining)

Material properties
- Larger variations
- More difficult to produce high-performance materials

Varying scrap availability



Feasibility study

Variable scrap yard to manage a precarious material supply

Key conclusions and lessons learned

- Limited focus on foundry material supply despite its critical importance. Other industries, such as batteries, electronics, and scrap-based steel production are ahead.
- Increasing competition requires new scrap sourcing strategies.
- Scrap variability is a critical challenge for quality and material properties.
- Advanced decision support is essential to handle variations and improve process stability.

Financed by Sweden´s Innovation Agency, Vinnova, within the program Impact Innovation: Genomförbarhetsstudier inom tekniska insatsområden i programmet Metals and Minerals.

Feasibility study

Variable scrap yard to manage a precarious material supply

Key conclusions and lessons learned

- Circular and resilient material flows are key for sustainability, efficiency, and long-term competitiveness.
- Resilient and circular systems are needed: more robust scrap yards and increased circularity strengthen resilience against disruptions in material supply.
- Need for a broad initiative going forward: Several coordinated projects are proposed, including an umbrella project and targeted efforts on material flows and chemical variability

Financed by Sweden´s Innovation Agency, Vinnova, within the program Impact Innovation: Genomförbarhetsstudier inom tekniska insatsområden i programmet Metals and Minerals.

Questions to address

Source: SKF Mekan AB

- How do we ensure access to the right scrap and develop effective sourcing strategies?
- How do we match the right material to the right foundry?
- How can scrap variability and fluctuations in chemical composition be effectively managed?
- How do we certify, control, and ensure the quality of incoming materials?
- How do we ensure products meet required properties and performance without increasing quality issues?

Questions to address

Source: SKF Mekan AB

- What is the optimal design and capacity of the scrapyard?
- How do we maintain control when switching materials and ensure full traceability?
- How do we ensure material availability at the right time?
- What alternative material flows can be implemented (e.g. shared scrapyards, direct material flows)?
- What tools, skills, and training are needed to support decision-making and operations?
- How can cost-efficiency be maintained?

Key focus areas identified

- **Securing and identifying suitable scrap flows.** Ensuring access to scrap streams that meet foundry requirements, including identifying alternative sources.
- **Managing increased variability in scrap composition.** If greater variations must be accepted, tools such as decision support are needed to handle this while maintaining required quality, properties, and performance.
- **Developing an understanding of trace elements and their effects,** including improved knowledge of the issues they cause and how they can be mitigated metallurgically, using LSRI methods to study solidification in situ.

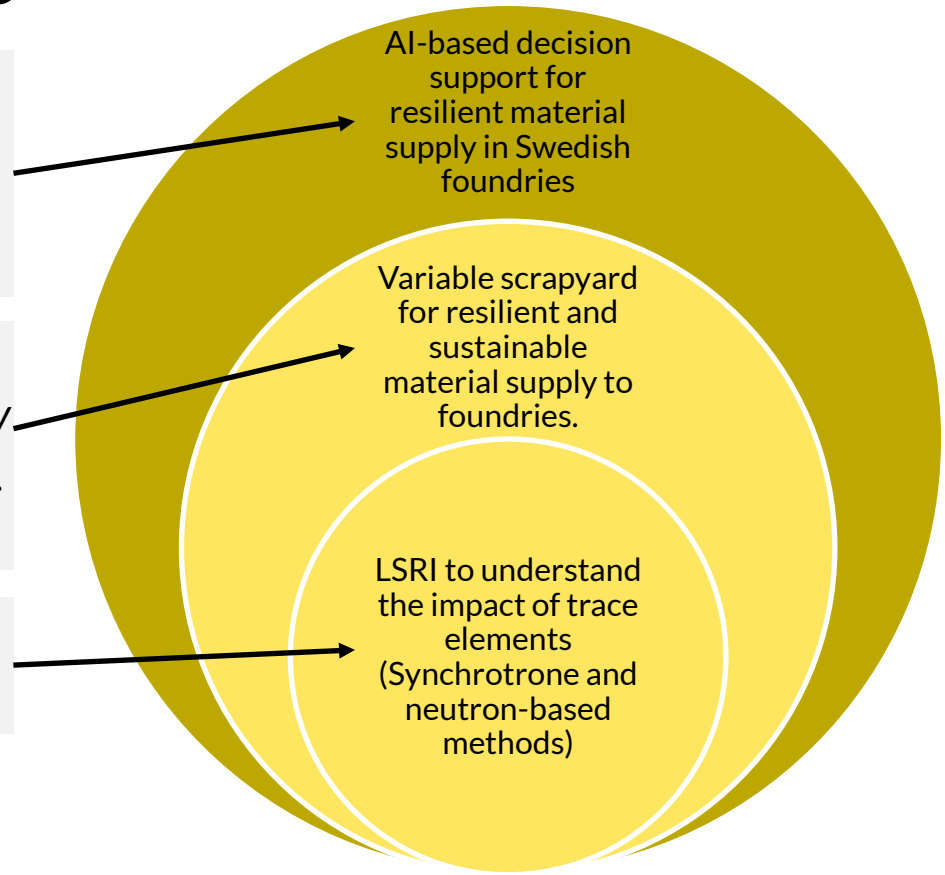
Source: www.esrf.fr

The planned project portfolio

Granted, starting April 15, 2026, and ending April 15, 2028. *Financed by Sweden´s Innovation Agency, Vinnova, within the program Advanced digitalization.* ***Total budget: 7 224 780 kr***

Granted, starting June 15, 2026, and ending June 15, 2029, *Financed by Swedish Energy Agency and Impact Innovation - Swedish Metals & Minerals.* ***Total budget:*** **11 898 995kr**

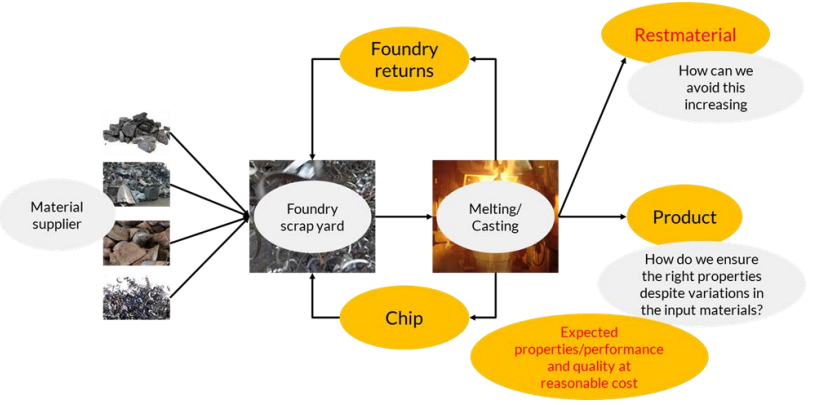
Project application is ongoing



AI-based decision support for resilient material supply in Swedish foundries

The project aims to develop methods and tools that help foundries manage variations in the chemical composition of scrap, thereby enabling more resilient and circular material flows.

The objective is to ensure the required quality and properties of cast products even when using variable raw materials, while reducing climate impact and strengthening competitiveness.



AI-based decision support for resilient material supply in Swedish foundries

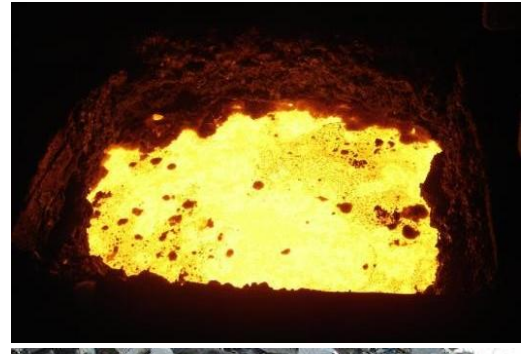
Overall objectives:

- Develop AI-based decision support to manage variations in chemical composition.
- Promote circular material flows and reduce climate impact.
- Strengthen the competitiveness of the entire foundry industry.

Apart from project management and current state analysis the project include

- Process mapping activities
- Data collection and feasibility analysis
- Development and training of a model for recipe optimization and resource allocation
- Integration, validation and demonstration

Variable scrapyard for resilient and sustainable material supply to foundries.



The project addresses a critical challenge for the Swedish foundry industry: ensuring a stable and sustainable raw material supply as global competition for scrap increases. Growing variability in scrap availability and composition risks process disruptions, quality issues, and reduced competitiveness.

- The project develops methods and strategies to optimize scrap across the value chain
- The goal is a robust, resource-efficient foundry process with higher tolerance to variations and a more stable material supply.

Variable scrapyard for resilient and sustainable material supply to foundries.

- Develop knowledge, methods, and practical solutions for managing scrap with varying chemical composition
- Enable a more resource-efficient, circular, and robust foundry process
- Broaden the usable scrap base to reduce reliance on primary raw materials without compromising quality or efficiency
- Develop new scrap combinations based on trace element tolerances, improved sorting, and material design

Variable scrapyard for resilient and sustainable material supply to foundries.

- Support stable production despite increasing variability in scrap quality and availability
- Strengthen competitiveness, resilience, and the role of the foundry industry in a circular metals sector
- Cover the full circular material flow—from scrap to products and back to scrap
- Contribute to a sustainable, energy-efficient, and attractive foundry process

Project partners

Industries

- 10 foundries
- 3 suppliers
- Swedish Foundry Association

Research performers

- RISE Research Institutes of Sweden
- Jönköping University

Contact:
Lennart Elmquist
lennart.elmquist@ri.se
+46 10 228 46 61