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CASE STUDY

2025

steel-a-thon
Prove your Metal
Season XII 2025

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Case Title

Crafting the Future: Steel 3D Printing to Rival Giga-Casting in EV Manufacturing – feasibility and business case

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Introduction:

The automotive industry is undergoing a profound transformation. As electric vehicles (EVs) become mainstream, manufacturers are rethinking how vehicles are designed and built. One of the most disruptive trends is the rise of giga-casting – the use of massive high-pressure die casting (HPDC) machines to produce large, integrated aluminium or magnesium structural components, replacing hundreds of stamped and welded steel parts.

This shift poses a significant threat to the traditional 'stamping + welding / joining' method and the associated flat steel supply chain. In response, we invite a business-case study to take on a bold challenge: develop a disruptive business case for high-speed, high-volume 3-D printing or additive manufacturing (AM) of low-alloy steels. The goal is to rival the rise of aluminium giga-casting and magnesium thixomoulding with a steel-based AM venture that redefines how steel-intensive EV structures are built – driving innovation, sustainability, and competitiveness in tomorrow's steel-intensive mobility.

Tata Steel is one of the world's leading producers of flat steels for automotive applications, with production facilities in India, the UK, and the Netherlands. This study will support Tata Steel in charting its strategic direction over the coming years and in formulating effective responses to the threat posed by giga-casting. Large, integrated AM steel EV body structures or sub-assemblies – if proven feasible – could offer many of the same advantages as giga-cast components. For Tata Steel, the potential business opportunities may range from supplying suitable steel powders for AM to establishing a dedicated additive manufacturing production business.

Background:

Since Tesla introduced giga-casting in 2020, the technology has rapidly gained traction:

• Tesla uses 6,000–9,000 tonne presses to produce front and rear underbodies for the Model Y and Cybertruck, reducing 171 parts to just two castings and eliminating 1,600 welds.

• Volvo has adopted 8,400–9,000 tonne presses and planed to produce rear floor castings, replacing 33 parts and reducing weight by 15%.[2]

• Ford is investing $2 billion in "unicasting" to modularise EV assembly.

• Volkswagen has opened a competence centre in Kassel, Germany, for large castings, including battery housings that previously required 122 parts.[3]

• China leads the global giga-casting market, with companies like Xpeng, NIO, and Xiaomi integrating 300+ parts into two castings. Chinese Tier-1 suppliers now account for 70% of giga-casting investments.

Meanwhile, magnesium thixomoulding is emerging as a complementary lightweighting technology. It offers near-wrought quality, low porosity, and high strength, with new modular systems enabling larger parts and faster cycles.

This trend is reshaping the material landscape of automotive manufacturing. Giga-casting is expected to grow at 13–33% annually, with 70% of large structural castings (>3,000 t) projected to be giga-castings by 2030. This could significantly reduce demand for flat steel in car body structures.

[1] Giga-Castings in the Automotive Industry: An Updated Review

[2] Production minimalism: How Megacasting is reshaping automotive manufacturing

[3] Megacasting: VW opens competence centre for large castings in Kassel

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How Thixomolding is Redefining Electric Vehicle Production

Problem Statement/Challenges:

To counter this disruptive shift, one of the responses that the steel industry can explore is metal additive manufacturing (MAM) as a viable alternative. However, several challenges must be addressed:

• Market Potential: Can steel AM compete with aluminium giga-casting in cost, scalability, and performance?

• Technological Feasibility: Are high-speed, high-deposition-rate AM processes for low-alloy steels (the main steel chemistry for automotive applications) ready for automotive-scale production?

• Supply Chain Integration: What ecosystem is needed to support a steel AM business—from powder production to post-processing?

• Sustainability: How does steel AM compare in lifecycle emissions, recyclability, and energy use?

Critical Case Questions:

The study teams are invited to conduct a detailed review, study, and analysis to answer the following:

1. Market Assessment

• What is the current and projected market share of aluminium giga-casting and magnesium thixomoulding in EV manufacturing?

• How much flat steel volume is at risk due to this shift?

• What are the cost and performance benchmarks for giga-cast vs. AM steel structures?

2. State-of-the-Art Technologies

• What are the latest developments in high-speed, high-volume metal AM (e.g. wire-arc AM, other DED – Direct Energy Deposition, or binder jetting etc.)?

• How do these compare with HPDC and thixomoulding in terms of:

• Build rate

• Mechanical properties

• Surface finish

• Post-processing requirements

3. Strategic Partnerships

• What partnerships (e.g. with AM machine builders, powder suppliers, automotive OEMs, research institutions) would be critical to success?

• Are there existing consortia or innovation hubs that could be leveraged?

4. Sustainability Strategies

• How can steel AM contribute to circularity and decarbonisation?

• What are the comparative carbon footprints of steel AM vs. aluminium HPDC and magnesium thixomoulding?

• Can renewable energy and recycled feedstock be integrated?

5. Capacity Building

• What infrastructure, talent, and digital capabilities are needed to scale a steel AM business?

• What are the capital and operational expenditure requirements?

• How can the business model be made resilient and scalable?

Deliverables

The business-case study team is expected to submit a **feasibility study** and **business proposal** that includes:

- Executive summary
- Market and technology analysis
- Business model and value proposition
- Go-to-market strategy
- Investment requirements
- Risk assessment and mitigation
- Sustainability roadmap
- Recommendations for the company to consider and adopt.

This is an opportunity to shape the future of automotive manufacturing. We challenge the team to think boldly, act strategically, and propose a business that could maintain steel's role in the EV era in the long run—not through tradition, but through transformation.