

FROM FOUNDRY TO FUTURE

How **Gigacasting** is redefining
electric vehicle(EV) production?



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Executive summary

Gigacasting's role in EV production

As EV production scales up, Gigacasting is set to transform automotive manufacturing, driving efficiency, cost savings, and sustainability

Emerging OEMs are driving the shift

New EV players are rapidly adopting Gigacasting to gain a competitive edge, pressuring legacy automakers to accelerate their transition

Localization & supply chain resilience

Automakers are localizing Gigacasting production to synchronize supply chains, improve logistics, and enhance manufacturing resilience

Repairability challenges & solutions

Concerns over repairability and defect risks persist, but OEMs are actively investing in advanced repair solutions and supply chain improvements

The race to scale Gigacasting

Emerging EV players will lead Gigacasting innovation, while legacy OEMs will scale up rapidly by leveraging Tier 1 suppliers' expertise

Tesla's early success sparks industry-wide adoption

Tesla's success with Gigacasting has influenced major automakers to invest strategically in this technology for innovation and efficiency

From 1+3 to 3+1-piece casting concepts

OEMs initially favored the 1+3-Piece concept, but proven benefits in waste reduction and faster production are driving a shift to 3+1-Piece casting

Higher CAPEX, lower OPEX – a long-term win

Despite ~55% higher initial CAPEX, Gigacasting's ~45% lower OPEX makes it a cost-effective choice for EV mass production in the long term

The manufacturing shift – from OEMs to tier 1 players

While early adopters (Giga Leaders) focus on in-house production, mass production needs will drive a shift toward Tier 1 suppliers for scalability

FutureBridge

Introduction to Gigacasting

An overview

Evolution of Gigacasting

Key characteristics

Gigacasting enables OEMs to replace multiple smaller stamped and welded parts with a **single, complex cast structure**, significantly improving **manufacturing efficiency, cost savings, vehicle performance, and sustainability**

The process relies on **ultra-large die-casting** machines (commonly referred to as Giga Presses) that exert 6,000 to 12,000+ tons of clamping force to inject molten aluminum alloy into precision-engineered molds. This results in **lightweight, structurally rigid, and high-integrity components** that streamline assembly and optimize vehicle design

Gigacasting is an advanced high-pressure die-casting (HPDC) process used in automotive manufacturing to produce large, single-piece aluminum structural components.



1+3 - piece

- Central casting with three additional bolted-on sections
- Hybrid approach balancing large casting benefits with modularity
- More common among legacy OEMs transitioning to Gigacasting



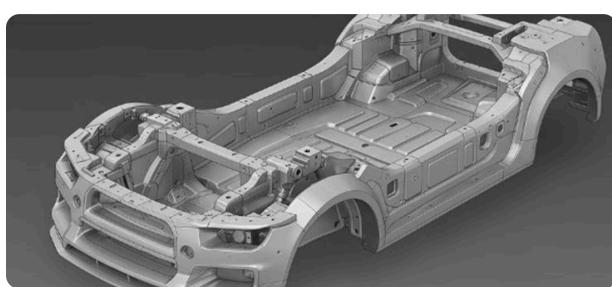
2+2 - piece

- Two large castings for front and rear
- Two additional side castings for reinforcements
- Increases scalability across vehicle platforms



3+1 - piece

- Three-piece Gigacasting with a smaller central reinforcement
- Strengthens the structure while improving modularity
- Expected to replace 1+3 in the future



1+1 - piece

- Separate front and rear underbody castings
- Modules are connected using bolts or adhesives
- Allows for more manageable repairs



1+0 - piece

- Entire car body (chassis + underbody + BIW) made with a single Gigacasting
- No additional modular sections
- Eliminates welding, bolting, and stamping completely

As the global transition to EVs accelerates and manufacturing efficiency gains importance, Gigacasting is set to play a pivotal role in transforming the future of automotive production



Leading the way: how Tesla's Gigacasting revolution is inspiring the industry

Traditionally, a car body consists of over a hundred stamped metal parts welded together. By minimizing part counts, the company achieved significant cost reductions and streamlined production, contributing to its industry-leading profitability.

Single rear in Model Y reduced related component costs by 40%.

Model 3's integration of front and rear components led to the removal of 600 robots from the assembly line.

This approach lowers vehicle weight, crucial for EVs with heavy battery packs.

What does the future hold?

Established players like **Toyota, Volvo, Hyundai, GM and VW** exploring its potential to transform manufacturing processes

The integration of Gigacasting and hybrid manufacturing is set to become the norm in EV production, driving efficiency and reducing complexity

Transition from “1+3” piece concept to “3+1” piece concept may happen in the next 6-8 years

Expert's viewpoints

“

Gigacasting reduces vehicle production time by up to 30%, streamlining assembly and boosting throughput at scale. This is a game-changer for EV manufacturing.



Chief Production Engineer: Tesla

“

With fewer individual parts, Gigacasting drastically cuts down on defect rates and enhances structural integrity, setting new industry standards for durability.



Operation Head: FORD Motors

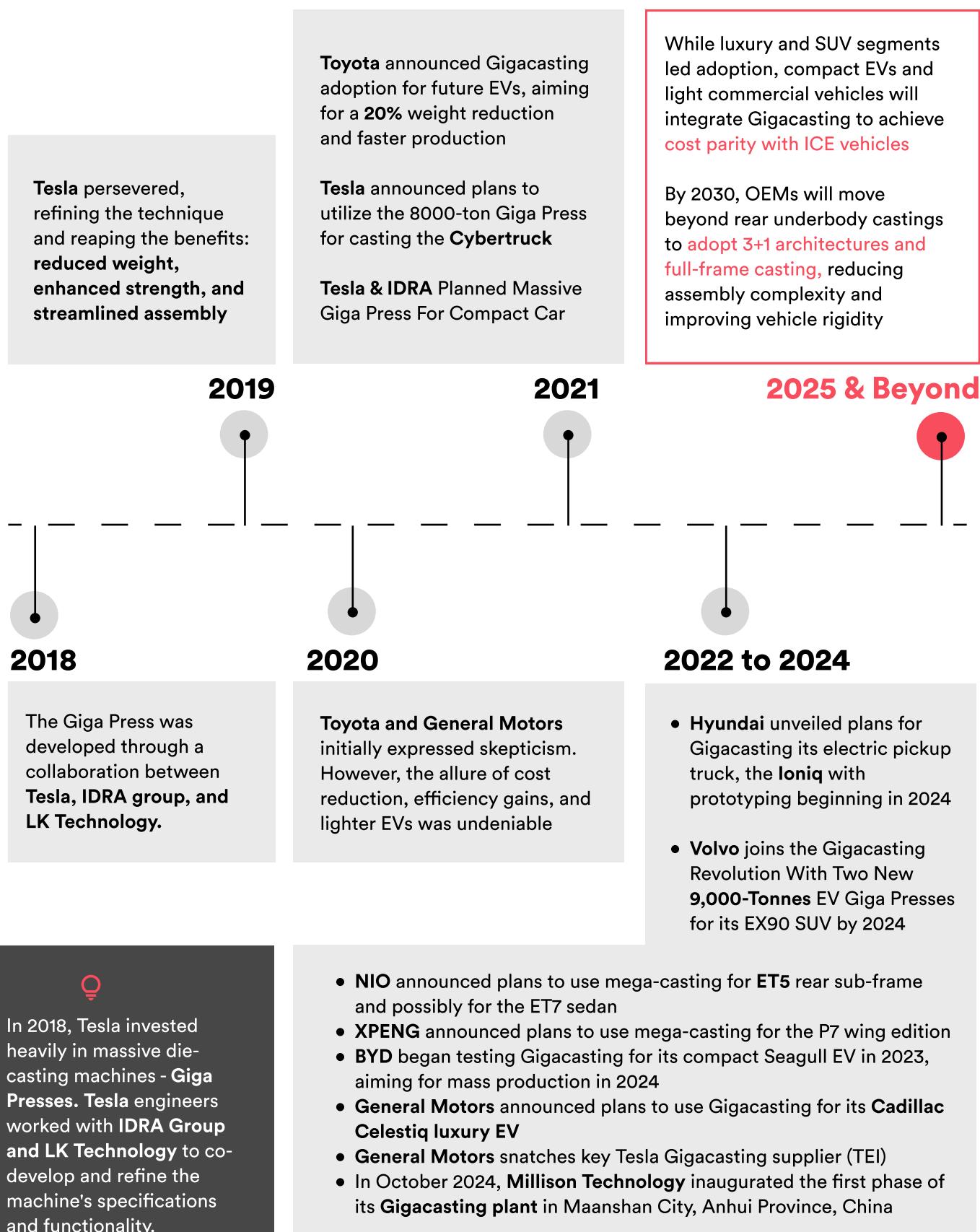
“

Gigacasting is reducing our reliance on traditional welding and joining techniques, but it's still early days. The long-term impact on vehicle lifecycle costs and repairability is something we'll need to monitor closely.



Senior Director: BYD

Tesla's early success with Gigacasting has inspired established players to strategically invest in this technology, aligning with their long-term objectives of operational efficiency and innovation



Gigacasting accelerating the shift to electric mobility

— OEMs adoption landscape

— Tailwinds fostering its growth

— Various concepts of Gigacasting

— Push for “localization” – supply chain resilience

Emerging automotive EV OEMs are adopting Gigacasting to better position themselves to compete in the evolving landscape of electric vehicle manufacturing

Rear lower body manufactured by Gigacasting



TESLA MOTORS

Powertrain focus:

Vehicle segment focus:



Model Y; 2T



MY RWD; 1.7T



Cybertruck; 3T



Powertrain focus:

Vehicle segment focus:



G6; 2.2T



X9; 2.2T



Powertrain focus:

Vehicle segment focus:



ES8; 2.1T



ES6; 2.3T



ET5; 2.5T



Powertrain focus:

Vehicle segment focus:



Model Y; 2T



MY RWD; 1.7T



Cybertruck; 3T

FutureBridge insights

- Gigacasting helps in weight reduction by 10% - 20% based on the OEM's approach
- PV segment is focused by OEMs due to higher production volumes for a quicker break-even
- 2.5 ton is preferred weight category to achieve high weight reduction of EVs and overall cost savings

FutureBridge perspective

- SUV and sedan adoption proves viability, but standardizing Gigacasting across multiple models will unlock true cost benefits
- OEMs should explore modular Gigacasting architectures that can be adapted across various model segments without extensive retooling

With higher production efficiency, lower emissions and optimized material use, Gigacasting is driving sustainable innovation in the auto industry.

How Gigacasting is driving sustainability?



Gigacasting achieves **27.8 jobs per hour**, outperforming steel stamping at 24.4, while reducing labor and indirect costs. The streamlined process, with fewer parts, simplifies assembly and quality control, **requiring fewer operators** on the production line.

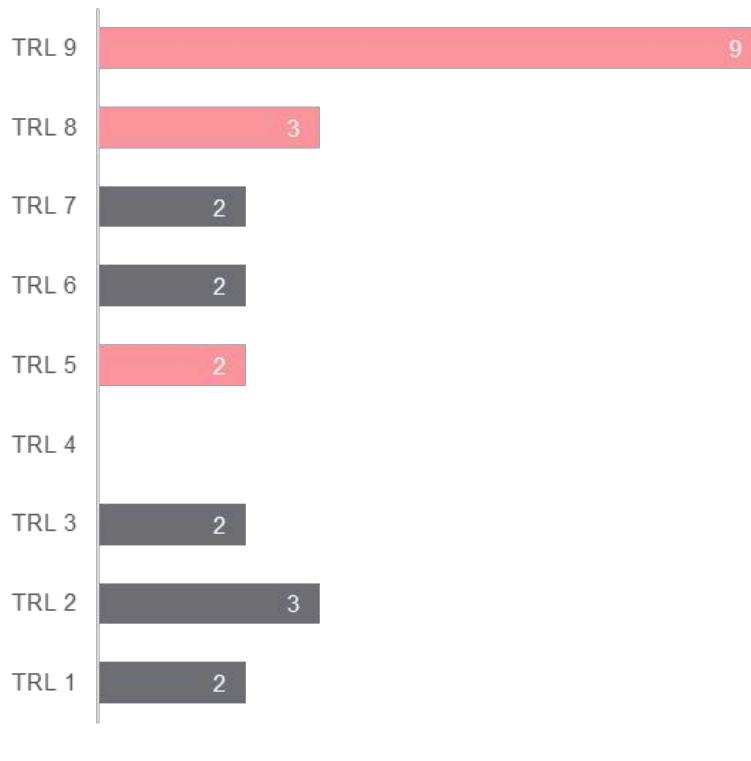
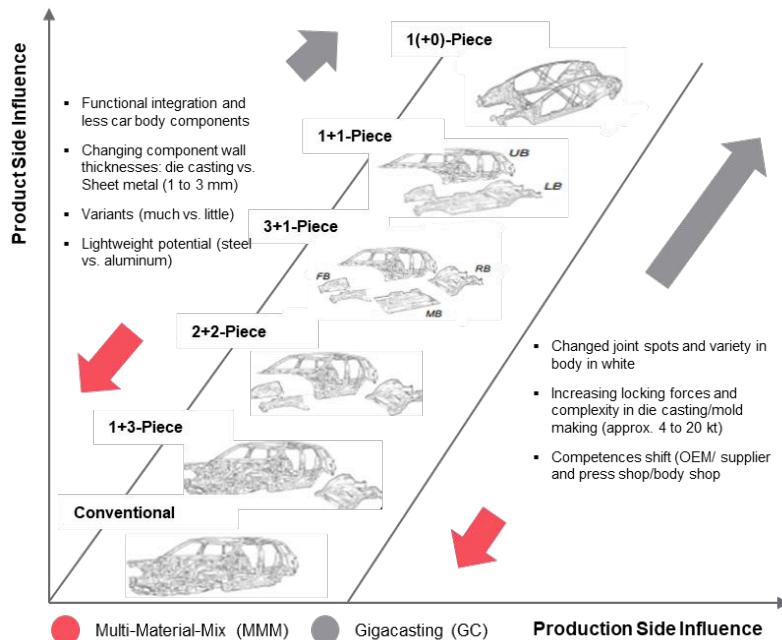
Gigacasting requires significantly **less energy** than traditional manufacturing methods. Giga presses offer energy savings up to 50%, thereby lowering **carbon emissions**.

CO2 emissions are lowered by **15-20%** due to the elimination of energy-intensive processes such as welding and riveting.

Gigacasting consolidates numerous components into a single, large part, **driving material efficiency**. Compared to traditional stamping, which can result in up to **30%** scrap, Gigacasting **optimizes aluminum use**, significantly reducing waste.

Each Gigacasting reduces the part count by **30 to 40 components** compared to conventional stamped construction. This streamlining **simplifies production**, lowering **complexity** in assembly, minimizing the need for additional fasteners or joints, and improving overall manufacturing efficiency.

1+3-Piece concept is widely used currently but with proven benefits like waste reduction and faster production, OEMs are expected to shift towards the 3+1-piece concept



Experts' opinions on estimation of TRL for Gigacasting (3- and 1- Piece) and it's feasibility for commercialization.

Increasing “localization” is pushing for synchronization between production and consumption centers thus maintaining supply chain resilience

Giga presses manufacturers

TEI - Michigan, USA



OEMs Gigacasting facility

Tesla - Texas, USA

Rivian - Illinois, USA

IDRA Group - Texas, USA



Volvo - Košice, Slovakia

Bühler Group - Uzwil, Switzerland

Tesla - Berlin, Germany

LK Group - Hong Kong, China



Nio - Hefei, China

Haitan International - Ningbo, China

Xpeng - Zhaoqing, China

Yizumi - Guangdong, China

Tesla - Shanghai, China

Ube Machinery - Yamaguchi, Japan



Hyundai - Ulsan, South Korea

FutureBridge perspective

From APAC hub to global expansion

China leads in giga press manufacturing, but IDRA, Buhler, and TEI are accelerating **regional growth in Europe & North America**

Localization: The next competitive edge

With logistics costs adding 10-15% on the CAPEX, “localization of production and consumption centers” will play a key role in defining the future manufacturing landscape.

This will lead to the rise of regional giga press manufacturers, enabling large scale casting operations thus streamlining traditional supply chain by integrating tier suppliers.

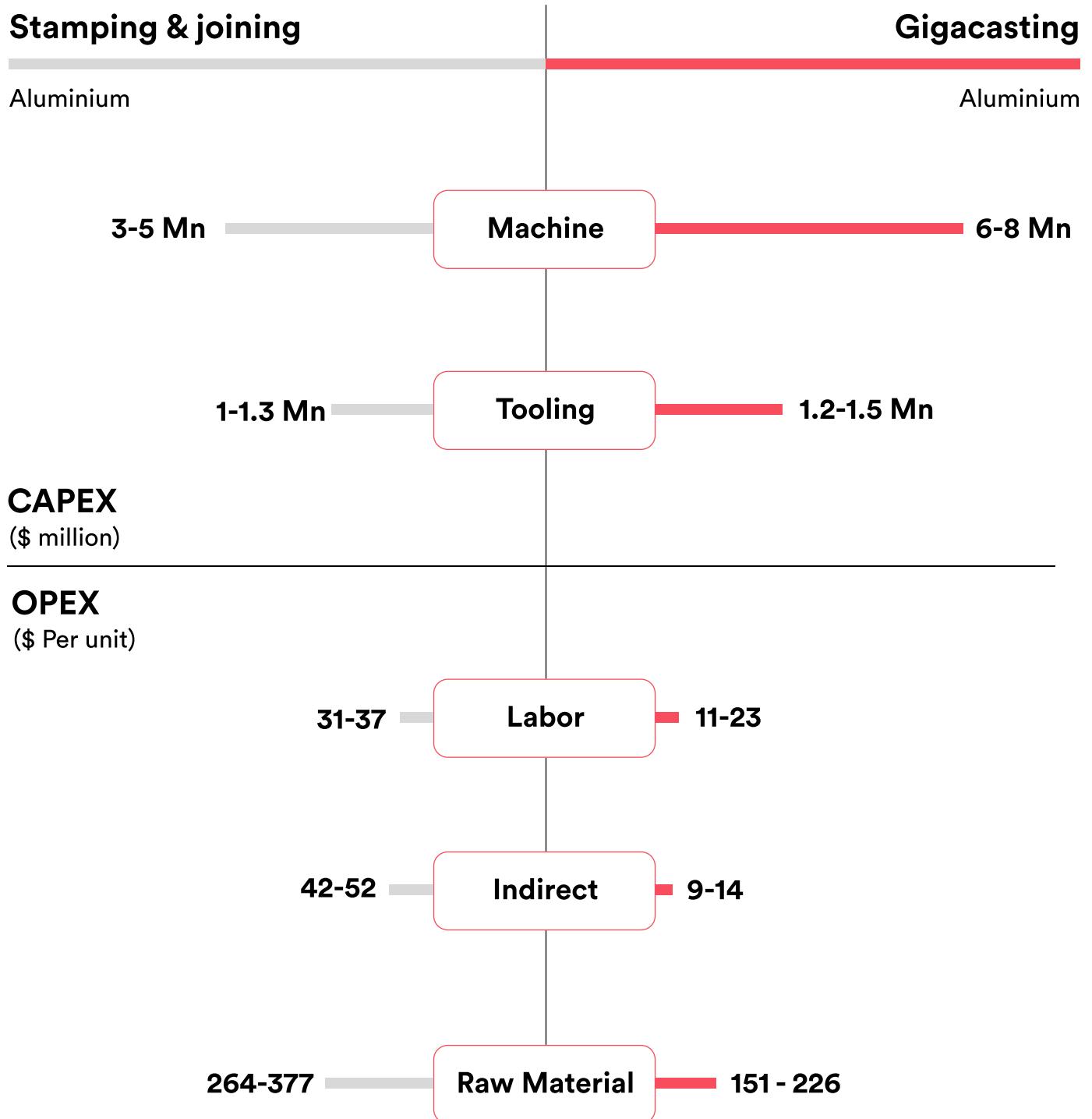
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Smart investment for long-term profitability

- CAPEX and OPEX comparative analysis

- Repairability challenges and workarounds

Although Gigacasting requires a ~55% higher initial CAPEX it benefits from ~45% lower OPEX, making it an effective choice for EV mass production in the long run



*Above numbers are calculated assuming manufacturing of rear underbody for 100,000 EV units/year

FutureBridge perspective

A phased transition strategy is critical

Instead of an all-in shift, OEMs should prioritize Gigacasting for **high-volume, cost-sensitive models** while gradually scaling to full-body casting architectures

OEMs must shift cost evaluations from CAPEX-focused to lifecycle economics

Short-term investment concerns must give way to **long-term cost leadership**, where lower OPEX and material efficiency make Gigacasting a **non-negotiable for EV mass production**

Concerns about repairability, the complexity of replacements, and potential defects continue to pose challenges, impacting the current adoption of Gigacasting technology

Single part, big impact

- Gigacasting integrates multiple parts into a single unit, which increases the complexity of repairs.
- This added complexity can lead to longer vehicle downtime and increased labor costs.

FutureBridge perspective

23-30%

Longer repair times than traditional methods

Complex replacements

- Higher labor costs for Gigacasting repairs could significantly impact overall maintenance budgets, especially for frequent repairs driven by need for specialized skills

FutureBridge perspective

1.5X

Labor costs

Large cast, larger defects

- Imperfections in a single casting could lead to weaknesses in larger portions of the vehicle structure

FutureBridge perspective

2X

Parts replacement cost

Concerns raised by



In 2023, The French Automobile Distribution Federation (FEDA) warned that Gigacasting technology in vehicle production could increase repair costs and create environmental challenges due to difficulty recycling large parts. They urged the government to evaluate these risks.

Despite these challenges, repair costs are unlikely to hinder Gigacasting adoption, as OEMs are proactively enhancing repair techniques and bolstering supply chain resilience

Gigacasting benchmarked against stamping [for integrated rear parts]

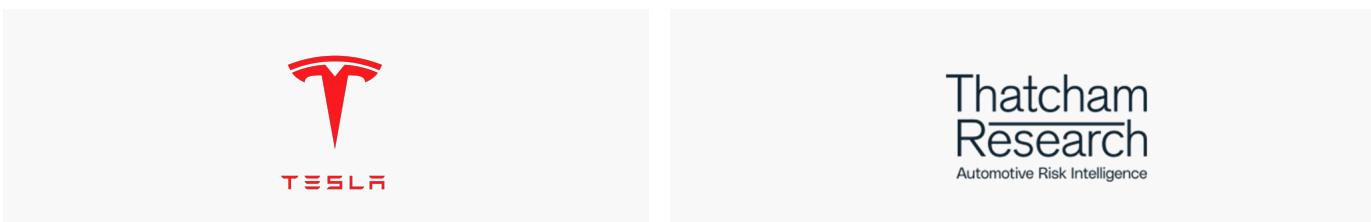
TRADITIONAL STAMPING	GIGACASTING
Repair feasibility	Replacement feasibility
10-50 mm crack <ul style="list-style-type: none">• Welding• Bolting• Patching	10-30 mm crack <ul style="list-style-type: none">• Welding
US\$ 100–600 <ul style="list-style-type: none">• After market price per part	US\$ 950–1500 <ul style="list-style-type: none">• After market price per part
Repair feasibility of giga casted parts is 33% less compared to conventional parts.	Gigacasting complicates replacement as instead of single part whole casting is replaced.

Key developments by stakeholders to mitigate aftermarket challenges in Gigacasting

Efforts being made to increase ease of availability for low-cost replacement parts in the market



Strategic partnerships executed for investigation of new repair techniques



FutureBridge insights

Investment-driven innovation will solve repair feasibility

As OEMs and equipment manufacturers ramp up Gigacasting investments, **expect advancements in repairability, aftermarket solutions, and localized supply chains**, strengthening sustainability and cost competitiveness

Tracking Gigacasting adoption is a competitive imperative

FutureBridge recommends stakeholders closely monitor how Tier 1 suppliers and OEMs scale Gigacasting, as **early adopters will set industry benchmarks** and define future strategic opportunities

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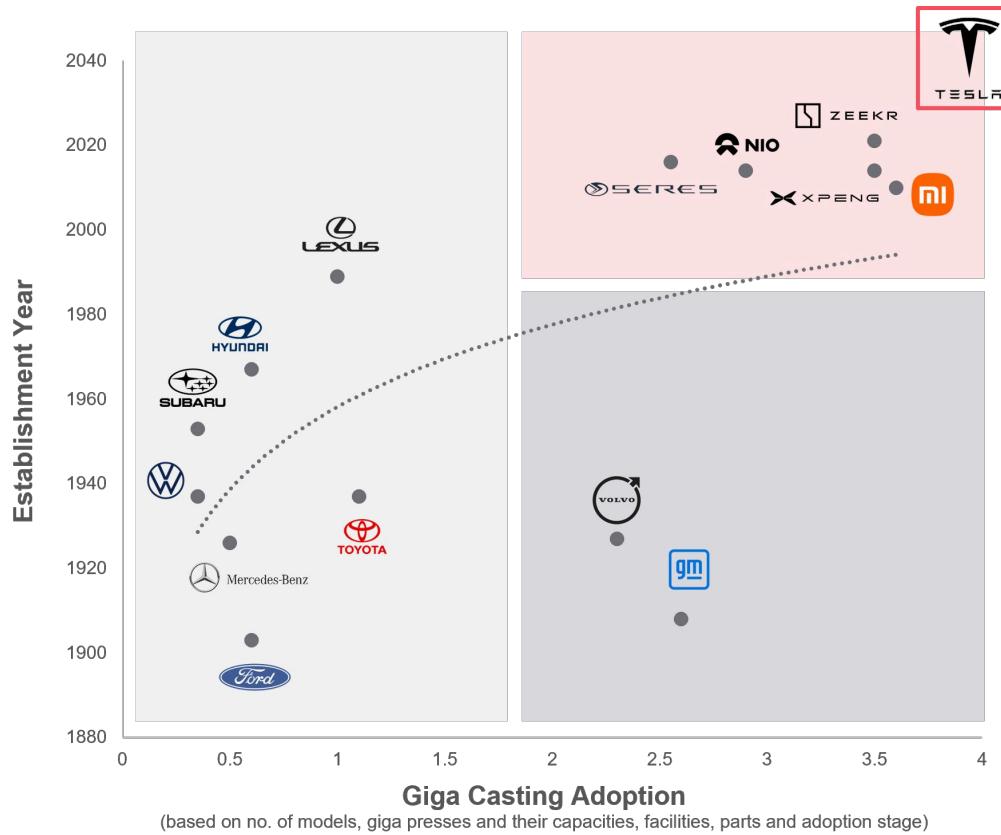
The Giga revolution: strategies for success

Start-ups vs legacy: Race towards competitive edge

Disruption in the value chain

Future roadmap

Gigacasting is reshaping the automotive landscape, with newer companies leading the charge and established players adapting to remain competitive



“Giga” leaders

- Tesla, pioneer in Gigacasting, started the industry trend
- Chinese EV start ups such as Zeker, Nio, and Seres, greenfield setups, production lines optimized for Gigacasting
- Lack of legacy systems giving them greater flexibility and efficiency

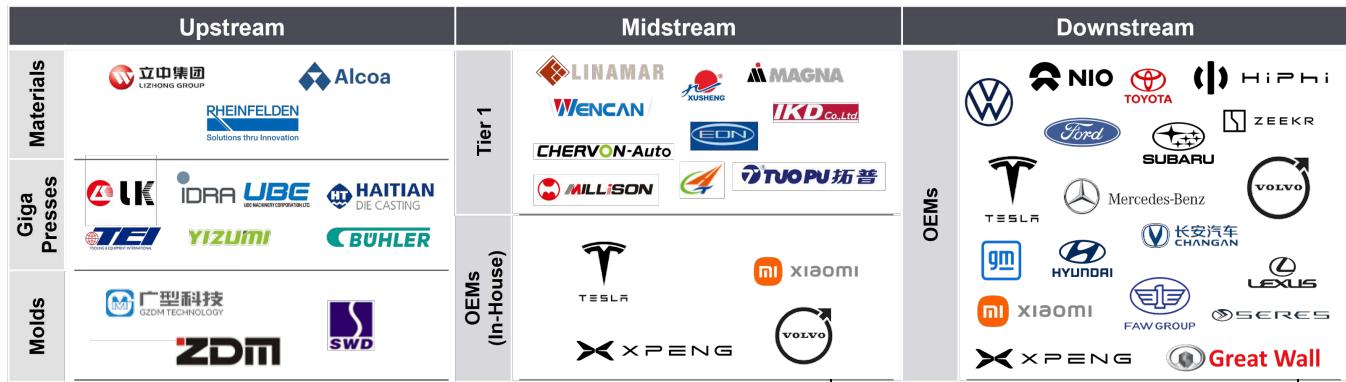
Forerunners

- Established companies including Volvo and GM, started greenfield production of EVs using Gigacasting
- Balancing innovation with tradition, leveraging existing resources and expertise

Seekers

- Larger, established companies such as Hyundai, VW, and Toyota are exploring Gigacasting potential through pilot projects and collaborations with Tier 1 suppliers
- Scale and resources can give them a competitive edge in the long run

Although in-house development is largely followed by the “Giga Leaders”, the manufacturing will ultimately shift to “Tier” players owing to mass production and scalability requirement



FutureBridge perspective

Upstream innovation in giga presses and materials will drive large-scale Gigacasting adoption, enabling **faster scaling and cost-efficient production** via OEM and Tier 1 partnerships

Automotive Tier 1 suppliers (Linamar, Guangdong Hongtu Technology, Ryobi, etc.) are transforming the landscape, **investing heavily in Gigacasting infrastructure** to offer OEMs a **scalable solution** that balances innovation with **risk-sharing**, bypassing heavy capital investments.

Seekers (Legacy OEMs) are expected to opt for **outsourcing** to Tier 1 suppliers, leveraging their advanced capabilities to avoid the capital risk of in-house Gigacasting while accelerating their **transition** to next-gen EV platforms

FutureBridge perspective



Our perspective on the future roadmap – emerging EV players will lead innovation, but legacy automakers will quickly catch up with tier 1 suppliers' support, reshaping the manufacturing landscape

EV startups: leading the way!

Emerging EV players such as Zeekr, and Xpeng, along with Tesla, the market leader, are set to continue spearheading Gigacasting adoption as their production lines are designed around the giga presses

Legacy players: navigating opportunities

Established players such as Toyota, GM, Volvo, Hyundai, will test Gigacasting via in-house capabilities for measuring success and collaborate with Tier 1 suppliers for mass production

Tier suppliers: catalysts for faster adoption

Tier 1 suppliers will start investing in Gigacasting infrastructure, empowering legacy automakers to scale while minimizing capital expenditures

Localization: regional revolution

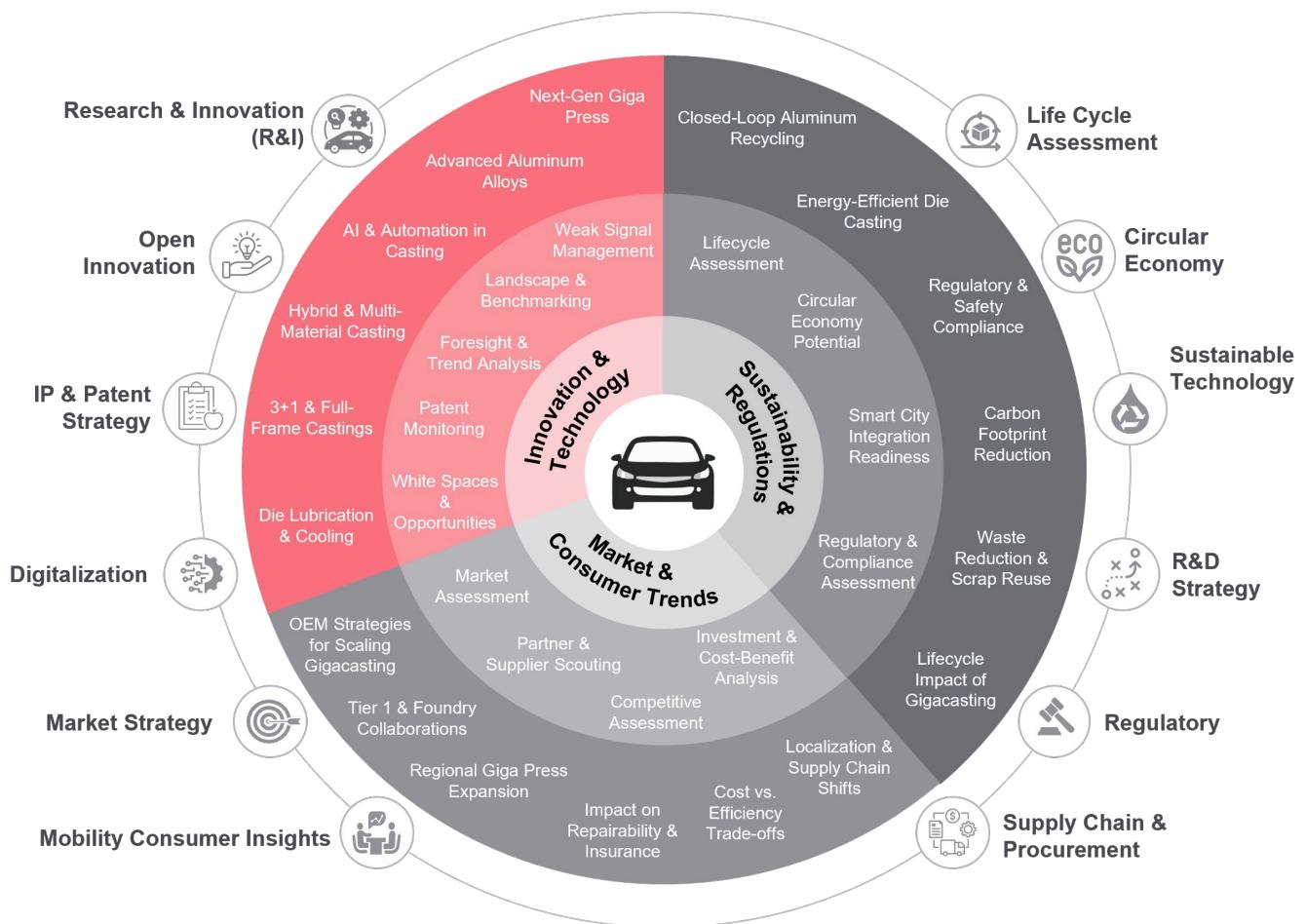
China and the US are currently leading in Gigacasting adoption. With push for sustainability and light weight vehicles, Europe will soon enter the fray

Short-term

Mid-term

Long-term

Start-ups focusing on in-house production	Legacy players entering the market	Expand to CV and support legacy players in mass production
Expect entrance of newer players	In-house production as a dip-test to measure success	Collaborate with tier players for large scale production
China and US to lead the Gigacasting economics	European players to follow the lead soon	Localization will push for global adoption
Testing investment and success with emerging players in PV		



FutureBridge's consulting support for mobility companies

3 Key mobility pillars

Indicative topics

Indicative assessments for which mobility players have collaborated with FutureBridge.

Our practice leaders



Ankur Vohra

Practice Head

Mobility & Industrial Business, FutureBridge

Business consulting and advisory leader with **25+ years of experience**, driving strategy and innovation for global mobility and industrial manufacturing organizations.



Arvind Sawarkar

Senior Director

Mobility & Industrial Business, FutureBridge

Business research, consulting, and advisory professional with **18+ years of experience** across industrial and mobility value chains.

Continue the conversation



Our addresses



North America

55 Madison Ave, Suite 400,
Morristown, NJ 07960, USA



Europe

WTC Utrecht, Stadsplateau 7,
3521 AZ Utrecht, The Netherlands



United Kingdom

Holborn Gate, 330 High Holborn,
London, WC1V 7QH, UK



Asia-Pacific

Millennium Business Park, Sector 3,
Building 4, Mahape, Navi Mumbai, India



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