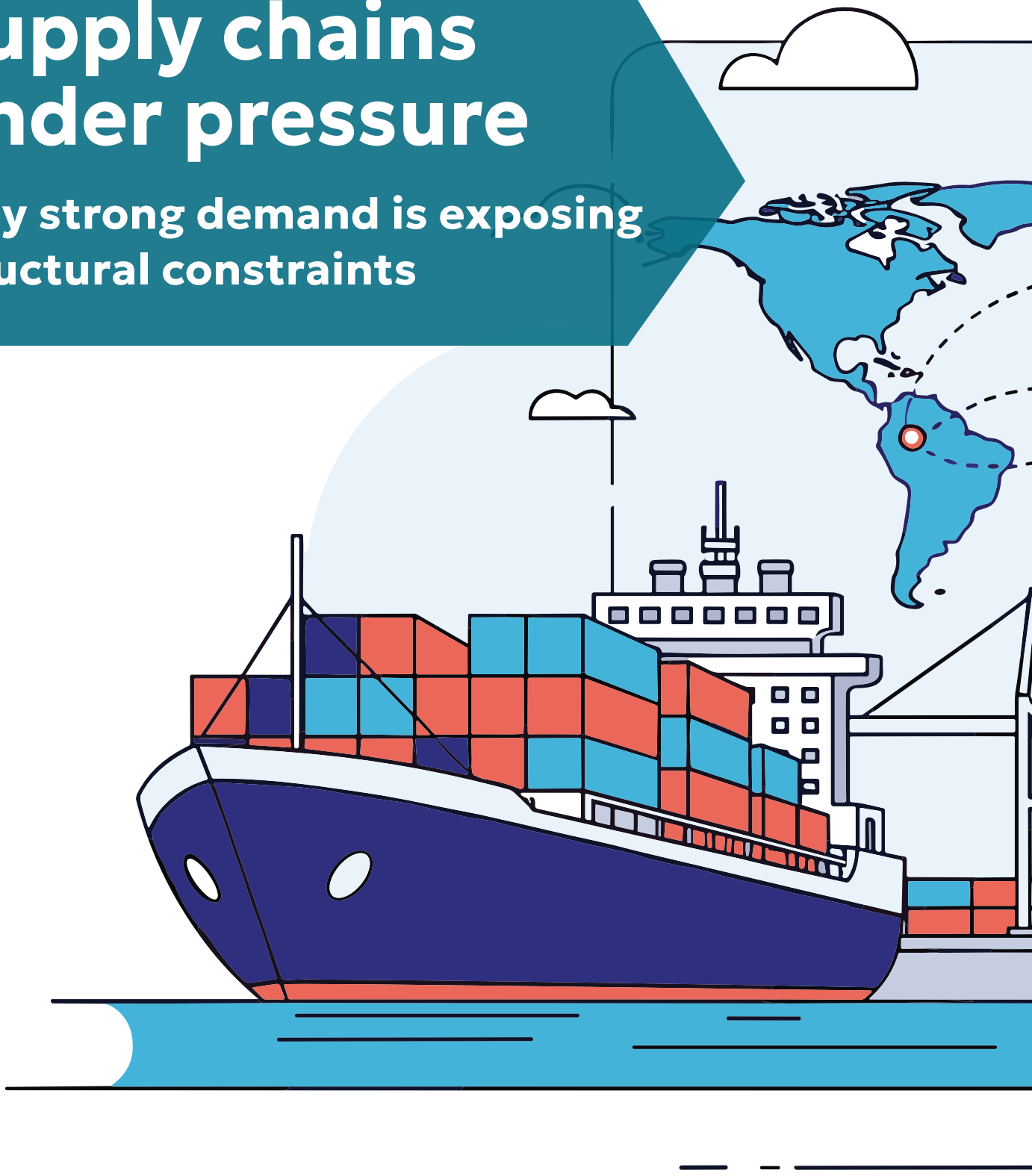
COLUMN

Supply chains under pressure

Why strong demand is exposing structural constraints



COLUMN

If demand for power equipment is rising, why are supply chains becoming more fragile rather than more secure?

In strong markets, supply chains are expected to become stronger, not weaker. In the transformer industry, however, they are revealing how little flexibility the system actually had.

Introduction

Demand has become the dominant theme across the transformer industry. Order books are strong, electrification is expanding across regions, and infrastructure investment is accelerating as part of the global energy transition. In this environment, strategic discussions naturally focus on growth.

Yet an equally important question is emerging beneath that growth: if the opportunity is so strong, why are supply chains becoming more fragile rather than more resilient?

In many industries, strong demand eventually encourages supply chains to expand, capacity to increase, and constraints to ease. In the transformer industry, the opposite has often happened. As demand has accelerated, bottlenecks have become more visible, lead times have stretched, and planning has become more defensive. What appears at first as a delivery problem increasingly looks like something deeper: a system operating with very little structural flexibility left. The system is not only busy. It is constrained.

This was one of the clearest signals emerging from the first stage of the Industry Navigator 2026 research and the subsequent discussion within the Transformer Champions Club. Among all challenge categories identified by industry participants, supply chain and lead-time issues dominated the responses. Importantly, careful analysis suggests they are not temporary disruptions but structural constraints.

Recent developments across materials supply, workforce availability, and logistics disruptions increasingly support this conclusion.

That distinction matters. Temporary disruptions can be absorbed. Structural constraints reshape how an industry operates.

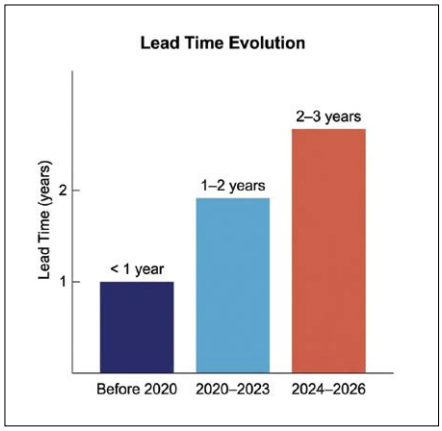
Will supply chains really adjust fast enough to meet demand?

Periods of strong market growth often produce a reassuring narrative: supply chains may struggle temporarily, but they will eventually adjust to meet demand. In the transformer industry, this assumption is becoming increasingly difficult to sustain.

The value chain depends on specialised materials, components, and processes. Grain-oriented electrical steel, specialised copper conductors, bushings, tap-changers, specialised insulation systems, testing capacity, and highly experienced engineering expertise form the backbone of transformer production. Weakness in any one of these areas can slow the entire system.

The 2024 Industry Navigator investment report illustrated this trend clearly. Typical lead times increased from less than one year before 2020 to one to two years by 2024. The report also predicted they would reach two to three years in the period 2024-2026, a forecast that has since proven accurate. At the same time, the availability of raw materials and components emerged as the most significant sourcing challenge, while core steel was identified as the single greatest materials-related risk to transformer manufacturing, a concern that has since proven well founded, as illustrated by production reductions by major suppliers such as thyssenkrupp in response to rising cost pressures.

These findings suggested that the system was not simply busy but constrained, a point already emphasised by Miguel Oliva of Hitachi Energy at Industry Navigator 2024 in Madrid.



Industry Navigator 2024 forecasted longer lead times, a prediction that has since proven accurate

Upstream reality: Bottlenecks start far from the transformer factory

One reason supply chain fragility is often misunderstood is that many of the most important bottlenecks occur far upstream from transformer manufacturing. In reality, the pressure often begins long before the transformer factory.

Many of the materials the industry depends on are produced in some of the most energy-intensive industrial processes in the world. Metal smelting provides a clear example of this dynamic. During the European energy crisis in 2022, several smelters reduced production because electricity prices made operation uneconomic. When such upstream facilities slow down, the consequences ripple through downstream industries long before they become visible in final equipment assembly.

The same dynamic applies to steel, copper processing, and other energy-intensive materials. When geopolitical tensions influence energy markets, transport routes, or industrial costs, supply constraints may first appear in smelters, mills, or refineries before eventually affecting transformer production.

Shipping disruptions illustrate the same principle. When major maritime routes become unstable or congested, transit times increase, freight costs rise, and supply schedules become less predictable. For industries dependent on large

components and long production cycles, logistics disruptions quickly translate into manufacturing delays.

In other words, many of the pressures affecting transformer delivery originate far upstream from the transformer factory.

The value chain depends on many specialised materials, components, and capabilities, and weakness in any one of them can slow the entire system

Geopolitics as an amplifier

Geopolitics alone does not explain the current situation. The transformer value chain already contained structural vulnerabilities: concentrated suppliers, long qualification cycles, and a limited pool of specialised expertise. However, geopolitical instability amplifies these weaknesses.

Local and regional conflicts, rising trade fragmentation, tariff uncertainty, and tensions affecting key maritime routes have all increased the risk profile of global supply chains. At the same time, these same geopolitical forces are accelerating investment in electricity infrastructure by strengthening the strategic importance of electrification, energy security, and system resilience.

This creates a paradox that is particularly relevant for the transformer industry: geopolitical instability may increase demand for electricity infrastructure while simultaneously making the supply chains needed to build that infrastructure more fragile.

Demand and uncertainty rise together.

Manufacturing hub not to be underestimated

Over the past decade, the Middle East has gradually evolved from a major energy producer into an increasingly important manufacturing base for energy infrastructure.

New transformer factories, aluminium smelters, copper processing facilities, conductor plants, and related industries have been established across the Gulf region, often in export-oriented free zones designed to supply global markets. These investments were supported by strong energy availability, strategic logistics positioning between continents, and industrial policies designed to attract manufacturing activity.

This development has quietly influenced parts of the global electrical-equipment supply chain.

If geopolitical instability in the region intensifies or conflict persists, the implications will extend beyond oil markets. Higher freight and insurance costs, export interruptions, or industrial disruptions could affect materials and components that feed directly into transformer production.

For the transformer industry, geopolitical instability creates a paradox: it can increase demand for electricity infrastructure while weakening the supply chains needed to build it

Pressures affecting transformer delivery often originate far upstream, in materials, energy markets, and geopolitics, long before they become visible at the transformer factory

In practice, workforce limitations and supply chain pressures often reinforce each other

In other words, a region traditionally viewed primarily as an energy supplier has also become a manufacturing node for the energy-infrastructure value chain itself.

The human side of supply chains

Another misconception is that supply chain challenges are primarily procurement issues. In reality, they are also capability issues.

The workforce research conducted in early 2025 revealed that the industry faces significant demographic and skills challenges. By late 2025, the first stage of the Industry Navigator 2026 research reinforced this insight from another perspective: shortages of skilled personnel increasingly affect design, supervision, manufacturing, quality assurance, and commissioning activities.

The 2024 investment research provided a striking indicator. At that time, the availability of staff was identified as the most significant constraint to expanding manufacturing capacity, and 45 % of respondents reported unused capacity due to labour shortages. The implication was clear: parts of the industry already had the physical capacity to increase output, but lacked the expertise needed to operate it fully.

In practice, workforce limitations and supply chain pressures often reinforce each other.

Could the next demand wave bypass transformers?

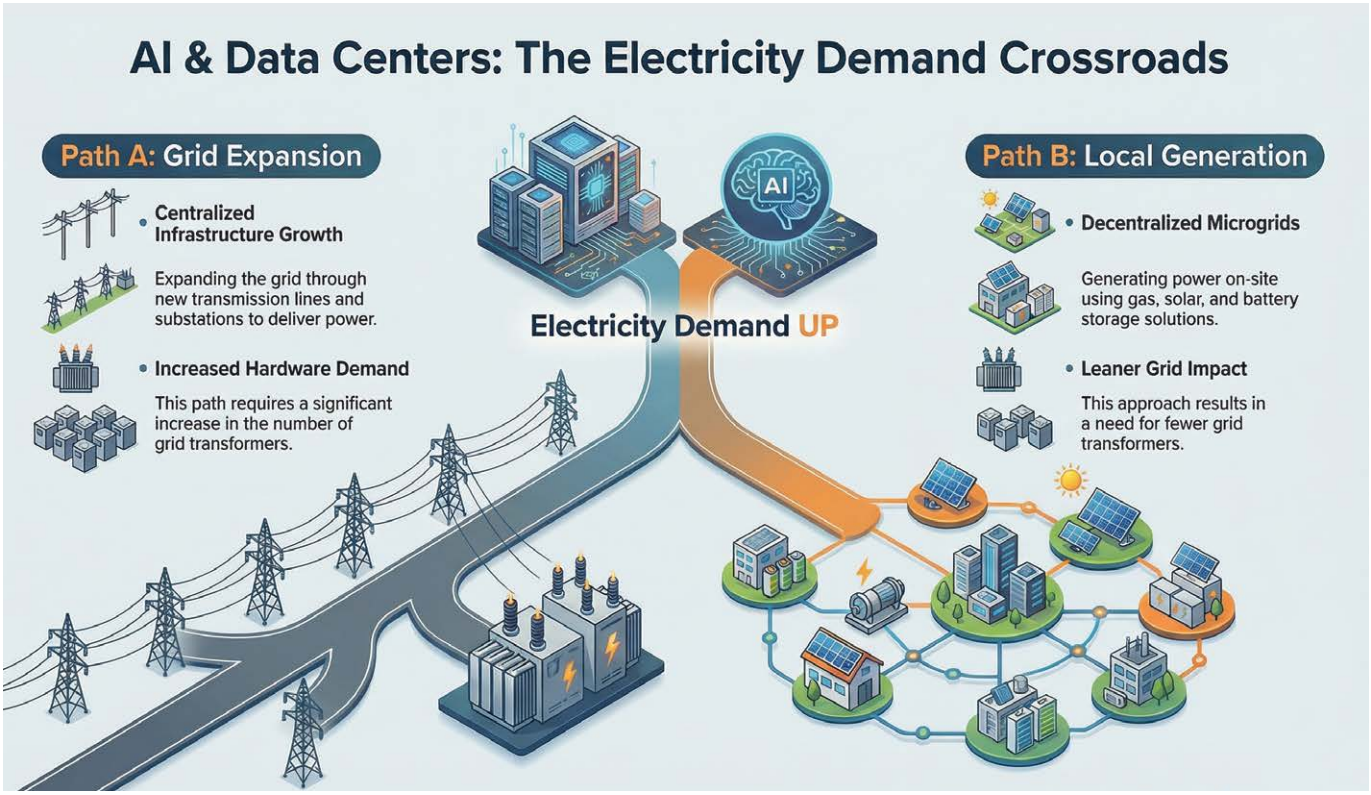
Another widely discussed driver of future transformer demand is the rapid expansion of data centres linked to artificial intelligence.

The logic appears straightforward: AI increases electricity demand, which requires more infrastructure, which in turn requires more transformers. However, this assumption depends on how that electricity is actually supplied. Yet the pathway from demand to infrastructure may be less linear than many assume.

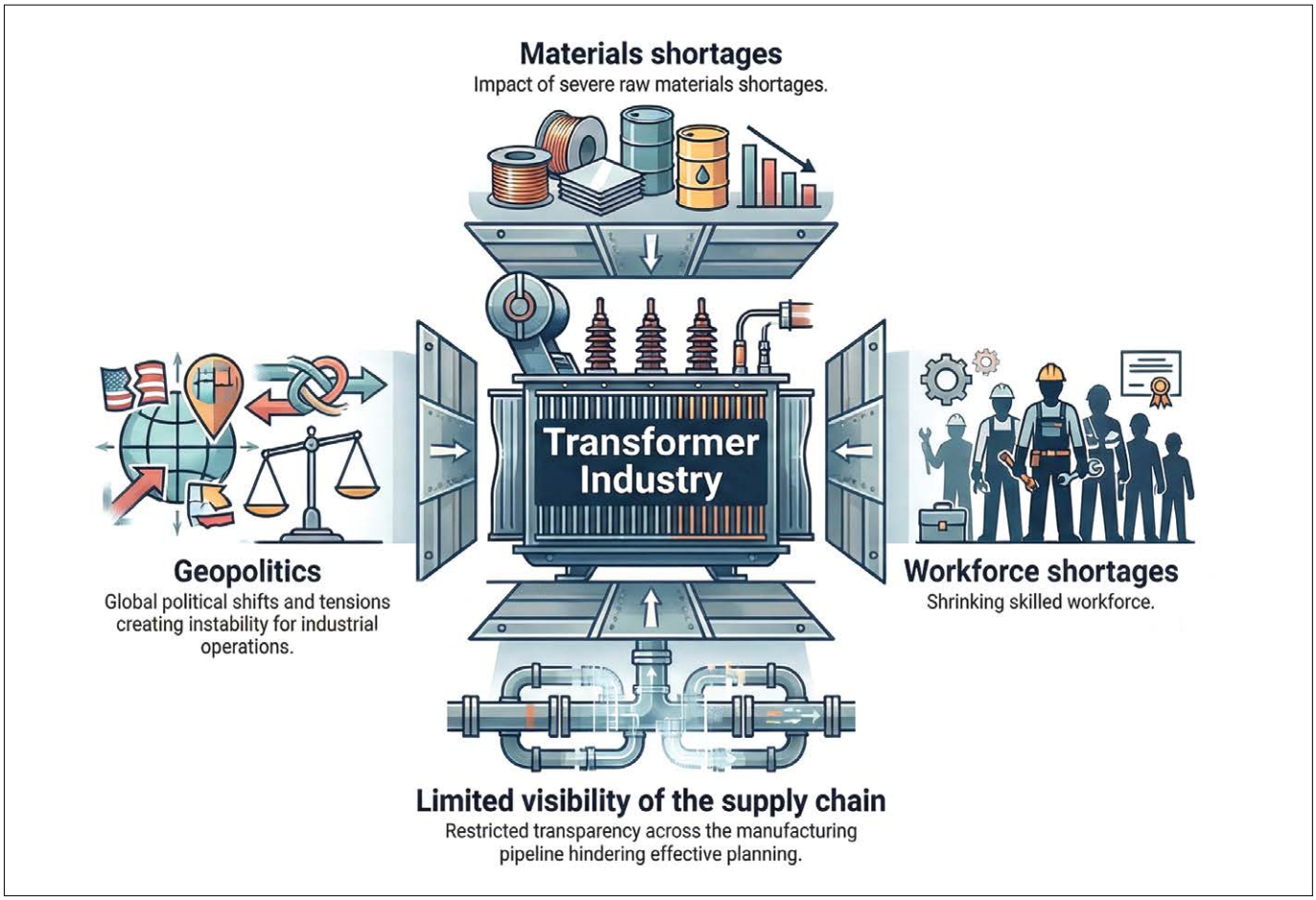
Transmission infrastructure development often moves far more slowly than digital infrastructure investment. In many regions, permitting, regulatory approvals, and construction timelines can extend over a decade. When electricity demand grows faster than transmission capacity, developers increasingly explore local energy solutions rather than waiting for grid expansion.

Transformers are required when new demand is supplied through the grid. If part of the next wave of data-centre capacity is powered by local generation such as gas-fired plants, solar installations, batteries, or hybrid microgrids, what is already happening, the pattern of transformer demand may shift. In such scenarios, the growth of electricity demand does not automatically translate into proportional growth of transformer demand.

AI development is advancing far faster than the electricity infrastructure re-



The next demand wave may not follow the grid



Multiple structural pressures interact across the transformer value chain

quired to support it. The power sector simply moves too slowly to keep pace.

For the transformer industry, this raises an important strategic question: do our expectations about future demand match how electricity will actually be supplied - through the grid or through local generation?

The real shortage may be visibility

Beneath all these pressures lies a more subtle challenge: the industry still lacks sufficient shared intelligence about where the most critical bottlenecks are emerging and how they interact.

The Transformer Champions Club has repeatedly emphasised the importance of supply-chain intelligence, and specification harmonisation precisely because many of these structural pressures remain poorly mapped at industry level.

Companies can observe their own supply chains. They cannot easily see the system as a whole.

The power sector moves too slowly to keep pace with AI development and to fully take advantage of the opportunities it offers

Without that visibility, organisations respond rationally but defensively: placing orders earlier, increasing inventories, seeking new suppliers, and negotiating long-term contracts. Each individual decision may make sense. Yet collectively they can create additional distortions across the system.

Looking ahead

The lesson emerging from recent research is both simple and uncomfortable. Supply chains in the transformer industry are under stress not because demand is weak, but because demand is strong in a system with limited flexibility, concentrated dependencies, growing geopolitical exposure, and insufficient shared visibility.

These costraints should therefore not be interpreted merely as operational inconveniences. They are early indicators of deeper structural pressure.

Understanding those pressures is not simply an operational task. It is a strategic responsibility. Only then can the industry answer the central question of this column: why supply chains weaken even as demand continues to grow.

In the next column, we will examine another dimension of the same challenge: when the signals the market interprets as “demand” do not mean what they appear to mean.

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