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Digital Transformation in the Electrical Manufacturing Industry: A Literature Review of Key Considerations and Strategic Priorities

Wael Ghazi Shaaban^{1*}

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ABSTRACT

This paper reviews the digital transformation landscape confronting the electrical manufacturing industry, examining the technological, operational, and strategic considerations that determine successful adoption. Drawing on industry reports, case studies, and recent literature, the study synthesizes emerging technology trends, including advanced connectivity, the Internet of Things, artificial intelligence, and big-data analytics, and their implications for electrical businesses transitioning toward Industry 4.0 practices. A risk framework is developed to categorize the principal threats and opportunities facing the sector, addressing challenges such as legacy-system interoperability, networking infrastructure gaps, high capital requirements, supply chain disruptions, and evolving data-governance regulations. Successful transformation practices from established organizations, including P&G, GE Digital, Schneider Electric, and Enel X, are examined to extract lessons applicable to the electrical manufacturing context. The findings indicate that a resilient technology foundation, anchored in enterprise resource planning and a coherent digital ecosystem, underpins sustained transformation, while regulatory, workforce, and infrastructure constraints remain significant barriers. The paper concludes by outlining the digital ambitions and priorities electrical businesses should pursue, including investment in data analytics capabilities, cybersecurity, and low-code/no-code enterprise tools, to remain competitive amid accelerating global sustainability and digitalization targets.

INTRODUCTION

The electrical manufacturing industry is undergoing a significant transformation driven by the convergence of digital technologies, evolving sustainability mandates, and shifting global supply chains. As renewable energy adoption accelerates and grid infrastructure modernizes, electrical manufacturers face mounting pressure to integrate advanced connectivity, artificial intelligence, and big-data analytics into their operations while managing legacy systems, capital constraints, and regulatory complexity.

Despite the growing body of literature on digital transformation in industrial sectors generally, comparatively little work has consolidated the specific considerations and priorities relevant to electrical manufacturing. This gap is significant because the sector combines capital-intensive infrastructure, stringent safety and data-governance requirements, and an accelerating shift toward low-carbon energy sources, all of which shape how digital transformation initiatives should be prioritized and executed.

This paper addresses this gap by reviewing recent industry reports, case studies, and academic literature to identify the emerging technologies reshaping the electrical industry, the principal risks and opportunities associated with their adoption, and the lessons learned from successful digital transformation efforts in comparable organizations. The objective is to provide electrical business leaders with a structured understanding of the technological trends, risk

landscape, and strategic priorities necessary to guide their digital transformation journey.

LITERATURE REVIEW

Emerging Technologies and Their Implications on Electrical Industry

Global Trends

(Chui & Yee, 2024) Global digital transformation is being shaped by electrification, renewable energy, advanced connectivity, and data-intensive technologies. Advanced connectivity, including IoT, is identified as a major technology trend, while investment in electrification and renewables continues to expand (Chui & Yee, 2024). The transition toward low-carbon energy also increases the need for digitally enabled infrastructure and data-driven operations.

The shift toward low-carbon energy is increasing the importance of digital technologies for energy planning and industrial operations. The International Energy Agency (International Energy Agency, 2023, 2024) highlights the growing role of smart grids, connected buildings, and integrated digital systems in supporting this transition.

(International Energy Agency, 2023) Examples from industry illustrate this direction. ABB's solar installation at an IKEA store in Singapore demonstrates how renewable-energy infrastructure can be integrated into large commercial operations (International Energy Agency, 2023).

¹ London Metropolitan University, Saudi Arabia

* Corresponding author's e-mail: Wael.shaaban@gmail.com

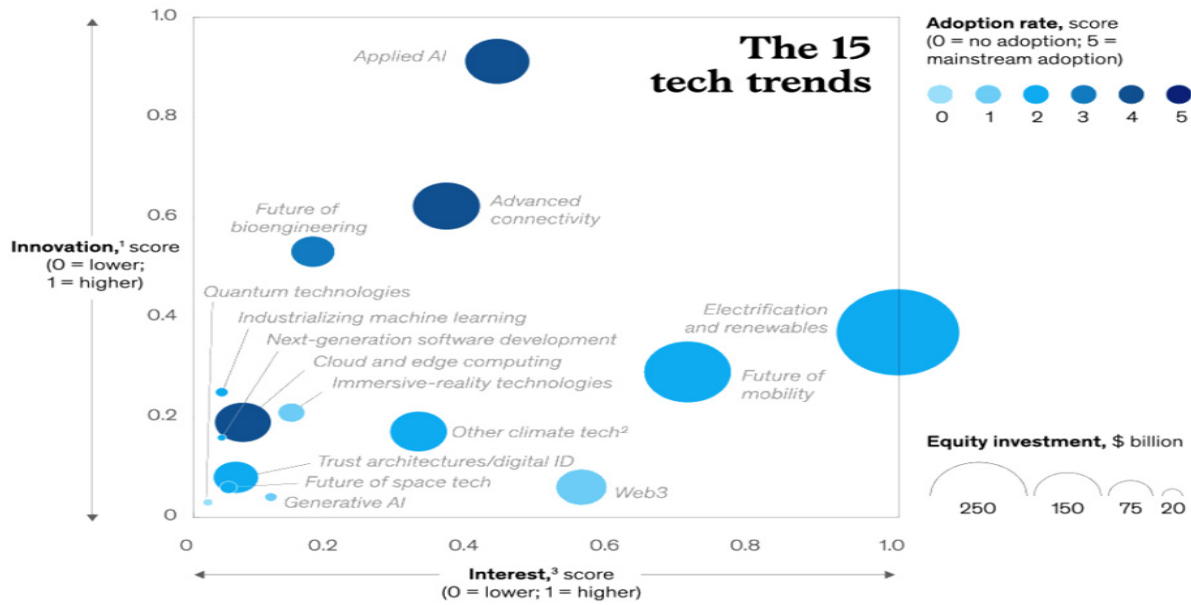


Figure 1: Top Fifteen Technological Trends
Source: McKinsey & Company - 2023

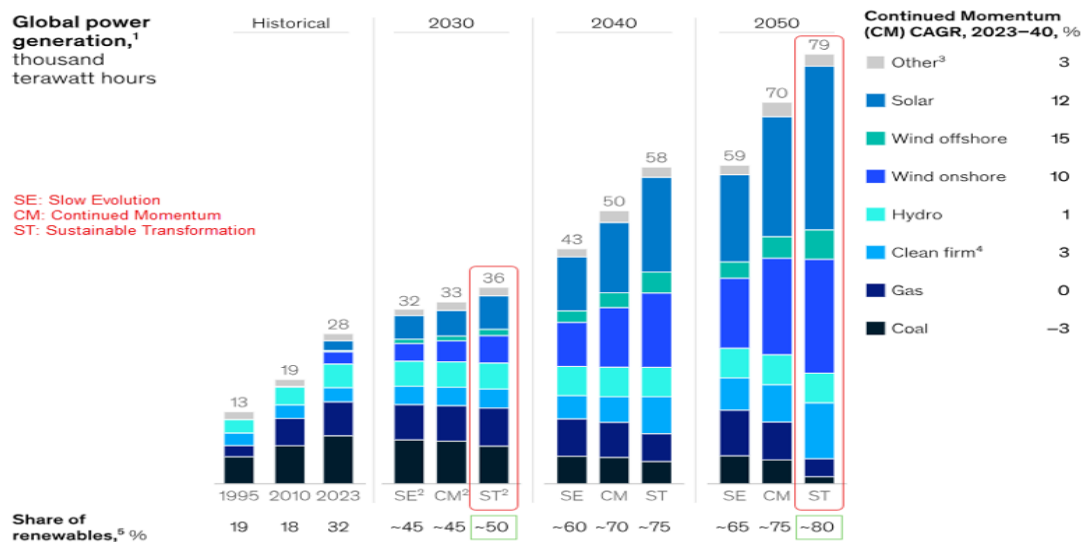


Figure 2: Projected Low-Carbon Energy Sources
Source: McKinsey & Company - 2023

(Deloitte, 2023) Deloitte (2023) similarly identifies innovation, supply-chain transformation, and climate and sustainability initiatives as major priorities for energy and resources organizations. These developments indicate that manufacturers require a strong technology foundation before scaling more advanced digital applications.

(Chui & Yee, 2024) Overall, the literature suggests that digital transformation in the electrical industry is not limited to adopting individual technologies; it requires coordinated changes in infrastructure, data, processes, and organizational capabilities (Chui & Yee, 2024).w

IE4 Implications on Electrical Business

Integrating Advanced Technologies (IoT, AI, and Big-Data) into Other Systems

(International Energy Agency, 2024) (International Energy Agency, 2023) IoT, AI, and big-data applications can improve smart-grid management, predictive control, spatial energy planning, and digital-twin applications. However, integrating these technologies with legacy systems can create interoperability, data-quality, cybersecurity, and reliability challenges (International Energy Agency, 2023, 2024).

The Need for New Networking Infrastructure

(International Energy Agency, 2023)(International Energy Agency, 2023)Grid-interactive technologies require advanced metering, smart inverters, storage, and other communication infrastructure. Older facilities may lack these capabilities, making infrastructure modernization an important prerequisite for wider digital adoption (International Energy Agency, 2023).

Power Consumption for Transition Initiatives

(Yao Doumon, 2024)Renewable-energy transitions also require complementary infrastructure such as batteries, wiring, and supporting structures. Their production, installation, and logistics add resource and energy requirements that must be considered in transformation planning (Yao Doumon, 2024).

High Capital Investment with Low Efficiency

(Yao Doumon, 2024)High investment requirements remain a further constraint. Renewable technologies involve substantial infrastructure, materials, storage, and specialist skills, while efficiency and lifecycle considerations influence the economic case for adoption (Yao Doumon, 2024).

JIT Supply and Operation Resilience

(Motyka, *et al.*, 2022)Global supply chains with uneven digital maturity can limit real-time visibility and increase disruption risk. Logistics bottlenecks, raw-material shortages, and labor gaps can raise costs and delay operations, strengthening the case for more resilient and digitally enabled supply-chain systems (Motyka *et al.*, 2022).

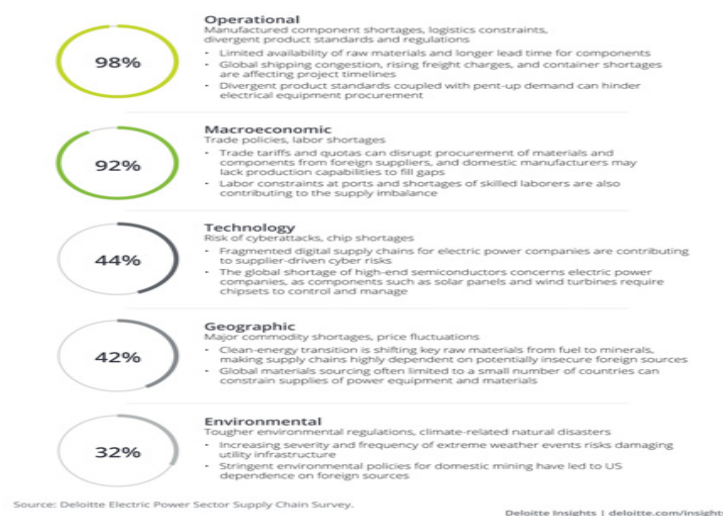


Figure 3: Main Supply Chain & Logistics Bottlenecks

Source: Deloitte

Electrical businesses therefore need supply-chain systems that improve visibility, resilience, and third-party risk management while supporting sustainability objectives.

IoT Data Management Regulations

(International Energy Agency, 2024)Digital integration can improve stakeholder coordination, but data-transfer requirements and regulatory differences remain barriers.

The absence of a common global data-sharing approach increases the importance of governance, interoperability, and workforce upskilling (International Energy Agency, 2024).

Standards and regulatory approaches also differ across jurisdictions, requiring organizations to align digital systems with applicable equipment, data, and cybersecurity requirements.

Table 1: Examples of Standards and Norms to Control and Monitor Equipment

Region	Document Name	Main Content
European Union	Norm EN 50631-1:2020: European Norm	Necessary control and monitoring for household appliances.
United Kingdom	PAS 1878:2021	Requirements and criteria for electrical energy smart appliances.
Australia	AS 4755 – Demand Response Standard	Demand response capability and modes of smart devices.
United States	ANSI/CTA-2045	Communication interface rules with residential energy devices
United States, California Only	Senate Bill 49 – The Flexible Demand Appliance Standards	Energy commission standards for flexible demand technologies.

International	IEC 62746-10-1	Automated demand response system interface between the smart system
International	OpenADR 3.0	Demand response system for two-way information exchange.

Source: IEA

Increasing Complexities

(International Energy Agency, 2024) As electrical systems become more connected, decision-making increasingly depends on diagnostic, predictive, and prescriptive analytics. This creates additional complexity in data volume, cybersecurity, infrastructure, computing requirements, and system integration (International

Energy Agency, 2024).

(International Energy Agency, 2024) The six characteristics of big data—often described through volume, velocity, variety, value, veracity, and variability—make analytics a strategic capability rather than a supporting function. Electrical organizations therefore need appropriate analytical skills and tools across design, deployment, and

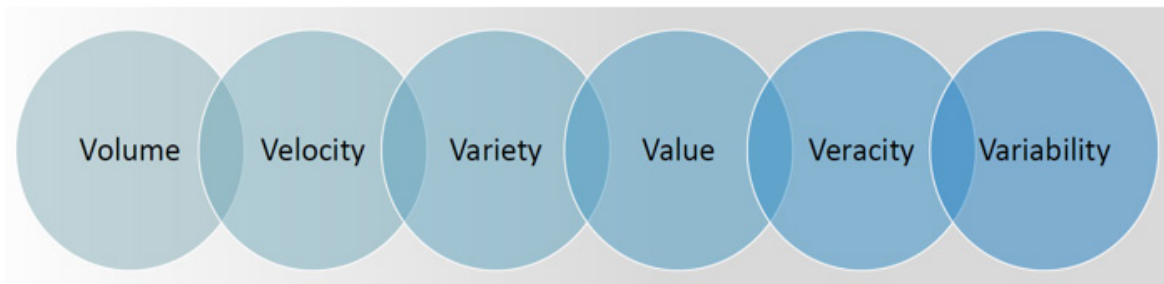


Figure 4: Data 6Vs

Source: LMU & NEXT 2024

maintenance activities (International Energy Agency, 2024).

(Davenport & Adnan, 2016) Data analytics must also

protect confidentiality, integrity, and availability through appropriate cybersecurity controls. These requirements

are particularly important as connected devices and



Figure 5: Data CIA Aspects

Source: Author's Findings

digital energy systems increase the scale and sensitivity of operational data (Davenport & Adnan, 2016).

(International Energy Agency, 2024) (EPOCH AI, 2024) The increasing digitization of electricity sources, infrastructure, devices, and consumption patterns is generating rapidly expanding data volumes. This growth increases demand for data centers, computing capacity, semiconductor supply, and AI/ML capabilities, creating a parallel energy-consumption challenge (International Energy Agency, 2024).

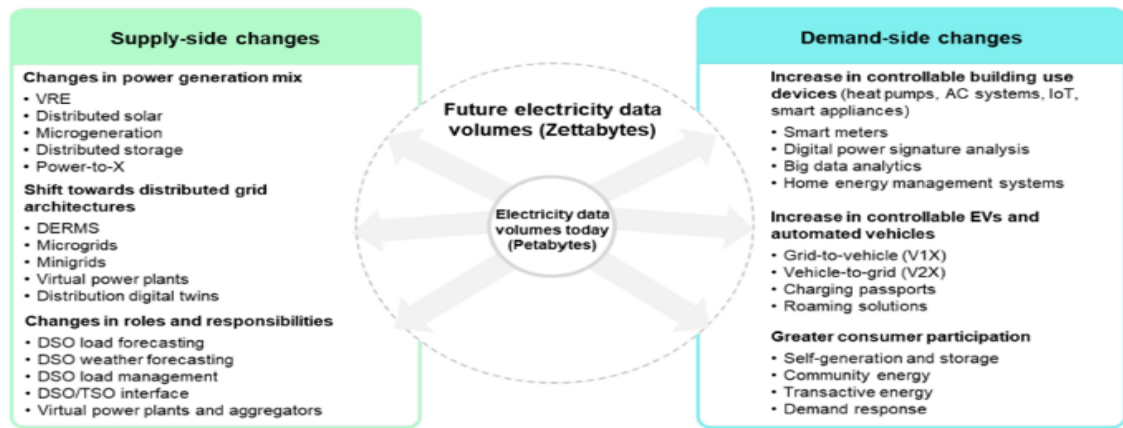
(Semianalysis, 2024) The growing energy requirements of

digital infrastructure illustrate a key transformation trade-off: technologies intended to improve efficiency can themselves create additional electricity demand.

The rapid expansion of connected IoT devices reinforces this challenge and highlights the need for scalable data-management and cybersecurity capabilities.

(International Energy Agency, 2024) (International Energy Agency, 2024) Finally, decentralized digital power systems operate across different technologies and maturity levels, creating integration and reliability

Drivers of electricity data volume and increasing complexity



IEA. CC BY 4.0.

Notes: AC = air conditioning; DERMS = distributed energy resources management system; DSO: distribution system operators; IoT = Internet of Things; TSO = transmission system operator; VRE = variable renewable energy.

Figure 6: Drivers of Electricity Data Complexity

Source: IEA

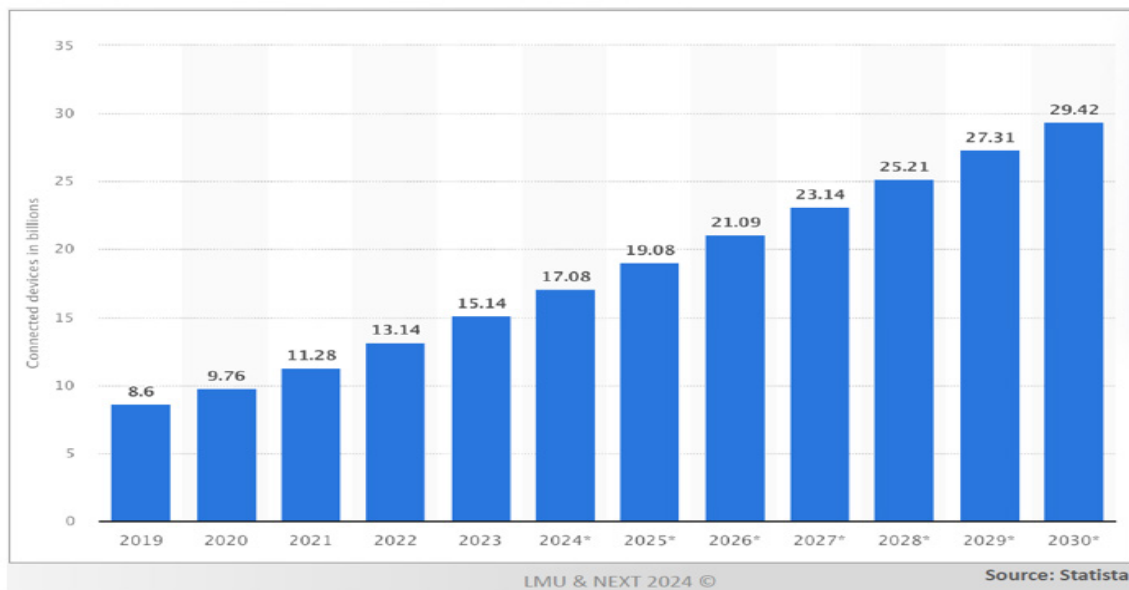


Figure 7: Number of Annually- Connected IoT Devices

Source: Statista

challenges. National registers and similar initiatives can improve visibility of distributed energy resources, but questions of data ownership, access, and commercial value remain important (International Energy Agency, 2024).

Successful Practices & Lessons Learned Successful Early Transformations

(Rogers, 2016)(Saldanha, 2019)Early digital

transformation initiatives commonly addressed customer experience, competition, data, innovation, and value creation (Rogers, 2016). Saldanha (2019) similarly emphasizes the importance of organizational alignment and execution. These experiences suggest that technology investment must be accompanied by changes in operating models and organizational capabilities.

Table 2: Examples of Early Transformation in the Five DT Domains

Firm	DT Main Domain	DT Main Strategic Initiative
	Rethinking Customer	DBS launched its joyful mobile banking wallet PayLah (2014), with a digital KYC for all the customer's lifestyle needs. DBS customer centricity was at highest priority.
	Rethinking Competition	Uber built a business model which value is created by its partners, with its platform acting as the critical connection point. Uber value creation was at highest priority.
	Rethinking Data	TWC has re-utilized source data as a key strategic asset and, increasingly, as a source of new market research innovation. TWC big-data utilization was at highest priority
	Rethinking Innovation	Amazon utilized rapid experimentation and multivariate testing paving the way for its partners to refine their online services. Amazon connectivity was at highest priority.
	Rethinking Value	New York Times Company has innovated its business model into a digital format offering an online trusted source of news. New York Times operating model was at highest priority.

Source: (Gupta, 2018)

P&G

(Saldanha, 2019)(Williams, 2018)P&G's integration of Gillette illustrates how digitalization can support supply-chain integration and data-driven decision-making. The organizations used integration practices to combine capabilities and improve operational visibility (Saldanha, 2019; Williams, 2018).

(Saldanha, 2019)The case indicates that digital transformation can create operational value when analytics, process integration, and organizational alignment are pursued together.

Transformations in Electrical Business Domain

GE Digital

(Reuters, 2017)(Platform9, 2021)GE Digital's experience

demonstrates the risks of pursuing industrial connectivity without sufficient strategic focus. The Predix initiative sought to connect industrial assets to cloud-based analytics, but challenges included business-strategy focus, ecosystem constraints, uncertain returns, and integration across diverse business units (Platform9, 2021; Reuters, 2017).

(Platform9, 2021)The case nevertheless shows the potential of cloud-based industrial platforms when digital capabilities are aligned with operational and market requirements.

(Zippia, 2023)GE's later approach to Predix illustrates a shift toward service-oriented capabilities and cloud infrastructure, reinforcing the importance of adaptable digital architecture (GE, 2023).



Figure 8: General Electric Predix structure

Source: (GE, 2023)

Schneider Electric

(Schneider Electric, 2023) Schneider Electric's transformation program focused on digitizing production and supply-chain processes, workforce enablement, and resource optimization. The company's reported outcomes include lower energy use and reduced downtime and maintenance costs, illustrating the operational potential

of connected industrial systems (Schneider Electric, 2023).

(Schneider Electric, 2023) The case also highlights the value of connecting manufacturing plants, supply chains, and distribution operations through an integrated digital ecosystem.

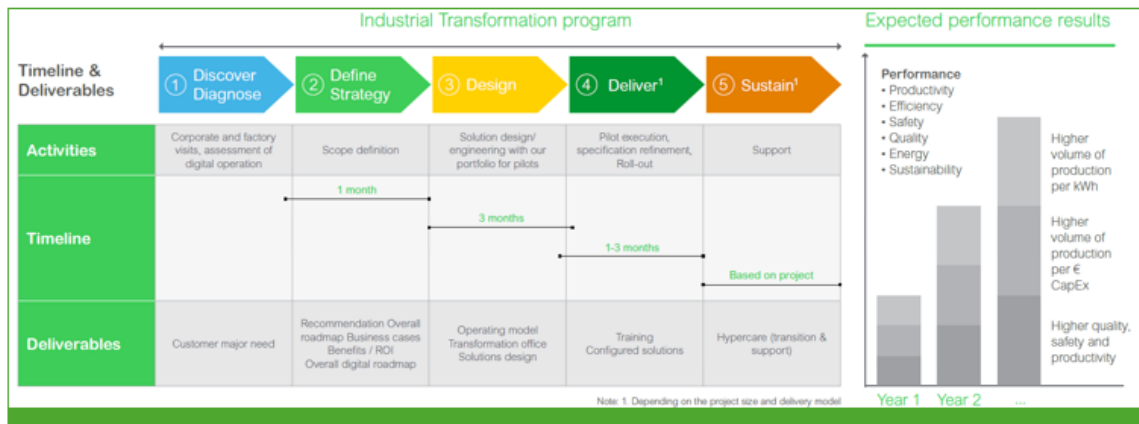


Figure 9: Schneider's Industrial Transformation Program

Source: (Schneider Electric, 2023)

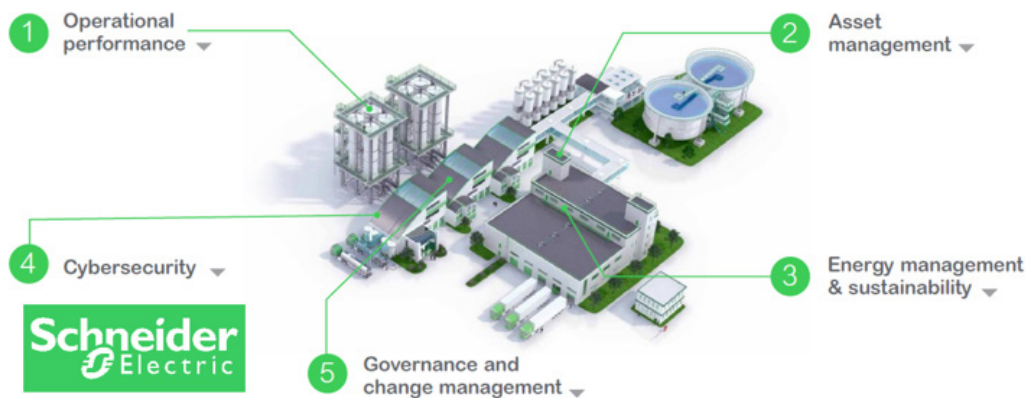


Figure 10: Schneider's DT Domains

Source: (Schneider Electric, 2023)

Enel X

(CHESBROUGH, 2020) Enel established Enel X to support digital transformation in e-industries, e-mobility, and smart-energy services. The initiative combined digitalization with new service models and supported diversification beyond traditional utility activities (Chesbrough, 2020).

Its experience illustrates how organizational culture and

digital capabilities can support new value streams, energy-efficiency services, and sustainability-oriented business models.

(Enel, 2024) Enel's battery-energy-storage activities further demonstrate the relationship between digital transformation, electrification, and renewable-energy integration (Enel, 2024).



Figure 11: BESS by Enel Green Power - Italy

Source: Enel Media

MATERIALS AND METHODS

This study adopts a qualitative, narrative literature review approach to synthesize evidence on digital transformation in the electrical manufacturing industry. Secondary sources were drawn from industry reports and white papers published by leading consulting and research organizations, including McKinsey & Company, Deloitte, the International Energy Agency (IEA), Gartner, KPMG, and PwC, alongside documented corporate case studies and academic literature, covering material published predominantly between 2016 and 2024. Sources were selected for their relevance to electrical and energy-

sector digital transformation, technology adoption trends, risk management, and enterprise architecture, and were thematically synthesized to identify recurring technological trends, risks, opportunities, and successful practices.

To study the risks (threats and opportunities) facing electrical business, a risk framework -addressing risk impact and probability- is developed as shown in the below two tables.

RESULTS AND DISCUSSIONS

Business Risks (Threats and Opportunities)

Table 3: Electrical business Risk Impact Rates

Rate	Weight	Risk Impact
Low	1	Uncertainties impacting (P&L) profit and loss.
Medium	2	Changes in industry basic assumptions impacting the electrical market.
High	3	Disruptions and/or innovations impacting the whole energy industry.

Source: Author's Findings

Table 4: Electrical Business Risk Probabilities

Rate	Weight	Risk Likelihood
Low	1	Never been addressed
Medium	2	Expected
High	3	Addressed with evidence

Source: Author's Findings

Based on the abovementioned, the electrical business risk framework will be as illustrated below in Table 10:

Table 5: Electrical business Risk Framework

Probability / Impact	Low Impact	Medium Impact	High Impact
High Probability	$3 \times 1 = 3$	$3 \times 2 = 6$	$3 \times 3 = 9$
Medium Probability	$2 \times 1 = 2$	$2 \times 2 = 4$	$2 \times 3 = 6$
Low Probability	$1 \times 1 = 1$	$1 \times 2 = 2$	$1 \times 3 = 3$
Risk Rate = Probability multiplied by Impact			

Source: Author's Findings

Reference (4.1.2) ten threats and opportunities will be identified throughout the following paragraphs

Main Five Threats

Table 6: Main Threats Surrounding Electrical Industry

Integration Challenges with Legacy Systems	
Rate: 9	High Probability and High Impact
Mitigations	• Develop a phased roadmap for upgrading legacy systems and integrating IE4 technologies. • Invest in middleware solutions that bridge digital and legacy infrastructure. • Conduct workforce training to enhance technology utilization.
High Capital Investment with Limited Efficiency	
Rate: 6	High Probability and Medium Impact
Mitigations	• Leverage public-private partnerships to share financial risks. • Invest in R&D to explore higher-efficiency renewable technologies, like perovskite solar cells. • Utilize government subsidies and tax incentives for clean energy initiatives.
Supply Chain Disruptions	
Rate: 6	High Probability and Medium Impact
Mitigations	• Diversify suppliers and establish long-term partnership strategy. • Adopt AI-powered supply chain predictive analytics for planning, ordering, monitoring, and tracking. • Implement contingency planning for critical resources.

Increasing Energy Consumption for Transition Initiatives	
Rate: 6	High Probability and Medium Impact
Mitigations	• Develop a robust cybersecurity framework aligned with global standards. • Enhance real-time monitoring and threat detection using AI tools. • Collaborate with regulatory bodies to assure compliance with data governance laws.

Source: Author's Findings

Main Five Opportunities

Table 7: Main Opportunities Surrounding Electrical Industry

Advanced Grid-Interactive Technologies	
Rate: 9	High Probability and High Impact
Accelerations	• Invest in deployment and R&D of smart grid technologies, including advanced metering and demand-response systems. • Integrate energy storage solutions (e.g., batteries) to stabilize operation and renewable energy supply. • Partner with electrical cars and mechanical instrument manufacturers to advance smart powering solutions.
Growth in Renewable Energy	
Rate: 6	High Probability and Medium Impact
Accelerations	• Invest in expanding renewable energy projects like solar, wind farms, and green hydrogen. • Collaborate with governments to align renewable strategies with national sustainability goals. • Scale design and production capabilities to meet increasing global demand for clean energy solutions.
Enhanced Data Analytics for Decision-Making	
Rate: 6	High Probability and Medium Impact
Accelerations	• Invest in digital twins to simulate and optimize electrical grid performance and future consumption planning. • Utilize AI and Big Data for predictive planning. • Integrate real-time performance dashboards for grid and energy system monitoring.
Potential of Supply Chain Eco-Systems	
Rate: 6	High Probability and Medium Impact
Accelerations	• Implement blockchain-based platforms for end-to-end visibility and partnership in supply chains and financial institutions. • Adopt IE4 to digitize procurement, inventory, and logistics. • Establish regional assembly hubs (JIT and semi-JIT) to reduce lead times and dependency on distant suppliers.
Wide IoT Adoption for Real-Time Monitoring	
Rate: 6	High Probability and Medium Impact
Accelerations	• Collaborate with governments and real-estate firms to align and enhance renewable strategies with national sustainability goals. • Enhance smart city and energy efficiency projects using IoT-enabled energy monitoring solutions. • Integrate IoT across facilities' plants and grids to monitor energy use, faults, compliance, deviations, and utilization.

Source: Author's Findings

Digital Ambition and Priorities

Gartner expects that value stream management platforms and industry cloud platforms improvements will continue

till after 2030 (Gartner, 2023) which gives ambitious to electrical leaders in their big-data investments (Figure 12). Reference 4.2, successful transformation stories share

a unique theme of their technology capabilities which foundation is the ERP and their cornerstone is the digital eco-system that enables data-driven innovative culture

and pave the way for achieving ExO attributes through an evolving MTP (Figure 13). Company's MTP, in turn, provides a long-term goal

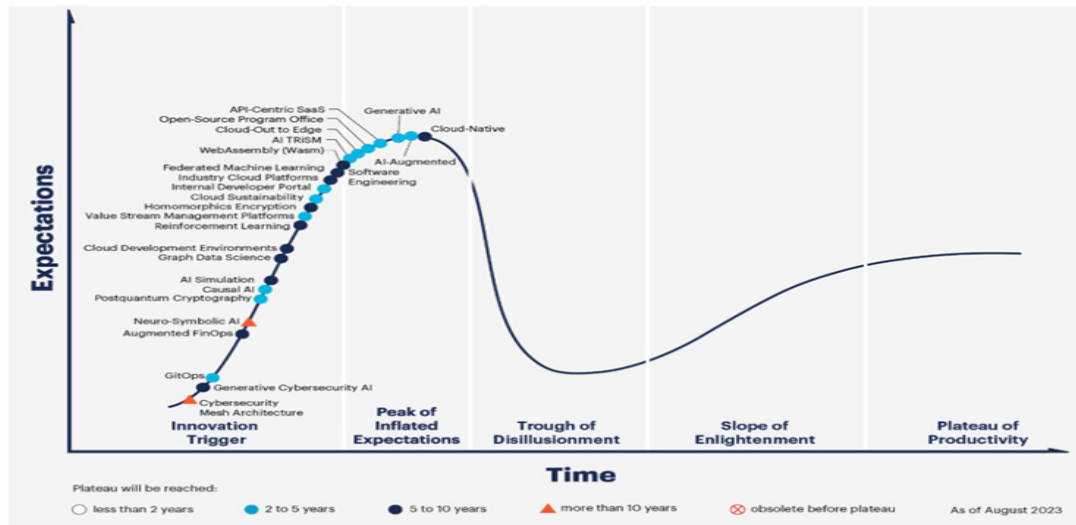


Figure 12: Hype Cycle for Emerging Technologies
Source: Enel Media

-through the growing application of Peter's Six Ds to computing: Digitalization, Deception, Disruption, Demonetization, Dematerialization Democratization - for the whole company so sweeping and profound that it is always within reach yet always unreachable (Ismail, *et al.*, 2023). ERPs 1st outcome is data management whereas data

analytics achieved an ROI at 10% to 25% (Gartner, 2023). However, business leaders still expect that advanced data analytics with AI and ML application will make 33% ROV in terms of efficiency, productivity, innovation, and growth (Smith, *et al.*, 2024). Gartner insists that although ERP applications leverage automation of business operation, including processes,

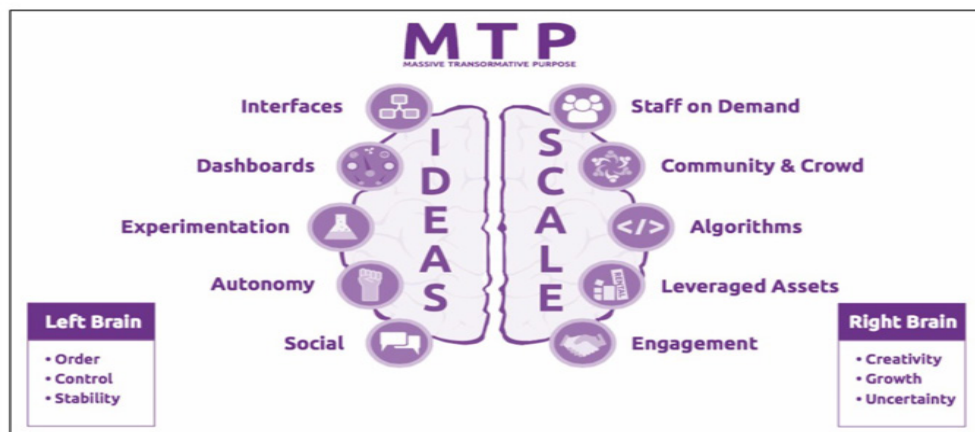


Figure 13: MTP Attributes
Source: (Ismail, *et al.*, 2023)

interface, and asset management, companies still need to modernize their digital initiatives through AI driven by business value (Gartner, 2024), this gives more priority to create a cloud ERP strategy and evaluate the most proper technologies -among IE4 enablers- that serve the projected business goals, and reduces the cost risk and impact of legacy systems by answering a key question "what's in it for us?" (Kienast, 2024). Upon this conclusion, companies shall assure both

visibility and control of current operations, but without blocking the agility which enables shifting a company into an ExO when using monolithic IT enterprise architecture along a strategic approach that targets gradual (but continuous) AI value creation, especially in the core ERP (Figure 14). Additionally, Forrester reports that more than 80% of corporations, who deployed advanced ERP capabilities (i.e. AI Powered Cloud S4/Hana), achieved intelligent

improvements, better real-time data utilization, and streamlined operations (Davison, *et al.*, 2019). It also reported, through a study made about four similar-size

organizations, two of them run a manufacturing business, that a successful S4/Hana implementation has a payback period of 13 months, adding an NPV of \$21.9 million



Figure 14: Hype Cycle of ERP 2023

Source: Gartner

and an ROI of 134% (Figure 15).

On top of the above-mentioned, centralized COE (Figure 16), usually run over a unified ERP, helps 71% of GBS firms to achieve digitization with 83% strategy focus on standardization and digitalization, and with 70% on

value-adding services (Weuster & Hiecke-Richter, 2023). Such GBS will require an ESM tool to bridge the ERP with the targeted user experience. Multinational organizations deploy ServiceNow since its ranked as best service technology workflow platform by Gartner

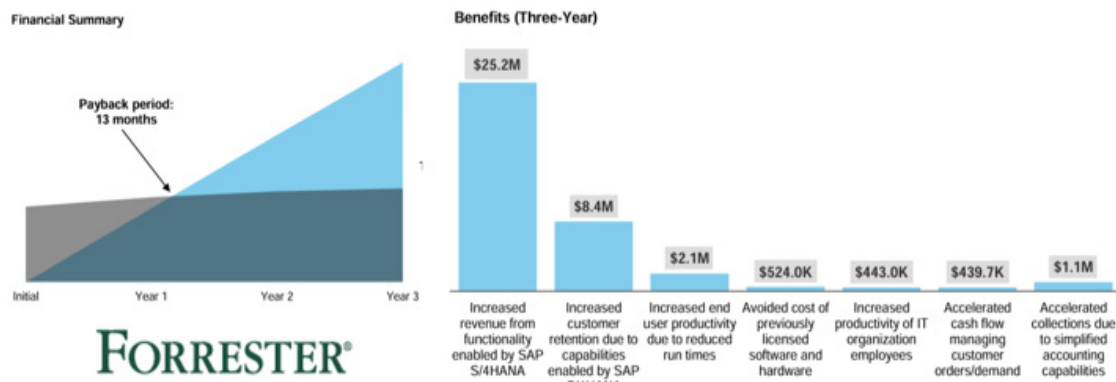


Figure 15: Total Economic Impact of SAP S/4 HANA

Source: Forrester

(Bacon, 2024).

Finally, it is crucial to build a low-code/no-code capability to maintain a clean-core ERP and benefit from the cloud

benefits provided via regular updates and cybersecurity enhancements; ServiceNow's low-code/no-code App engine empower both professional development of end-

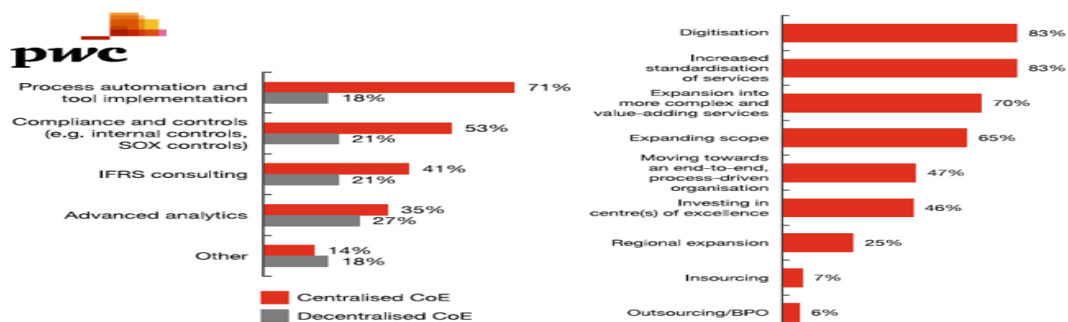


Figure 16: GBS Role and Strategy Focus

Source: PwC

to-end ESM interfaces and also non-technical business applications through visual interfaces and pre-built components which integrate almost all ERPs (Coforge, 2022). Service application development agility can then accelerate design thinking cycles, foster innovation, and allows for swift adaptation to changing business

requirements (ServiceNow, 2023).

Priorities

Along the key global findings, shown in Figure 17, there are specific priorities for all transforming businesses and most of them surround the value creation (KPMG, 2024).



Figure 17: Global Key Findings

Sources: (KPMG, 2024)

KPMG insists that international firms shall consider priorities illustrated in the below figure.

Willing-to-Pay Priorities		Willing-to-Sell Priorities	
1	Customer Trust		Ecosystem
2	Speed of Service		Automation
3	Convenience		Employee Satisfaction
4	Cybersecurity		Business Development
5	Engagement		ESG Commitment

Figure 18: Global Priorities

Sources: (KPMG, 2023)

Simultaneously, PWC reports five technological priorities (Figure 19). These priorities are addressed by GBS

organizations at different rates (Weuster & Hiecke-Richter, 2023).

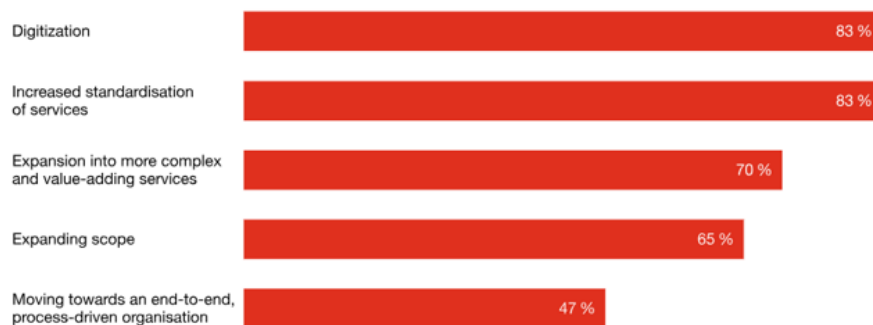


Figure 19: GBS Organizations' Priorities

Sources: PWC

CONCLUSION

This review shows that digital transformation in the electrical manufacturing industry depends on the combined development of technology, infrastructure, data capabilities, and organizational readiness. IoT, AI, advanced connectivity, and big-data analytics can support efficiency, innovation, sustainability, and operational resilience, but adoption is constrained by legacy-system interoperability, infrastructure requirements, capital costs, supply-chain disruption, cybersecurity, and fragmented data-governance requirements. Evidence from P&G,

GE Digital, Schneider Electric, and Enel X indicates that transformation is more sustainable when digital initiatives are aligned with business strategy and supported by an integrated technology foundation. Electrical businesses should therefore prioritize data analytics, cybersecurity, workforce upskilling, resilient supply-chain systems, and flexible enterprise technologies such as cloud and low-code/no-code platforms. The review is limited by its reliance on secondary sources; future empirical case studies and survey research could further validate these findings.

REFERENCES

- Bacon, S. (2024). *ServiceNow ranks No. 1 and No. 2 in technology workflow markets in Gartner® market share, 2023*. <https://www.servicenow.com/blogs/2024/technology-workflow-gartner-market-share>
- Chesbrough, H. (2020). *Enel X: Driving digital transformation in the energy sector*. <https://cases.haas.berkeley.edu/assets/documents/2021-best-case-award-enelx-preview.pdf>
- Chui, M., & Yee, L. (2024). *Tech trends worth your time*. <https://www.mckinsey.com/featured-insights/sustainable-inclusive-growth/chart-of-the-day/tech-trends-worth-your-time>
- Coforge. (2022). *ServiceNow's low-code/no-code App Engine and its advantages*. <https://www.coforge.com/what-we-know/blog/servicenows-low-code-no-code-app-engine-and-its-advantages>
- Davenport, T. H., & Adnan, A. (2016). *The future of cybersecurity in analytics and automation*. <https://www2.deloitte.com/us/en/insights/topics/analytics/future-of-cybersecurity-in-analytics-automation.html>
- Davison, D., Cavallaro, R., & Capaldo, A. (2019). *The total economic impact™ of SAP S/4HANA*.
- Deloitte. (2023). *Deloitte insights magazine (Issue 31)*. https://www2.deloitte.com/content/dam/insights/articles/us176126_dim31/Deloitte-Insights-Magazine-Issue-31.pdf
- Enel. (2024). *Enel Green Power is a key player in the growth of battery storage systems in Italy*. <https://www.enelgreenpower.com/media/news/2023/04/bess-growth-italy>
- EPOCH AI. (2024). *Can AI scaling continue through 2030?* <https://epoch.ai/blog/can-ai-scaling-continue-through-2030#notes>
- Gartner. (2023a). *Key peer insights from the 2023 CDAO survey*.
- Gartner. (2023b). *What's new in the 2023 Gartner hype cycle for emerging technologies*. <https://www.gartner.com/en/articles/what-s-new-in-the-2023-gartner-hype-cycle-for-emerging-technologies>
- Gartner. (2024). *Replace monolithic legacy ERP with flexible capabilities*. <https://www.gartner.com/en/information-technology/topics/enterprise-resource-planning>
- GE. (2023). *GE Predix overview*. https://www.governova.com/software/documentation/predix-platforms/PDFs/Predix_Overview.pdf
- Gupta, S. (2018). *Driving digital strategy: A guide to reimagining your business*.
- International Energy Agency. (2023). *Efficient grid-interactive buildings*. <https://iea.blob.core.windows.net/assets/71d1b69d-e8aa-49e5-9e0c-12c13d5a3a1f/EfficientGrid-InteractiveBuildings.pdf>
- International Energy Agency. (2024). *Empowering urban energy transitions: Smart cities and smart grids*. <https://iea.blob.core.windows.net/assets/00f7d520-d517-473d-b357-5adb43c4a57e/EmpoweringUrbanEnergyTransitions.pdf>
- Ismail, S., Diamandis, P. H., & Malone, M. S. (2023). *Exponential organizations 2.0*.
- Kienast, T. (2024). *Cloud ERP: Strategies for successful implementation*. <https://www.gartner.com/en/articles/cloud-erp>
- KPMG. (2023). *Global tech report 2023*. <https://assets.kpmg.com/content/dam/kpmgsites/xx/pdf/2023/09/kpmg-global-tech-report.pdf>
- KPMG. (2024). *Stepping up to a new level of compliance*. <https://assets.kpmg.com/content/dam/kpmg/xx/pdf/2024/01/stepping-up-to-a-new-level-of-compliance.pdf>
- Motyka, M., Hardin, K., & Nagdeo, J. (2022). *Electric power supply chains: Achieving security, sustainability, and resilience*. <https://www2.deloitte.com/us/en/insights/industry/power-and-utilities/supply-chain-resilience-electric-power-sector.html>
- Platform9. (2021). *What we can learn from GE and why digital transformations fail*. <https://platform9.com/blog/what-we-can-learn-from-ge-and-why-digital-transformations-fail/>
- Reuters. (2017). *GE shifts strategy, financial targets for digital business after missteps*. <https://www.reuters.com/article/us-ge-digital-outlook-insight/ge-shifts-strategy-financial-targets-for-digital-business-after-missteps-idUSKCN1B80CB/>
- Rogers, D. (2016). *The digital transformation playbook*.
- Saldanha, T. (2019). *Why digital transformations fail*.
- Schneider Electric. (2023). *Industrial digital transformation*. https://download.schneider-electric.com/files?p_Doc_Ref=998-22531650&p_enDocType=EDMS
- SemiAnalysis. (2024). *Scaling laws – O1 Pro architecture, reasoning training infrastructure, Orion and Claude 3.5 Opus "failures"*. <https://semianalysis.com/2024/12/11/scaling-laws-o1-pro-architecture-reasoning-training-infrastructure-orion-and-claude-3-5-opus-failures/>
- ServiceNow. (2023). *Driving ERP modernization with a "clean core"*. <https://www.servicenow.com/content/dam/servicenow-assets/public/en-us/doc-type/resource-center/case-study/cs-now-on-now-erp-modernization.pdf>
- Smith, T., et al. (2024). *Bridging measurement divides in AI, cloud, and cyber*. <https://www2.deloitte.com/us/en/insights/industry/technology/measuring-cyber-ai-and-cloud-kpis.html>
- Weuster, A., & Hiecke-Richter, C. (2023). *Global business services: Catalysts of value*. <https://www.pwc.com/us/en/services/consulting/business-transformation/finance-transformation/pwc-2023-global-business-services-study.pdf>
- Williams, P. (2018). *The P&G acquisition of Gillette: Case analysis and case solution*. <https://www.case48.com/case-analysis/11011-The-P-G-Acquisition-of-Gillette>
- Yao Doumon, N. (2024). *Transitioning to renewable energy: Challenges and opportunities*. <https://iee.psu.edu/news/blog/transitioning-renewable-energy-challenges-and-opportunities>
- Zippia. (2023). *General Electric revenue*. <https://www.zippia.com/general-electric-careers-4876/revenue/>