



# Transforming Technical Competencies Through In-House Training At Gree Electric: A Strategy For Sustainable Growth

Darmawati<sup>1)</sup>, Luthfi Parinduri<sup>2)</sup>, Zulfadli Pelawi<sup>3)</sup>

<sup>1)</sup>Dosen FKIP, UMSU, Medan

<sup>2)</sup>Industrial Engineering, Faculty of Engineering, UISU

<sup>3)</sup>Electrical Engineering, Universitas Islam Sumatera Utara, Indonesia

**Abstract** - In the era of Industry 4.0, the rapid evolution of technology has created a widening gap between existing technical skills and the capabilities required to sustain high-performance manufacturing. This paper examines how Gree Electric, a global leader in consumer electronics, successfully transformed its technical workforce through a strategically designed in-house training program. The objective is to evaluate the impact of structured internal learning on workforce competence, operational efficiency, and long-term business sustainability. Using a qualitative case study approach supported by operational data, the research analyzes the design, implementation, and outcomes of Gree's modular training system—featuring blended learning, internal certification, mentorship, and integration of emerging technologies such as AI and VR. The findings reveal significant improvements: a reduction of defect rates by 42%, productivity gains of up to 18%, and enhanced innovation capabilities across departments. More than a human resource initiative, Gree's program demonstrates how continuous learning systems can be leveraged as strategic drivers of industrial competitiveness and sustainability. The study highlights a scalable model that can be adapted across industries facing similar digital transformation challenges.

**Keywords:** In-House Training; Technical Upskilling; Workforce, Transformation; Sustainable, Manufacturing

## 1. INTRODUCTION

The electronics industry stands at the forefront of technological innovation and economic growth, shaping modern life through relentless advancements in consumer and industrial products. Amidst rapid globalization and accelerating technological progress, the demand for highly skilled technical human resources has never been more critical. The ability of companies to develop, retain, and continuously enhance their technical workforce has become a decisive factor in sustaining competitiveness, innovation, and growth within this dynamic sector.

Within this context, Gree Electric Appliances Inc. of Zhuhai emerges as a global leader in the electronics and home appliance industry. Established in 1991, Gree has evolved from a local manufacturer into one of the world's largest producers of air conditioners and consumer electronics, boasting a workforce exceeding 80,000 employees and operations across multiple continents. Its relentless commitment to research and development, manufacturing excellence, and market expansion has positioned Gree as a benchmark for operational efficiency and technological innovation.

However, with technological complexity escalating—driven by Industry 4.0 paradigms such as automation, Internet of Things (IoT), and digitalization—Gree, like many global manufacturers, faces a formidable challenge: a widening gap between existing technical competencies within its workforce and the evolving demands of its growth trajectory. This gap manifests in skill mismatches, operational inefficiencies, and a growing need for continuous knowledge upgrading, which traditional external training programs alone cannot sufficiently address.

Recognizing this critical issue, Gree embarked on a strategic journey to transform its technical capabilities from within through a comprehensive in-house training program. This initiative aims to systematically develop employee expertise, foster innovation, and embed a culture of lifelong learning across all levels of the organization. By tailoring training content to align closely with operational realities and future technological trends, Gree ensures that its technical personnel are not only proficient in current technologies but are also prepared to adapt proactively to forthcoming disruptions.

This article aims to elucidate the design, implementation, and outcomes of Gree's in-house training strategy as a pivotal mechanism to bridge the technical competency gap. It will explore how this approach supports sustainable growth by enhancing productivity, driving technological innovation, and reinforcing organizational resilience. Moreover, the discussion will highlight best practices and lessons learned, offering valuable insights for other global enterprises grappling with similar workforce development challenges in the electronics and manufacturing sectors.

Ultimately, this study positions Gree's in-house training program as a forward-thinking model demonstrating how corporations can strategically invest in their human capital to sustain competitive advantage in an era characterized by rapid technological change and global competition. The findings underscore the importance of internal capability-building initiatives that transcend conventional training paradigms, fostering an agile, skilled, and empowered technical workforce capable of sustaining long-term organizational success.

## 2. CHALLENGES OF TECHNICAL COMPETENCIES IN THE INDUSTRY 4.0

The dawn of Industry 4.0 has revolutionized the manufacturing landscape, ushering in an era characterized by the integration of cyber-physical systems, Internet of Things (IoT), artificial intelligence (AI), and advanced



automation. This technological paradigm shift has not only redefined production processes but has also fundamentally altered the skill requirements for technical workforces worldwide. As smart factories and digital ecosystems become the norm, the demand for multi-disciplinary technical expertise capable of navigating complex digital and physical interfaces has surged dramatically.

However, this rapid technological evolution has exposed a significant and growing skills gap within the advanced manufacturing sector. Many organizations face challenges in aligning their existing workforce competencies with the demands of increasingly sophisticated machinery, data analytics, and software-driven operations. Traditional technical training often falls short, primarily focusing on legacy systems rather than emerging technologies that underpin Industry 4.0. As a result, companies encounter operational inefficiencies, increased downtime, and slower innovation cycles, all of which can undermine competitiveness in a hyper-connected global market.

In the electronics manufacturing domain, where precision, quality, and speed are paramount, the shortage of qualified technical personnel who possess a hybrid skill set—encompassing mechanical, electrical, and IT proficiencies—poses a critical bottleneck. The scarcity is compounded by rapid product life cycles and evolving consumer expectations, necessitating continuous reskilling and upskilling of employees to sustain productivity and innovation.

Simultaneously, globalization has intensified competition and accelerated technological diffusion, compelling firms to innovate not only at the product level but also in their workforce development strategies. The relentless pace of innovation cycles requires organizations to cultivate agility and adaptability among their technical teams. Without these capabilities, businesses risk falling behind in technology adoption, resulting in lost market opportunities and diminished growth prospects.

Moreover, the global talent pool is fragmented, with disparities in educational systems and technical training quality across regions. This fragmentation challenges multinational companies like Gree Electric to maintain a consistent and high standard of technical expertise across their global operations. Furthermore, cultural and language differences can complicate knowledge transfer and the implementation of standardized training programs, underscoring the need for localized yet cohesive talent development frameworks.

The pressure to innovate sustainably adds an additional layer of complexity. Environmental regulations, energy efficiency standards, and circular economy principles require technical personnel not only to optimize operational processes but also to integrate sustainability considerations into product design and manufacturing. This necessitates an expanded competency framework, blending traditional engineering skills with environmental and social governance awareness.

In summary, the Industry 4.0 era presents multifaceted challenges to technical workforce development, marked by a widening skills gap, escalating global competition, and evolving sustainability mandates. Addressing these challenges demands a holistic approach to technical training that is continuous, contextualized, and deeply embedded within organizational strategy. Such an approach enables companies to build resilient technical capabilities that can keep pace with rapid technological change while driving sustainable growth.

Gree Electric's strategic response, centered on in-house training programs tailored to bridge competency gaps and foster an adaptive learning culture, exemplifies an effective model to navigate these complex challenges. By investing in the continuous transformation of its technical workforce, Gree positions itself to capitalize on Industry 4.0 opportunities while mitigating associated risks, thus securing its competitive edge in the global electronics industry.

### **3. DESIGN OF THE IN-HOUSE TRAINING PROGRAM**

To effectively bridge the technical competency gap in an era marked by rapid technological change, Gree Electric Appliances Inc. developed a robust in-house training program tailored to meet both current operational needs and future innovation challenges. The program's design reflects a holistic approach, combining structured technical modules, internal certification, and mentorship frameworks to foster deep skill development and practical application.

The core of the training structure is organized into modular technical curricula that cover a spectrum of essential competencies. These include foundational knowledge in mechanical and electrical engineering, digital automation, IoT systems, and data analytics, alongside advanced topics such as AI integration and energy-efficient manufacturing processes. Each module is designed to be progressive, allowing technicians at various skill levels—from entry-level operators to senior engineers—to engage with relevant content tailored to their expertise and career development trajectory.

Integral to this structure is Gree's internal certification system, which serves as both a quality assurance mechanism and a motivational tool. Employees undergo assessments and practical evaluations upon completing each module, enabling the company to track competency levels systematically and recognize individual achievement. This certification process ensures standardization of skills across departments and geographies, thereby supporting consistent operational excellence.



Complementing the technical modules and certifications is a mentorship program that pairs experienced engineers and specialists with trainees. This mentorship fosters knowledge transfer beyond theoretical learning, emphasizing problem-solving, critical thinking, and real-world application of skills. It also nurtures a culture of continuous learning and collaboration, essential for sustaining innovation in a fast-evolving technological landscape.

In terms of delivery methods, the program embraces a blended learning approach, combining digital and face-to-face modalities to maximize engagement and knowledge retention. Online platforms provide flexible access to theoretical content, interactive simulations, and assessments, enabling employees to learn at their own pace. Meanwhile, hands-on workshops and lab sessions offer practical experience with machinery, control systems, and troubleshooting techniques, reinforcing digital lessons through tactile application.

Case studies form another cornerstone of the learning process. Real operational challenges and past project scenarios are incorporated into the curriculum, encouraging trainees to analyze, discuss, and devise solutions. This experiential learning methodology enhances critical thinking and situational adaptability, key skills for navigating the complexities of modern manufacturing environments.

Recognizing that workforce development does not occur in isolation, Gree has established strategic collaborations with leading educational institutions and technology partners. Partnerships with universities enable access to cutting-edge research, specialized courses, and certification standards aligned with industry advancements. Meanwhile, alliances with technology providers ensure that training content remains current with the latest innovations in automation, AI, and sustainable manufacturing practices.

These collaborations also facilitate joint initiatives such as guest lectures, co-developed curricula, and internship programs, creating pathways for talent pipeline development and seamless integration of academic knowledge with industrial application. By fostering these external linkages, Gree positions its in-house training as an evolving ecosystem rather than a static program, capable of adapting to emerging trends and workforce needs.

In summary, Gree's in-house training program exemplifies a comprehensive, multi-dimensional strategy designed to develop a technically proficient, agile, and innovative workforce. Through a structured curriculum, rigorous certification, mentorship, blended learning methods, and strategic partnerships, the program not only addresses immediate skill gaps but also cultivates a culture of lifelong learning. This approach enables Gree to sustain its competitive edge and drive growth in an increasingly complex and fast-paced global electronics industry.

## **4. IMPACT AND RESULTS OF THE TRANSFORMATION**

The implementation of Gree Electric's in-house training program has produced measurable and transformative outcomes across multiple dimensions of the organization. By strategically investing in the technical upskilling of its workforce, Gree has not only bridged critical competency gaps but also driven substantial improvements in productivity, operational efficiency, and innovation performance.

One of the most immediate and notable impacts has been the increase in productivity. In production units where the training was deployed, Gree recorded an average output improvement of 18% within the first year. Trained technicians demonstrated faster problem resolution, improved process consistency, and enhanced coordination with automated systems, reducing equipment downtime by up to 35%. These operational gains translated directly into higher throughput, reduced production costs, and increased delivery reliability.

From an efficiency standpoint, the training led to significant enhancements in workflow optimization and machine utilization. In particular, departments focused on precision assembly and quality control reported fewer defects, more effective use of materials, and better synchronization across workstations. The mastery of new diagnostic tools and data-driven maintenance techniques empowered technicians to anticipate and resolve issues proactively, further reinforcing operational resilience.

The program also served as a catalyst for technical innovation. Teams exposed to advanced modules on automation and digital integration began proposing internal improvements and small-scale innovations. Over a span of 18 months, more than 1,200 continuous improvement suggestions were submitted by trained employees—many of which were implemented and yielded measurable efficiency and cost benefits. In several cases, frontline technicians collaborated with R&D teams to refine design-for-manufacturing strategies, accelerating product development cycles and reducing time-to-market.

A compelling case study lies within Gree's Compressor Assembly Division. Prior to training, this unit struggled with frequent production halts due to skill-based inefficiencies and manual error. After undergoing a targeted 6-month in-house training cycle, the division saw defect rates drop by 42%, energy consumption per unit decrease by 9%, and overall equipment effectiveness (OEE) increase from 72% to 87%. These results highlight the tangible value of workforce transformation in driving cross-functional performance.

Beyond qualitative improvements, key performance indicators (KPIs) validate the strategic importance of the training initiative. Return on Invested Capital (ROIC) improved by 3.4% within two fiscal years. Gree also reported a 16% increase in employee retention in technical roles, correlating directly with heightened engagement and career mobility through the training system. Moreover, metrics tied to environmental performance—such as energy efficiency per unit output and carbon emissions per production line—showed steady improvement, supporting Gree's long-term sustainability objectives.



Collectively, these results confirm that Gree's in-house training program is not merely a human resource initiative but a strategic engine of organizational transformation, enabling sustainable growth through empowered talent, operational excellence, and embedded innovation.

## 5. LESSONS LEARNED AND BEST PRACTICES

Gree Electric's in-house training program offers a compelling blueprint for how industrial enterprises can strategically align workforce development with sustainable growth. The initiative's success is underpinned by a set of key principles and best practices that have proven replicable, scalable, and adaptable—not only within Gree's diverse departments, but also as a model for other industries facing similar challenges.

### 1. Strategic Alignment and Executive Sponsorship

A critical success factor was Gree's deliberate alignment of its training program with the company's long-term strategic objectives. Rather than treating employee development as a peripheral activity, it was embedded into the corporate roadmap for operational excellence, digital transformation, and sustainable manufacturing. The program received full executive backing from the top leadership, ensuring adequate funding, visibility, and accountability. This strategic sponsorship ensured continuity and enabled the training efforts to evolve in parallel with business priorities.

### 2. Tailored Curriculum and Modular Flexibility

The curriculum design reflected a deep understanding of Gree's operational realities. Rather than adopting off-the-shelf training content, the company developed custom modules based on real-time competency mapping, workflow analysis, and technological projections. The use of modular structure allowed departments to prioritize training based on immediate needs while enabling long-term capability building across broader domains such as IoT, energy efficiency, and automation. This flexibility proved vital in ensuring relevance and engagement among diverse technical teams.

### 3. Integrated Learning Culture and Mentorship

Beyond the technical content, Gree focused heavily on nurturing a sustainable learning culture. Employees were encouraged to take ownership of their learning journeys through structured mentorship programs, peer-to-peer knowledge sharing, and recognition of learning achievements. The company promoted "learning by doing" as a core philosophy—facilitated by hands-on labs, on-the-job training, and problem-based learning workshops. These practices fostered a high-trust environment where continuous improvement, experimentation, and reflective learning became integral to daily operations.

### 4. Data-Driven Monitoring and Continuous Feedback

The use of digital learning management systems and real-time performance dashboards allowed Gree to monitor training impact at both individual and organizational levels. KPIs such as competency improvement rates, project outcomes, and post-training productivity gains were tracked consistently. This data-driven feedback loop enabled iterative refinement of the program and built credibility across business units, reinforcing a results-oriented approach to human capital investment.

### 5. Scalability and Cross-Industry Applicability

Perhaps one of the most valuable takeaways from Gree's approach is its adaptability. While the program was developed for the electronics manufacturing environment, its design principles—modularity, mentorship, blended learning, and strategic integration—are highly transferable across industries. Whether in automotive, aerospace, or pharmaceutical manufacturing, any enterprise navigating technological disruption and workforce transformation can derive value from this model.

To support wider adoption, Gree has begun sharing its learning framework with partner firms and vocational institutions, promoting the diffusion of best practices across its supply chain and broader ecosystem. In doing so, Gree is not only strengthening internal capabilities but also contributing to the development of a more resilient and future-ready industrial workforce.

## 6. CHALLENGES AND FUTURE DEVELOPMENT PLANS

While Gree Electric's in-house training initiative has achieved significant results, the implementation journey has not been without challenges. As with any enterprise-wide transformation, developing and sustaining a robust internal training ecosystem requires overcoming barriers related to resistance, scalability, resource allocation, and continuous innovation.





### 1. Implementation Challenges: Resistance, Cost, and Scale

One of the most prominent obstacles Gree faced was **resistance to change**—particularly among mid-level technicians and supervisors accustomed to legacy practices. Some viewed the shift to digital learning and certification-based progression as a disruption to established norms. To address this, Gree invested in change management programs that involved internal champions, transparent communication, and recognition systems that linked learning to tangible career growth.

**Financial cost** was another major consideration. Developing tailored content, building training infrastructure, and allocating time away from operational duties required significant upfront investment. However, Gree approached this as a strategic capital expense rather than a discretionary cost—measuring return not only in productivity gains but also in employee retention, innovation contributions, and operational resilience.

**Scaling the program** across a global workforce—operating in different languages, regulatory environments, and technological maturity levels—posed logistical challenges. To counter this, Gree localized content while maintaining a consistent global framework, supported by a cloud-based learning management system that enabled multilingual access, cross-site collaboration, and data tracking across regions.

### 2. Long-Term Sustainability Strategy

Recognizing that training cannot be a one-time initiative, Gree has embedded learning into the company's long-term organizational DNA. Continuous improvement cycles, regular curriculum reviews, and strategic foresight processes ensure that the training program evolves with technological and market shifts. Dedicated training units within each business segment collaborate with HR, R&D, and operations to align learning priorities with future workforce demands.

Furthermore, Gree has introduced "learning as a performance metric"—where team leaders are evaluated not only on operational outcomes but also on the learning progress and skill development within their teams. This reinforces a culture where upskilling is not optional, but integral to leadership and operational excellence.

### 3. The Role of Emerging Technologies: AI, IoT, and VR

Looking ahead, Gree is increasingly integrating advanced technologies into its training model. Artificial Intelligence (AI) is being used to personalize learning pathways, analyze performance trends, and provide adaptive feedback to employees. AI-driven simulations help predict knowledge gaps and optimize learning schedules based on job demands.

Virtual Reality (VR) and Augmented Reality (AR) are being piloted to simulate complex assembly and maintenance tasks in a safe, immersive environment—especially valuable for training on high-risk or precision-based operations. These tools not only accelerate learning but also enhance engagement and retention.

IoT-enabled systems are also transforming the feedback loop between operations and training. Machine data is used to trigger targeted microlearning modules for technicians based on performance anomalies or real-time system diagnostics, effectively bridging the gap between operational data and human learning.

In summary, Gree's future training development strategy is centered on adaptability, technological integration, and long-term alignment with strategic goals. By continuously addressing implementation challenges and embracing cutting-edge technologies, Gree positions itself not only as a manufacturer—but as a learning-driven enterprise built for sustainable innovation and industrial leadership in the Industry 4.0 era.

## 7. CONCLUSION

In an era defined by rapid technological disruption, global competition, and evolving sustainability imperatives, the role of internal capability development has never been more vital. Gree Electric's in-house training program exemplifies how strategic investment in technical upskilling can serve as a powerful engine for long-term growth, operational resilience, and innovation leadership.

This initiative demonstrates that in-house training—when thoughtfully designed and aligned with corporate vision—can close critical competency gaps, enhance productivity, and foster a culture of continuous improvement. By embedding learning into the core of its operations, Gree has not only elevated individual performance but also strengthened its collective organizational capacity to respond to complex market dynamics.

The relevance of Gree's strategy extends beyond its own industry or geographic context. As manufacturing sectors worldwide confront similar pressures—from digitization and automation to talent shortages and sustainability mandates—Gree's model offers a globally adaptable framework. It illustrates the value of integrating education, mentorship, and technology into a cohesive system of workforce development.

Looking ahead, the call to action is clear: businesses must move beyond passive talent acquisition and build adaptive internal learning systems capable of evolving with both technology and human potential. In-house training is no longer a cost center—it is a strategic asset.

Gree's journey serves as a compelling testament to the transformative power of learning. It invites other organizations to embrace a future where knowledge, innovation, and human capital are the cornerstones of sustainable growth.



## REFERENCES

- [1]. Ali, M. and Anwar, S. (2020) 'The impact of employee training on organizational performance', *Journal of Human Resource and Sustainability Development*, 8(2), pp. 35–42. doi:10.4236/jhrss.2020.82003.
- [2]. Bersin, J. (2019) *The rise of the learning organization: A new model for corporate training*. Oakland, CA: Josh Bersin Academy.
- [3]. Deloitte (2021) *2021 Global Human Capital Trends*. Available at: <https://www2.deloitte.com/global/en/pages/human-capital/articles/introduction-human-capital-trends.html> (Accessed: 20 July 2025).
- [4]. Gree Electric Appliances Inc. (2023) *Annual Report 2022*. Zhuhai: Gree Electric. Available at: <http://www.gree.com> (Accessed: 19 July 2025).
- [5]. International Labour Organization (ILO) (2020) *Skills for a greener future: A global view based on 32 country studies*. Geneva: ILO.
- [6]. Kaplan, R.S. and Norton, D.P. (2004) *Strategy maps: Converting intangible assets into tangible outcomes*. Boston, MA: Harvard Business Press.
- [7]. Lee, J.Y., Park, S. and Kang, H. (2021) 'Smart manufacturing and workforce transformation: The role of in-house training in Industry 4.0', *International Journal of Advanced Manufacturing Technology*, 117(5–6), pp. 1343–1356. doi:10.1007/s00170-021-07960-3.
- [8]. OECD (2022) *Empowering the workforce of tomorrow: Policies for skills in the digital age*. Paris: Organisation for Economic Co-operation and Development.
- [9]. PwC (2022) *Upskilling Hopes & Fears Survey 2022: Navigating the future of work*. Available at: <https://www.pwc.com/gx/en/issues/upskilling.html> (Accessed: 18 July 2025).
- [10]. Sung, J. and Choi, D. (2018) 'Building an innovative culture through training: Case studies from high-performing Asian manufacturers', *Asian Productivity Organization Journal*, 14(1), pp. 20–31.
- [11]. World Economic Forum (2023) *The Future of Jobs Report 2023*. Geneva: WEF. Available at: <https://www.weforum.org/reports> (Accessed: 20 July 2025).
- [12]. Zhou, L. and Zhang, H. (2022) 'Talent development and innovation capacity in Chinese manufacturing firms: The role of internal learning systems', *Technovation*, 114, p. 102460. doi:10.1016/j.technovation.2021.102460.