Proceedings of Business and Economic Studies, 2025, Volume 8, Issue 4
http://ojs.bbwpublisher.com/index.php/PBES
Online ISSN: 2209-265X
Print ISSN: 2209-2641

Application Analysis of Growth Strategies for Industrial Automation Enterprises in the Automotive Manufacturing Sector

Honggang Liu*

Oliver Wyman Consulting (Shanghai) Ltd., Shanghai, China

**Author to whom correspondence should be addressed.*

Abstract: As the demand for intelligent and flexible production in the automotive manufacturing industry continues to intensify, industrial automation enterprises are gaining ever-greater market opportunities and competitive advantages in this field. Based on a literature review and representative case studies, this paper constructs a theoretical framework for growth strategies and systematically analyzes the current application status and growth paths of automation enterprises in both complete vehicle and component production. The research finds that different growth strategies (such as vertical integration, horizontal diversification, and digital service transformation) exhibit varying applicability across upstream and downstream segments of automotive manufacturing, while simultaneously facing challenges related to technology integration, business models, and organizational change. In response to these issues, this paper proposes countermeasures such as optimizing R&D and customer relationship management, improving branding and after-sales service systems, and strengthening policy and industry environment support, thereby offering guidance for sustainable growth of industrial automation enterprises in the automotive manufacturing sector.

Keywords: Industrial automation; Growth strategy; Automotive manufacturing; Smart manufacturing; Case analysis

Online publication: September 10, 2025

1. Introduction

In recent years, driven by the global trend toward intelligent and digital transformation in manufacturing, the automotive industry—an essential pillar of national economies—has accelerated its transition from traditional labor-intensive operations to high-end automation. Under China's "dual circulation" development framework and its goals of "carbon neutrality and carbon peak," demand for automation solutions—such as flexible production lines, intelligent robots, and big data analytics—has risen exponentially in both complete vehicle and component production. Against this backdrop, industrial automation enterprises face enormous market opportunities, yet must continuously enhance their technological R&D capabilities, offer customized services, and innovate their business models to achieve sustained growth amid fierce competition. Relying solely on traditional product sales can no longer satisfy customer-driven value chain requirements; instead, enterprises must adopt diversified growth strategies—such as vertical integration, horizontal diversification, or digital service transformation—to gain advantages in resource integration, ecosystem collaboration, and sustainable profitability. Therefore, examining the growth strategies adopted by industrial automation enterprises in the automotive manufacturing field holds significant theoretical value and practical guidance.

Through in-depth analysis of representative cases and empirical data, this study aims to clarify growth paths, optimize resource allocation, and support the intelligent upgrading and high-quality development of the automotive manufacturing industry. Based on this background, the primary objective of this research is to construct a theoretical framework of growth strategies tailored to industrial automation enterprises, using the automotive manufacturing sector as an application scenario, and to systematically explore the applicability and implementation effects of various growth strategies in both complete vehicle and component production. Specifically, on one hand, this paper synthesizes the core content and mainstream models of growth strategies for industrial automation enterprises through a literature review, and identifies development trends in automotive manufacturing automation. On the other hand, by conducting case studies and comparing financial indicators of representative vehicle manufacturers and component suppliers, the paper deeply analyzes the practical paths and challenges that automation enterprises face in market expansion, technological innovation, and service extension.

To accomplish these goals, this study employs a combination of literature analysis, case research, and empirical investigation. In the literature analysis phase, relevant academic findings and industry reports—both domestic and international—are systematically organized to provide theoretical support for constructing the growth strategy framework. In the case research phase, first-hand empirical data are gathered through interviews and data collection with multiple automotive manufacturers and automation solution providers. In the empirical investigation phase, SWOT analysis and financial data comparisons are used to evaluate the performance and risks of various growth strategies in real-world applications. Finally, based on the research findings, the paper proposes optimization measures and policy recommendations directed at industrial automation enterprises and industry regulators, with the aim of supporting the intelligent upgrading of the automotive manufacturing industry and the sustainable development of automation enterprises.

2. Literature review

2.1. Current research on growth strategies for industrial automation enterprises

Research on growth strategies for industrial automation firms has evolved from straightforward market- and product-expansion models toward more complex, service-oriented, and ecosystem-based approaches. Early work classified growth modes into four basic types: deepening presence in existing markets, entering new markets, developing new products for current customers, and diversifying into adjacent or unrelated sectors. In relatively stable supply-chain environments, simply increasing market share or introducing incremental product variants can deliver short-term gains. However, the pace of technological change and the blurring of industry boundaries have rendered these tactics insufficient for long-term competitiveness [1]. More recent studies emphasize the rise of servitization, in which equipment vendors expand their offerings to include software platforms, remote diagnostics, preventative maintenance, and outcome-based contracts. By transforming one-time hardware sales into ongoing "product-plus-service" relationships, companies build stronger customer loyalty and generate recurring revenue streams.

Case analyses of leading integrators show that cloud-enabled monitoring dashboards, predictive analytics engines, and on-demand consulting services can shorten delivery cycles and enhance profitability without heavy new-product investments. At the strategic level, the focus has shifted toward building digital ecosystems through partnerships and open platforms. Manufacturers that share data with suppliers, clients, and research institutions are better positioned to co-innovate, accelerate time-to-market, and spread the cost of R&D. Multi-tier growth frameworks now incorporate factors such as platform governance, data-sharing protocols, and collaborative innovation networks. Empirical comparisons of different integrator models suggest a three-stage progression: establishing technical leadership, developing platform-based service offerings, and ultimately engaging in broader ecosystem collaboration. Despite these advances, gaps remain in understanding how small and medium-sized enterprises can navigate the costs and organizational changes required by servitization and digital-ecosystem participation. There is also limited cross-industry benchmarking to reveal which combination of product, service, partnership, and platform strategies yields the best risk-adjusted returns. Addressing these unanswered questions will be key to guiding automation firms of all sizes toward sustainable, high-value growth paths [2].

2.2. Current research on automation applications in automotive manufacturing

With the industry's shift toward highly flexible, data-driven production, recent work has moved beyond single-process optimization to integrated, intelligent automation across the entire vehicle lifecycle. In stamping operations, researchers have explored closed-loop control strategies that adjust press parameters in real time based on force and displacement feedback, enabling consistently high-quality forming of both traditional steel and advanced lightweight alloys. Simulation-driven parameter tuning—combined with adaptive die-clearance adjustment—has been shown to reduce defect rates and tooling wear, while modular quick-die-change systems shorten setup times for new model runs. Welding technology has likewise advanced through the integration of real-time sensing and machine-learning-based path planning. Vision-guided seam tracking, using laser or structured-light scanners, enables robots to dynamically correct trajectory deviations, improving joint consistency for mixed-material body structures.

At the same time, data-driven weld-parameter optimization frameworks analyze historical process data to recommend optimal current, speed, and torch-angle settings for varying material thicknesses, reducing under- or over-fusion defects without manual retuning. In paint shops, dynamic spray-pattern algorithms now adapt robot motion profiles and spray-gun flow rates according to local part geometry and ambient conditions. Closed-loop thickness control—using infrared or ultrasonic sensors—maintains uniform coating even on highly contoured surfaces, while automated solvent-recovery and airflow-management systems capture overspray and accelerate drying, cutting both energy use and VOC emissions. Final assembly has seen rapid growth in collaborative robots (Cobot) applications and digital guidance systems. Lightweight, sensor-equipped Cobots assist human workers with torque-sensitive fastening, part presentation, and ergonomic lifting, balancing flexibility and throughput without extensive safety guarding. Augmented-reality work instructions and force-feedback tools guide technicians through complex multi-step assemblies, reducing errors and accelerating operator learning curves. Supporting all production stages, factory-wide digital platforms unify MES, PLM, and equipment-health data via industrial-edge nodes and high-bandwidth networks. Digital-twin models mirror physical assets and process flows, enabling virtual commissioning, "what-if" scenario analysis, and predictive maintenance scheduling.

In-process quality inspection leverages multi-sensor fusion—combining 2D/3D vision, laser scanning, and acoustic emission—to detect surface scratches, dimensional deviations, and feature defects on the fly. Logistics and material handling have been transformed by autonomous guided vehicles (AGVs) and smart conveyors coordinated through centralized traffic-management software. AGVs equipped with LiDAR and simultaneous localization and mapping (SLAM) navigate dynamic shop floors, delivering parts just-in-time to workstations and returning waste containers without human intervention. Despite these advances, challenges remain in seamless data integration across heterogeneous equipment, ensuring cybersecurity in connected production lines, and scaling AI-based controls in legacy facilities. Future research is focusing on end-to-end digital-twin ecosystems, federated learning for on-device AI model updates, and multimodal human–machine interfaces that combine vision, touch, and voice to further enhance efficiency, quality, and workforce collaboration [3].

3. Theoretical framework and research methods

This study uses a mixed-method approach of literature analysis, case studies, in-depth interviews, and empirical data comparison. In the literature phase, databases (e.g., CNKI, Web of Science) and industry reports are searched to review growth strategies, servitization, and digital transformation research in industrial automation and automotive manufacturing. White papers and market research summarize technology trends and market size, guiding case selection and metric definitions. In the case study phase, two automation solution providers and two automotive manufacturers are chosen. The automation firms have extensive automotive experience with projects like complete-vehicle welding lines, stamping lines, and painting upgrades. The manufacturers include a leading domestic brand and a joint-venture factory, illustrating diverse scales and technology levels. Interviews with senior managers and project leaders yield first-hand details on project backgrounds, technological plans, investment scales, and implementation challenges [4]. Public financial statements, annual reports, and industry analyses provide financial indicators (revenue growth, profit margin, R&D ratio) and capacity utilization rates, allowing quantitative evaluation of performance before and after upgrades.

In the data analysis phase, SWOT and PEST tools assess internal resources and external environments of each growth strategy. Comparing financial and performance metrics before and after implementation reveals actual outcomes and risks. To bolster reliability, questionnaires are designed for both automation buyers (manufacturers) and providers, covering technology satisfaction, service experience, and return expectations. This collection of methods and data ensures theoretical depth and practical relevance, offering comprehensive guidance to optimize growth strategies for industrial automation enterprises in automotive manufacturing [5].

4. Current status of industrial automation applications in the automotive manufacturing sector

4.1. Technological evolution and application scenarios

Driven by smart manufacturing and Industry 4.0, automotive automation has evolved from standalone CNC machines to flexible, intelligent systems. Initially, stamping, welding, and painting relied on CNC tools and traditional manipulators, supporting high-volume, single-model lines with limited automation. As demand for lightweight materials and model variety increased, stamping adopted high-speed servo presses, closed-loop control, and quick-die changes, enabling high-quality forming of complex parts [6]. In welding, spot-welding robots were enhanced with vision guidance and laser distance sensors for online seam tracking, while laser and hot-forming welding produced higher-strength body structures.

In the intelligent phase, paint shops implemented robot-based painting—using genetic algorithms or path planning plus electrostatic atomization—to improve coating uniformity. Automatic air curtains, online inspection, and drying systems ensured consistent curing and thickness. Final assembly shifted to human–robot collaboration (Cobots), combining human flexibility with robotic precision to reduce labor intensity and quality risks. Concurrently, MES, PLM, and industrial-internet platforms were deployed shopwide. Equipment now connects via industrial Ethernet and edge computing, providing real-time data on status, productivity, and quality. Digital twins simulate physical assets for mixed-model production and flexible changeovers. Quality inspection uses machine vision, 3D laser scanning, and deep learning to detect surface defects online and guide rework.

Moreover, intelligent logistics and AGV systems—using multi-sensor navigation—replace manual handling, efficiently delivering parts in complex, mixed-model workshops. Overall, automotive automation has progressed from “single-machine, single-line” to a three-tiered “equipment → systems → digital platforms” structure, enhancing flexibility, efficiency, and responsiveness to market and customer demands [7].

4.2. Status of typical case enterprises

This study examines two Chinese automotive plants: a domestic independent OEM (Plant A) and a joint-venture OEM (Plant B). Plant A, founded in 2005 and focused on new-energy passenger vehicles, has staged automation upgrades across stamping, welding, painting, and final assembly. In 2019, its stamping shop added closed-loop high-speed servo presses, quick-die change systems, and online pressure monitoring to handle lightweight part production. By late 2020, its welding shop deployed a vision-guided laser-welding line—compatible with steel and aluminum—using image-recognition algorithms for real-time quality checks [8].

In 2021, Plant A upgraded electrostatic paint robots and installed an online thickness-measurement and adjustment system, boosting its paint pass rate from 85 percent to over 95 percent. Its final assembly area now pilots Cobot-assisted trim installation, reducing labor intensity by 20 percent and improving precision to ± 0.2 mm. Plant B, operating since 1998, launched a “smart factory” initiative in 2020 aimed at digital workshop construction. Its stamping area employs a digital twin platform to map equipment to virtual models, predict die wear, and improve uptime. In welding, it introduced North China’s first hybrid laser-plus-six-axis robot line, enabling flexible, small-batch switching through trajectory simulation and collision detection. Plant B’s paint shop uses a closed-loop system integrating electrostatic robots, an automatic drying tunnel, and paint-fume recovery to ensure coating uniformity and meet strict environmental standards.

In final assembly, Plant B partnered with technology firms to implement an MES-centric scheduling system that synchronizes materials, equipment, and personnel, and added a robot-vision inspection station to check exterior and panel gaps, reducing defect feedback time by 30 percent. Both plants share three traits: (1) phased, tailored upgrade plans; (2) simultaneous integration of advanced equipment, intelligent algorithms, and digital platforms in stamping, welding, painting, and final assembly; (3) emphasis on human–robot collaboration via vision guidance, digital twins, and Cobots to reduce labor intensity and increase flexibility. They also confront common challenges: high costs for premium robots and sensors, complex technology integration, and the need to reskill employees—factors that shape subsequent growth strategy research [9].

5. Analysis of growth strategy applications for industrial automation enterprises

5.1. Evaluation of growth strategy applicability

To systematically evaluate the applicability of different growth strategies in automotive manufacturing, this study compares them across multiple dimensions: financial investment, technical fit, market risk, expected return, and organizational readiness. **Table 1** shows the ratings and characteristic descriptions for four typical growth strategies (market penetration, market development, product development, and diversification) in these five dimensions, providing an intuitive overview of each strategy's advantages and limitations.

Table 1. Comparison of main growth strategies across key dimensions

Dimension	Market penetration (MP)	Market development (MD)	Product development (PD)	Diversification (DV)	Note: Ratings are on a scale of 1 (lowest) to 5 (highest)
Financial investment	Moderate (2)	Moderately high (3)	High (4)	Very high (5)	Cost level required for implementation
Technical fit	Good (4)	Average (3)	Best (5)	Poor (2)	Degree of alignment between existing technology and strategy requirements
Market risk	Low (2)	Medium (3)	Relatively high (4)	High (5)	Risk level (industry barriers, customer acceptance, etc.)
Expected return	Moderate (3)	Moderately high (4)	High (5)	Uncertain (2)	Based on industry trends and case analyses
Organizational readiness	Best (5)	Good (4)	Average (3)	Poor (2)	Alignment of internal resources and team capabilities with strategy execution

From **Table 1**, it can be observed that market penetration scores well in technical fit and organizational readiness, but its expected return is only moderate, making it suitable for automation enterprises with stable customer bases seeking steady short-term expansion. Market development requires higher investment and carries moderate risk but offers solid expected returns and organizational alignment; it is suited for companies leveraging brand reputation to expand into new regions or downstream component suppliers. Product development scores highest in technical fit and expected return, but demands substantial R&D and equipment investments and carries relatively high risk—making it appropriate for firms with strong R&D capabilities that wish to create differentiated offerings with higher added value. Diversification is the most demanding: it involves cross-industry operations, high complexity, and high uncertainty. Although diversification can yield new profit streams, it requires an extensive technical foundation and organizational change, so it is generally recommended only for large enterprises with ample resources and mature management.

In summary, industrial automation enterprises of different sizes and resource endowments should select growth strategies based on their own circumstances and market conditions, prioritizing those with strong technical fit, organizational readiness, and manageable risk. For example, small- to medium-sized automation firms might first pursue market penetration and market development by optimizing product performance and service quality to deepen presence in existing or adjacent markets. Large enterprises, on the other hand, can build on these approaches by increasing R&D investment and exploring product development or even diversification—provided they carefully manage risk and prepare in advance by training talent and fostering cross-department collaboration to ensure stable implementation and sustained benefit [10].

5.2. Implementation challenges and countermeasures

When implementing growth strategies in the automotive manufacturing sector, industrial automation enterprises face multiple challenges: technical integration complexity, financial pressure, organizational resistance to change, and talent shortages. **Table 2** summarizes these challenges, their impacts, and proposed countermeasures.

Table 2. Comparison of implementation challenges and countermeasures

Challenge category	Impact	Countermeasure
Technical integration	System compatibility issues, extended delivery timelines	Establish collaborative R&D platforms with universities and suppliers
Financial pressure	High equipment and R&D costs, cash flow strain	Phase investments and implement ROI evaluation mechanisms
Organizational resistance	High cross-department coordination costs and reluctance to adopt new models	Implement change management processes and strengthen internal training
Talent shortage	Insufficient core technical and project management staff	Combine university–enterprise collaborative training with selective outsourcing

To address these challenges, companies can mitigate technical integration risks by forming joint R&D partnerships and collaborating across the value chain; alleviate financial pressure through staged investments and rolling ROI evaluations; improve organizational acceptance of new strategies by creating dedicated change-management teams and conducting targeted training sessions; and rapidly fill key talent gaps via a hybrid approach that combines university collaboration, internal upskilling, and selective outsourcing. By deploying these countermeasures, industrial automation enterprises can steadily advance their growth strategies in automotive manufacturing and achieve the desired outcomes.

6. Conclusion

This paper proposes a growth strategy framework for industrial automation firms in automotive manufacturing, identifying four paths—market penetration, market development, product development, and diversification—and evaluating each by investment, technical fit, market risk, expected return, and organizational readiness. Small- to medium-sized enterprises should focus on market penetration and development by improving existing products and services, while firms with strong R&D can pursue product development and, eventually, diversification into “hardware + software + services.” To address challenges like technical integration, financial constraints, organizational resistance, and talent shortages, companies should form joint R&D platforms, phase investments with ROI checks, strengthen change management and training, and close skill gaps via university partnerships and outsourcing. Continuous policy and market monitoring is essential to adapt offerings and achieve sustainable, agile growth.

Disclosure statement

The author declares no conflict of interest.

References

[1] Boavida N, Candeias M, 2021, Recent Automation Trends in Portugal: Implications on Industrial Productivity and Employment in Automotive Sector. Societies, 11(3): 101.

[2] Wankhede VA, Vinodh S, 2022, State of the Art Review on Industry 4.0 in Manufacturing with the Focus on

Automotive Sector. International Journal of Lean Six Sigma, 13(3): 692–732.

[3] Stawiarska E, Szwajca D, Matusek M, et al., 2021, Diagnosis of the Maturity Level of Implementing Industry 4.0 Solutions in Selected Functional Areas of Management of Automotive Companies in Poland. Sustainability, 13(9): 4867.

[4] Bhatia MS, Kumar S, 2020, Critical Success Factors of Industry 4.0 in Automotive Manufacturing Industry. IEEE Transactions on Engineering Management, 69(5): 2439–2453.

[5] Valaskova K, Nagy M, Zabojnik S, et al., 2022, Industry 4.0 Wireless Networks and Cyber-Physical Smart Manufacturing Systems as Accelerators of Value-Added Growth in Slovak Exports. Mathematics, 10(14): 2452.

[6] Butt J, 2020, A Strategic Roadmap for the Manufacturing Industry to Implement Industry 4.0. Designs, 4(2): 11.

[7] Tortorella GL, Narayanamurthy G, Thurer M, 2021, Identifying Pathways to a High-Performing Lean Automation Implementation: An Empirical Study in the Manufacturing Industry. International Journal of Production Economics, 231: 107918.

[8] Aithal PS, 2023, Enhancing Industrial Automation Through Efficient Technology Management in Society. International Journal of Applied Engineering and Management Letters (IJAEML), 7(4): 184–215.

[9] Pillai R, Sivathanu B, Mariani M, et al., 2022, Adoption of AI-Empowered Industrial Robots in Auto Component Manufacturing Companies. Production Planning & Control, 33(16): 1517–1533.

[10] Inyang V, Kanakana GM, Laseinde OT, 2023, Application of Sustainable Smart Manufacturing Technologies and Toolkits in the Automotive Industry. International Journal of Low-Carbon Technologies, 18: 412–422.