

Research Article

Digital Transformation and Intelligent Upgrading: Pathways, Mechanisms, and Evaluation Across Industries

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Abstract: Digital transformation and intelligent upgrading have become central concerns across enterprise, manufacturing, transportation, healthcare, and consumer device domains, yet pathways remain uneven and success criteria are not commensurable. This paper develops a four-layer analytical framework, digitalization, intelligent upgrading, standardization, and evaluation, and applies it to a multi-industry review of recent research. Enterprise studies suggest that platform operation and standard systems shape outcomes, though evidence remains case-based and causal inference is difficult. Manufacturing and transportation research indicates that online monitoring, degradation evaluation, simulation testing, and deep reinforcement learning can support intelligent upgrading, but data quality and sim-to-real transfer limit confidence. Health service and smart device studies reveal tensions between standardization and flexibility, between benchmark performance and deployment robustness, and between technical feasibility and ethical acceptability. Rather than proposing a unified evaluation model, the paper argues that cross-domain learning is possible only if concepts are translated with care and if the limitations of current evidence, small samples, short follow-up, contextual confounding are acknowledged. Future research may benefit from longitudinal designs, broader heterogeneous datasets, and greater attention to implementation contexts and governance mechanisms.

Keywords: Digital Transformation, Intelligent Upgrading, Standard System, Multi-Industry Comparison, Comprehensive Evaluation.

1. Introduction

The growing pressure on traditional industries to improve efficiency, responsiveness, and adaptability has made digital transformation and intelligent upgrading central concerns in both management and engineering research. This chapter attempts to establish a theoretical framework by examining how digitalization has evolved from process-level informatization toward data-driven decision-making, platform-based operation, and intelligent evaluation across enterprise, manufacturing, transportation, healthcare, and consumer device contexts. Rather than assuming a uniform pathway, the discussion acknowledges that transformation trajectories remain uneven and, to some extent, contingent on institutional conditions, data infrastructure, and organizational readiness. Existing studies often emphasize technological adoption while paying limited attention to standard systems, governance mechanisms, and

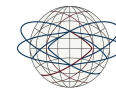
the performative effects of efficiency indicators. Considering these limitations, the chapter proposes a four-layer framework—digitalization, intelligent upgrading, standardization, and evaluation—as a tentative organizing logic rather than a fixed prescription. Whether such a framework can be generalized without losing sensitivity to domain-specific conditions remains an open question, and further research is needed to test its analytical value across heterogeneous settings.

The emergence of digital transformation as a distinct research area can be traced to several converging developments. On the management side, the increasing availability of enterprise data and cloud infrastructure has made platform-based operation feasible in settings where hierarchical coordination was once the norm. Research on the operation mechanism and achievement transformation efficiency of industry-university-research collaborative innovation platforms examines how incentive mechanisms and institutional trust shape transformation outcomes, rather than technology alone ^[1], while work on digital operation systems and efficiency evaluation for enterprise service platforms explores how platform-based service delivery generates operational data that can be used to assess performance ^[2]. These studies share a common assumption: that digital platforms generate data that can be used to improve organizational performance. Whether this assumption holds across all organizational contexts is, however, an open question, and the literature has not yet reached consensus on how much digitalization is sufficient.

On the engineering side, the rise of low-cost sensors and embedded computing has made continuous state observation feasible in settings where periodic inspection was once the norm. In automotive-grade radio frequency power amplifiers, endurance aging introduces gradual performance degradation that may not be captured by conventional end-of-line testing, and online monitoring has been proposed as a possible remedy ^[3]. Similar concerns appear in V2X on-board terminals, where receiving sensitivity must be validated under multiple working conditions rather than a single nominal configuration ^[4]. These engineering efforts share a common assumption: that continuous data streams contain information about system health that discrete testing cannot provide. Whether this assumption holds across all operating regimes is, however, an open question.

The framework proposed in this chapter is therefore deliberately modest. It does not claim that digitalization, intelligent upgrading, standardization, and evaluation form a universal sequence; rather, it suggests that these four layers represent recurring concerns that appear, in different forms, across the domains reviewed in this paper. The digitalization layer concerns the conversion of physical and organizational processes into digital representations. The intelligent upgrading layer concerns the application of data-driven methods to monitoring, recognition, prediction, and optimization. The standardization layer concerns the codification of practices, interfaces, and metrics into shared rules. The evaluation layer concerns the assessment of whether digitalization and intelligent upgrading have produced the outcomes that were intended. In practice, these layers overlap, and their boundaries are not always clear.

One difficulty encountered in constructing this framework was the temptation to treat it as a taxonomy into which every study could be neatly placed. Several studies resisted such placement. Research on smart wellness models integrating traditional Chinese medicine standards with digital systems, for example, combines digitalization, standardization, and evaluation in a single initiative ^[5], while work on intelligent pet anti-barking collars blurs the line between intelligent upgrading and evaluation ^[6]. Rather than forcing these studies into separate layers, the framework treats them as instances where multiple layers are active simultaneously. This adjustment was not anticipated at the outset and reflects a broader lesson: theoretical



frameworks in digital transformation research are often more useful as diagnostic tools than as classification schemes.

Another difficulty concerned the treatment of evidence. Management studies often rely on case-based reasoning and qualitative evidence, while engineering studies frequently report quantitative performance metrics. Comparing these evidence types directly is problematic, and the chapter does not attempt to do so. Instead, it treats evidence quality as a cross-cutting concern that manifests differently in different domains. In management, uncertainty may be epistemic, arising from incomplete understanding of organizational behavior; in engineering, uncertainty may be aleatoric, arising from sensor noise or environmental variation. Recognizing this distinction may help future research avoid the error of applying engineering-style uncertainty quantification to problems where it is not appropriate.

The chapter also reflects on the limitations of the multi-industry comparative approach adopted in this paper. Comparing digital transformation practices across enterprise, manufacturing, transportation, healthcare, and consumer device domains risks superficiality, as the institutional, regulatory, and cultural contexts differ substantially. To some extent, this risk is unavoidable. The justification for comparison is not that the domains are identical but that they face structurally similar problems: how to convert processes into data, how to apply data-driven methods under uncertainty, how to codify practices into standards, and how to evaluate whether outcomes match intentions. Whether these structural similarities are deep enough to support meaningful cross-domain learning remains to be seen, and further research is needed to test this possibility.

2. Enterprise Digital Transformation

This chapter examines enterprise digital transformation through the intertwined lenses of platform operation, standard systems, and achievement transformation. It considers digital operation systems for enterprise service platforms, industry-university-research collaborative innovation platforms, ERP and WMS integration for inventory turnover efficiency, cross-industry data integration standards, and compliance requirements for customer data in financial CRM systems. A recurring observation is that digitalization does not automatically generate efficiency gains; outcomes depend on how standards are designed, how data flow across organizational boundaries, and how platform governance is structured. Studies on collaborative innovation platforms suggest that achievement transformation efficiency is shaped by incentive mechanisms and institutional trust, yet the evidence base remains limited and case-based, which constrains generalization. The chapter also notes that efficiency evaluation is not neutral, as indicator selection can shape organizational behavior in unintended ways^[7]. Considering these complexities, the discussion avoids treating digital platforms as uniform solutions and instead highlights the need for context-sensitive evaluation frameworks.

The literature on enterprise service platforms provides a useful starting point. Research on digital operation systems and efficiency evaluation examines how platform-based service delivery generates operational data that can be used to assess performance. The methodological approach is primarily case-based, drawing on platform data rather than large-scale quantitative surveys. This choice is understandable given the heterogeneity of enterprise services, but it limits the generalizability of the findings. A related concern is that platform data are often self-reported, and self-reported data may be subject to strategic manipulation, particularly when platform performance is tied to funding or reputation. Whether this concern is empirically significant remains an open question, and further research is needed to assess the reliability of platform-generated data.

The case of ERP and WMS integration is more established. Research has examined how seamless integration of ERP and WMS can enhance corporate inventory turnover efficiency, arguing that data consistency across systems reduces delays and errors [7]. The argument is plausible, but the evidence is based on a limited number of cases, and the causal direction is not fully established: firms that integrate ERP and WMS may differ systematically from firms that do not, and these differences may confound the relationship between integration and efficiency. A related study addresses technical standard development for cross-industry data integration in enterprise-level ERP systems [8]. Standard development is a slow, consensus-based process, and the study provides useful insights into the challenges involved. However, standards are not self-enforcing, and adoption depends on incentives that vary across firms and industries. A third study examines compliance and cross-border transfer technology for customer data in financial CRM systems, highlighting the tension between data utility and regulatory constraints [9]. This tension is likely to persist, and technical solutions alone may not resolve it.

Comparing these cases, several themes emerge. First, digital platforms are not neutral infrastructure; they embody assumptions about how work should be organized and how value should be measured. Second, standards are essential for interoperability but may also entrench particular interests and exclude alternatives. Third, efficiency evaluation is performative: what is measured tends to be what is managed, and what is managed tends to become what matters. These themes suggest that the study of enterprise digital transformation requires not only technical expertise but also institutional and ethical analysis. A purely technical approach may miss important aspects of how platforms function in practice.

One methodological difficulty encountered in reviewing this literature was the variability in evidence quality. Some studies provide detailed case evidence, while others rely on conceptual arguments. Some discuss limitations candidly, while others do not. This variability makes it difficult to draw firm conclusions about what works and what does not. A possible response is to treat the literature as a source of hypotheses rather than conclusions, and to design future research that tests these hypotheses more rigorously. Whether such research is feasible, given the complexity of the phenomena involved, is uncertain. Further research is needed to develop methods that are both rigorous and context-sensitive.

3. Intelligent Upgrading in Manufacturing and Transportation

This chapter shifts attention to intelligent upgrading in manufacturing and transportation, where monitoring, inspection, and scheduling problems are technically demanding and often safety-critical. It examines online monitoring and degradation evaluation for automotive-grade RF power amplifiers, automatic test methods for V2X on-board terminal receiving sensitivity, modular simulation test platforms for vehicular wireless signals, geometric curvature inspection and multi-physics coupling analysis for laminated automotive windshield glass, and multi-agent deep reinforcement learning for shared e-mobility fleet rebalancing. One observation that emerges is that monitoring methods are only as good as the data they rely on, and data quality issues—sensor drift, missing values, labeling errors—are pervasive across these domains. Another is that simulation-based evaluation, while useful, may not transfer cleanly to real-world conditions, particularly when demand is non-stationary or when operating environments change. The chapter also reflects on the difficulty of comparing methods across domains with different failure costs and different regulatory constraints. These considerations suggest that intelligent upgrading is not merely a technical aggregation problem but a socio-technical one, in which measurement infrastructure, maintenance practices, and organizational priorities all play a role.

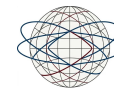
The methodological landscape of online monitoring in manufacturing is more fragmented than it first appears. In the case of automotive-grade RF power amplifiers, the challenge is not simply to detect degradation but to distinguish it from normal parameter drift caused by temperature, supply voltage variation, and load mismatch. Research on online monitoring and performance degradation evaluation addresses this by tracking multiple performance indicators over time and applying degradation criteria calibrated to endurance aging. One limitation of this approach is that calibration requires prior knowledge of aging behavior, which may not be available for new device generations. This limitation is not unique to RF amplifiers; similar issues arise in semiconductor manufacturing, where process changes and equipment aging interact in ways that are difficult to anticipate.

V2X on-board terminals present a different set of challenges, particularly in the context of automatic testing under multiple working conditions. Research on RF receiving sensitivity proposes an automatic test method designed to reduce manual intervention and improve repeatability. The method is promising, but its validation is based on a specific set of working conditions, and it is unclear how well it would generalize to conditions not represented in the test set. A related study on modular simulation test platforms for vehicular wireless signals proposes a modular architecture that supports multi-scenario testing ^[10]. The architecture is flexible, but flexibility comes at a cost: modular systems may be more complex to configure and maintain, and the overhead may not be justified for applications with narrow testing requirements.

Automotive laminated windshield glass introduces yet another dimension, namely the coupling of geometric, thermal, mechanical, and electromagnetic properties. Research on multi-point geometric curvature inspection proposes a framework with unified-datum decoupling, region-aware adaptive NSGA-II layout, and closed-loop mold compensation ^[11]. The complexity of this framework reflects the difficulty of achieving dimensional consistency in large-size laminated glass, where small deviations can accumulate during lamination. A related study examines thermo-mechano-electromagnetic multi-physics coupling and unified-datum tolerance coordination, with full-lifecycle experimental verification [12]. These studies are methodologically ambitious, but the reliance on simulation and controlled experiments raises questions about performance in mass production environments, where variability is higher and feedback loops are longer. Research on weathering resistance of high UV-blocking coatings for automotive glass evaluates performance through accelerated aging tests ^[13]. Accelerated tests are useful but may not perfectly reproduce field conditions, and the extrapolation from laboratory to service life involves assumptions that are not always made explicit.

Shared e-mobility fleet rebalancing presents a different kind of problem, namely the recognition of demand patterns and the coordination of multiple agents. Research on fleet rebalancing for expanding shared e-mobility systems proposes a multi-agent deep reinforcement learning approach ^[14], building on earlier work that applied deep reinforcement learning to expanding EV sharing systems ^[15]. The methodological progression is notable, moving from single-agent to multi-agent formulations. However, the evaluation is primarily simulation-based, and the transferability of learned policies to real systems is uncertain. Simulation environments inevitably simplify reality, and the simplifications may be consequential: for example, if demand is modeled as a stationary process but actual demand is non-stationary, learned policies may perform poorly. The studies acknowledge some of these issues, but a systematic treatment of sim-to-real transfer remains a topic for further research.

Comparing these domains, several common threads emerge. First, degradation and anomaly detection are rarely single-variable phenomena; they typically involve interactions among multiple physical or



operational factors. Second, monitoring methods are only as good as the data they rely on, and data quality issues are pervasive. Third, the choice of evaluation metrics shapes what is detected and what is missed, and metric selection is often driven by practical considerations rather than theoretical ones. These threads suggest that intelligent upgrading in manufacturing and transportation is not a purely technical problem but a socio-technical one, in which measurement infrastructure, maintenance practices, and organizational priorities all play a role.

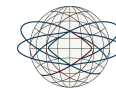
One methodological difficulty encountered in reviewing these studies was the inconsistency of reporting practices. Some studies report extensive validation results, while others provide only illustrative examples. Some discuss limitations candidly, while others do not. This inconsistency makes it difficult to compare methods on a common basis and may lead to overconfidence in methods that have been tested in narrow conditions. A possible remedy is the development of reporting standards for intelligent upgrading studies, analogous to those in clinical research. Whether such standards would be adopted, and whether they would improve practice, is an open question. Further research is needed to explore this possibility.

4. Digitalization of Health Services and Smart Devices

This chapter explores digitalization in health services and smart devices, a domain where standardization, clinical evidence, and user acceptance interact in ways that differ markedly from manufacturing or enterprise settings. It considers standardized traditional Chinese medicine external therapy for chronic soft tissue pain, standard systems for traditional external therapy in health preservation, smart wellness models integrating traditional Chinese medicine standards with digital systems, integrated acupuncture, tuina and moxibustion for chronic musculoskeletal pain and mild cognitive impairment, and the three-in-one therapy for pediatric asthma. It also examines intelligent pet anti-barking collars based on multi-sensor fusion, dog bark recognition using Mel-frequency cepstral coefficients and lightweight neural networks, and thermal runaway early warning for polymer lithium-ion batteries in wearable pet devices. A recurring difficulty is that traditional Chinese medicine concepts do not always map cleanly onto digital data models, and standardization may inadvertently reduce the flexibility that characterizes traditional practice. Similarly, lightweight recognition models may perform well on benchmark data but degrade under sensor placement changes or background noise. These tensions suggest that digitalization in health and smart devices requires not only technical expertise but also clinical, ethical, and cultural sensitivity.

The case of traditional Chinese medicine standardization illustrates the tension between codification and flexibility. Research on standardized traditional Chinese medicine external therapy for chronic soft tissue pain reports a multicenter observational study, suggesting that standardization can support consistent practice across sites ^[16]. The study is valuable for its multi-site design, but observational designs cannot establish causality, and the absence of randomization leaves open the possibility that observed improvements reflect selection effects or regression to the mean. A related study on the construction and application of a standard system for traditional external therapy in health preservation addresses the codification of practice more directly ^[17]. Standard systems are useful for training and quality assurance, but they may also freeze practice in ways that inhibit innovation. Whether this trade-off is acceptable depends on the goals of standardization, which may vary across stakeholders.

The integration of traditional Chinese medicine standards with digital systems offers a distinctive case. Research on smart wellness models integrating traditional Chinese medicine health preservation industry standards and digital systems proposes a model that combines standardized practice with digital



infrastructure. The model is ambitious, but its implementation requires substantial investment in data infrastructure and training, and the study does not fully address the sustainability of these investments over time. A related concern is that digital systems may privilege certain kinds of data—structured, quantifiable, easily transmitted—over others, potentially marginalizing aspects of traditional practice that resist quantification. Whether digital systems can support rather than constrain traditional medicine is an open question, and further research is needed to explore this tension.

Clinical research on traditional Chinese medicine interventions provides a different kind of evidence. Research on integrated acupuncture, tuina and moxibustion for chronic multisite musculoskeletal pain reports a three-arm assessor-blinded randomized controlled trial with biomarker and pressure pain threshold assessments ^[18]. The trial design is rigorous, but the intervention is complex, and it is difficult to isolate which component contributes most to observed effects. A related theoretical analysis of combined acupuncture, tuina and moxibustion for elderly chronic musculoskeletal pain guided by meridian examination offers a conceptual framework ^[19]. The framework is useful for organizing clinical reasoning, but it is not directly testable in its current form. Research on standardization of time-based moxibustion with Linggui Bafa for intervention in mild cognitive impairment proposes a theoretical analysis from the perspectives of time-based qi transformation and meridian time sequence ^[20]. The analysis is rich in traditional theory, but its translation into testable hypotheses remains a challenge.

Smart devices for pets present a different set of challenges. Research on intelligent pet anti-barking collar control systems based on multi-sensor fusion describes a system that integrates acoustic, motion, and possibly physiological signals to distinguish barking from other vocalizations and to trigger a corrective response. The system-level perspective is valuable, but the study does not fully address the ethical dimensions of automated corrective devices, including the potential for stress or discomfort. These concerns are not merely externalities; they may affect user acceptance and, consequently, the practical viability of the technology. Research on dog bark recognition using Mel-frequency cepstral coefficients and lightweight neural networks proposes an algorithm designed for embedded deployment ^[21]. The method achieves reasonable accuracy on the reported dataset, but the dataset composition is not fully described, and it is unclear how the method would perform on breeds or acoustic environments not represented in training. Research on thermal runaway early warning and safety management for polymer lithium-ion batteries in wearable pet devices proposes a safety management system that integrates thermal monitoring with warning logic ^[22]. The system is promising, but the study does not fully specify how warning thresholds were determined or how they might transfer to other battery chemistries.

Comparing these cases, several themes emerge. First, digitalization in health and smart devices is not merely a technical process; it involves the translation of clinical, cultural, and ethical concepts into data models that may or may not preserve their meaning. Second, standardization can support consistency but may also reduce flexibility, and the trade-off depends on context. Third, evidence quality varies widely, and claims about effectiveness should be tempered by attention to study design, sample size, and potential biases. These themes suggest that digitalization in health and smart devices requires not only technical expertise but also clinical, ethical, and cultural sensitivity. A purely technical approach may miss important aspects of how these systems function in practice.

One difficulty encountered in reviewing this literature was the incommensurability of evidence across domains. Randomized controlled trials, observational studies, theoretical analyses, and engineering evaluations each have their own standards of rigor, and comparing them directly is problematic. Rather than attempting such comparison, this chapter treats each study on its own terms and asks what it can and

cannot establish. This approach is more modest than a unified evaluation framework, but it may be more honest about the limits of current knowledge. Whether a more integrated approach is possible remains an open question, and further research is needed to explore this possibility.

5. Conclusion

The final chapter turns toward comprehensive evaluation and future directions, not as a summary of preceding chapters but as a reconsideration of what digital transformation and intelligent upgrading might mean when viewed across enterprise, manufacturing, transportation, health service, and consumer device domains; it asks how pathways differ across sectors, why some organizations progress more rapidly than others, and what role standard systems, governance mechanisms, and evaluation practices play in shaping outcomes, and it reflects on the difficulty that success criteria are not commensurable—what counts as efficiency in a service platform may not count as safety in a medical intervention, and what counts as robustness in a semiconductor fab may not count as user acceptance in a pet device—which makes any unified evaluation framework attractive in theory yet problematic in practice; rather than proposing such a framework, the chapter suggests that cross-domain learning may be possible only if concepts are translated with care and if the limitations of current evidence, including small sample sizes, short follow-up periods, and the difficulty of isolating intervention effects from contextual factors, are acknowledged rather than smoothed over, and it looks toward future research that might combine longitudinal designs, broader and more heterogeneous datasets, and greater attention to implementation contexts, so that the question of how digital transformation can be governed responsibly across heterogeneous domains becomes not a concluding remark but an opening for further inquiry.

Data Availability Statement

Data will be made available on request.

Funding

This work was supported without any funding.

Conflicts of Interest

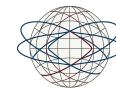
The author(s) declare no conflicts of interest.

Ethical Approval and Consent to Participate

Not applicable.

References

- [1] Shi, C. (2026). *Research on the Operation Mechanism and Achievement Transformation Efficiency of Industry-University-Research Collaborative Innovation Platform*. *Journal of World Economy*, 5(2), 40-48.
- [2] Shi, C. (2026). *Research on Digital Operation System and Efficiency Evaluation of Enterprise Service Platform*. *Frontiers in Management Science*, 5(3), 26-33.
- [3] Zhao, Y. (2026). *Online Monitoring and Performance Degradation Evaluation Method for Automotive-Grade RF Power Amplifiers Under Endurance Aging*. *Journal of Progress in Engineering and Physical Science*, 5(2), 66-76.
- [4] Zhao, Y. (2026). *Research on Automatic Test Method of RF Receiving Sensitivity for V2X On-Board Terminals Under Multi-Working Conditions*. *Innovation in Science and Technology*, 5(3), 9-17.
- [5] Yao, C. (2026). *Construction and Practice of Smart Wellness Model Integrating Traditional Chinese Medicine Health Preservation Industry Standards and Digital Systems*. *Insights in Social Science*, 4(2), 76-86.



- [6] Lin, H. (2026). *Design and Implementation of Intelligent Pet Anti-Barking Collar Control System Based on Multi-Sensor Fusion*. *Innovation in Science and Technology*, 5(3), 1-8.
- [7] Qiu, Y. (2025). *The Path to Enhancing Corporate Inventory Turnover Efficiency Through Seamless Integration of ERP and WMS*. *Journal of World Economy*, 4(6), 51-57.
- [8] Qiu, Y. (2026). *Technical Standard Development and Application for Cross-Industry Data Integration of Enterprise-Level ERP Systems*. *Frontiers in Management Science*, 5(1), 47-53.
- [9] Qiu, Y. (2025). *Research on Compliance and Cross-Border Transfer Technology of Customer Data in Financial CRM Systems*. *Law and Economy*, 4(11), 18-24.
- [10] Yanbo, Z. (2026). *Modular Architecture Design of Multi-Scenario Simulation Test Platform for Vehicular Wireless Signals*. *Journal of Academic Research and Advances*, 2(2), 11-21.
- [11] Jiang, Y. (2026). *Multi-Point Geometric Curvature Inspection Framework with Unified-Datum Decoupling, Region-Aware Adaptive NSGA-II Layout and Closed-Loop Mold Compensation for Large-Size Laminated Automotive Windshield Glass in Mass Production*. *Innovation in Science and Technology*, 5(2), 69-85.
- [12] Jiang, Y. (2026). *Thermo-Mechano-Electromagnetic Multi-Physics Coupling Analysis, Unified-Datum Tolerance Coordination and Full-Lifecycle Experimental Verification of Triple-Functional Integrated Automotive Laminated Windshield Glass*. *Journal of Progress in Engineering and Physical Science*, 5(2), 32-43.
- [13] Yan, J. (2026). *Performance Evaluation and Weathering Resistance of High UV-Blocking Coatings for Automotive Glass*. *Journal of Academic Research and Advances*, 2(1), 53-65.
- [14] Luo, M., Du, B., Zhang, W., Song, T., Li, K., Zhu, H., ... & Wen, H. (2023). *Fleet rebalancing for expanding shared e-mobility systems: A multi-agent deep reinforcement learning approach*. *IEEE Transactions on Intelligent Transportation Systems*, 24(4), 3868-3881.
- [15] Luo, M., Zhang, W., Song, T., Li, K., Zhu, H., Du, B., & Wen, H. (2021, January). *Rebalancing expanding EV sharing systems with deep reinforcement learning*. In *Proceedings of the Twenty-Ninth International Conference on International Joint Conferences on Artificial Intelligence* (pp. 1338-1344).
- [16] Chen, Y. (2026). *Standardized Traditional Chinese Medicine External Therapy for Chronic Soft Tissue Pain: A Multicenter Observational Study*. *Current Research in Medical Sciences*, 5(3), 36-45.
- [17] Chen, Y. (2026). *Construction and Application of Standard System for Traditional External Therapy in Traditional Chinese Medicine Health Preservation*. *Journal of Innovations in Medical Research*, 5(2), 23-31.
- [18] Huang, R. (2026). *Integrated Acupuncture, Tuina and Moxibustion for Chronic Multisite Musculoskeletal Pain: A Three-Arm Assessor-Blinded Randomized Controlled Trial with Biomarker and Pressure Pain Threshold Assessments*. *Journal of Innovations in Medical Research*, 5(2), 16-22.
- [19] Huang, R. (2026). *Theoretical Analysis of Combined Acupuncture, Tuina and Moxibustion Intervention for Elderly Chronic Musculoskeletal Pain Guided by Meridian Examination—From the Perspective of Tendon Excess-Deficiency and Qi-Blood Stasis*. *Journal of Research in Social Science and Humanities*, 5(2), 32-41.
- [20] Rui, H. (2026). *Theoretical Analysis on Standardization of Time-Based Moxibustion with Lingui Bafa for Intervention in Mild Cognitive Impairment: From the Perspectives of Time-Based Qi Transformation and Meridian Time Sequence*. *Insights in Social Science*, 4(2), 102-113.
- [21] Haipeng, L. (2026). *Research on Dog Bark Recognition Algorithm Based on Mel-Frequency Cepstral Coefficients and Lightweight Neural Network*. *Journal of Academic Research and Advances*, 2(2), 1-10.
- [22] Lin, H. (2026). *Design of Thermal Runaway Early Warning and Safety Management System for Polymer Lithium-ion Batteries in Wearable Pet Devices*. *Journal of Progress in Engineering and Physical Science*, 5(2), 58-65.