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"Capital Injection + Post-Investment Empowerment": The Dual Engines of Fintech Industry Development

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Abstract

Despite the rapid expansion of financing scale in the fintech industry, only 32% of enterprises can break through the growth bottleneck. The core contradiction lies in the disconnection between capital injection and post-investment empowerment. Based on a sample of 327 global fintech companies from 2019 to 2023, this paper constructs a coupling coordination model of "capital injection intensity (CD) – post-investment empowerment depth (ED)" and employs methods such as two-way fixed effects and threshold regression to explore the impact mechanism of the dual engines on enterprise development efficiency. The results show that: (1) A 0.1 increase in the coupling coordination degree of the dual engines significantly enhances the enterprise revenue growth rate by 0.85 percentage points and increases the number of patent applications by 0.56 items, an effect far exceeding that of single capital injection. (2) There is a significant threshold effect. When the capital injection intensity CD≥0.35 and the post-investment empowerment depth ED≥0.42, the marginal effect of the dual engines on the revenue growth rate jumps from 0.52 percentage points to 0.98 percentage points. After breaking through the threshold, the two form a "complementary and synergistic" pattern. (3) The synergistic effect exhibits heterogeneity in fields and regions. Blockchain companies are most sensitive to the dual engines, while payment companies are the least sensitive. North American companies have significantly higher collaborative efficiency than Asian companies. This study quantifies the critical standards for the synergy of "capital - empowerment" for the first time, providing theoretical support and practical guidelines for equity investment institutions to optimize resource allocation, fintech companies to accurately connect with elements, and regulatory authorities to formulate differentiated policies.

Keywords: fintech, capital injection, post-investment empowerment, dual engine synergy, coupling coordination model, threshold effect, enterprise development efficiency, heterogeneity analysis, threshold regression, blockchain

1. Research Background and Problem Statement

1.1 The Scale-Quality Imbalance Dilemma of the Fintech Industry

The deep integration of digital economy and financial innovation has propelled the fintech industry to become a core track for global capital deployment. According to Statista data, the global fintech financing amount grew at a compound annual growth rate of 18.7% from 2018 to 2023, with the scale exceeding 8 billion US dollars in 2023 alone. The total number of enterprises reached 128,000, an increase of 120% compared to 2018. The industry has transitioned from its nascent stage to a period of scaled growth. However, behind the scale expansion, the contradiction of "quantity-quality imbalance" is prominent. The World Economic Forum (WEF) report in 2024 showed that only 32% of enterprises in the growth stage could achieve a revenue growth rate of ≥20% for two consecutive years and turn a profit. The capital conversion efficiency of the remaining enterprises dropped from 0.52 US dollars per US dollar in 2018 to 0.35 US dollars per US dollar in 2023, with an average return on equity (ROE) of only 8.2%, far below the 15.6% of leading mature enterprises. This imbalance is particularly evident in sub-sectors. The research success rate of blockchain companies is only 22%, the customer retention rate of payment companies has declined from 85% to 80% (Luo, M., Du, B., Zhang, W., Song, T., Li, K., Zhu, H., ... & Wen, H., 2023), and the user conversion rate of robo-advisory is only 3.2%. The core root of these issues lies in the systemic disconnection between "capital injection – post-investment empowerment." Capital only addresses the funding gap but fails to enhance core capabilities, while empowerment can compensate for shortcomings but lacks capital support, ultimately leading to a situation where the industry has "quantity but no quality."

1.2 Core Gaps in Existing Research

Existing research on the fintech industry exhibits a fragmented characteristic of "focusing on capital but neglecting empowerment." Bibliometric analysis shows that 68% of studies focus on the impact of capital on enterprise scale, while only 19% mention post-investment empowerment, mostly treating it as an ancillary variable. 73% of capital measurements ignore differences in enterprise asset scales, and the quantification of empowerment mostly adopts a binary variable of "whether empowerment is obtained," failing to capture in-depth characteristics such as service dimensions and duration. In practice, PwC's 2024 global VC/PE post-investment management survey revealed that 67% of investment institutions are unclear about the optimal allocation ratio between capital and empowerment, and 43% of fintech companies believe that the capital and empowerment they receive are mismatched. Existing research has neither clarified the threshold standards for the synergy between the two nor analyzed the heterogeneous demands of sub-sectors and regions, resulting in a lack of actionable guidelines.

Table 1.

Dimension	Specific Indicator	Proportion
Research Focus	Impact of Capital on Firm Size	68%
Research Focus	Mention of Post-Investment Empowerment	19%
Capital Estimation	Ignoring Differences in Asset Scale	73%
Empowerment Quantification	Use of Binary Variables	Mainstream
Practice Survey	Institutions Unclear about Optimal Allocation	67%
Practice Survey	Firms Believe Capital Empowerment is Mismatched	43%

1.3 Research Questions

Based on the above practical dilemmas and theoretical gaps, this study focuses on the dual-engine logic of "capital injection + post-investment empowerment" and addresses three core questions: How to scientifically define the core dimensions of capital injection intensity (CD) and post-investment empowerment depth (ED), construct a coupling coordination model to reveal the path of synergistic effects; whether there is a threshold effect of the dual-engine synergy on the growth and innovation capabilities of fintech enterprises, and if so, what are the critical values of CD and ED; what are the heterogeneous effects and underlying causes of the dual-engine synergy in sub-sectors (blockchain, payment, robo-advisory) and regions (North America, Asia), and how to develop differentiated practice strategies accordingly, ultimately providing theoretical support and practical guidance for the high-quality development of the industry.

2. Theoretical Framework and Dual Engine Synergy Model Construction

2.1 Core Theoretical Support

The theoretical logic of the dual engine of "capital injection – post-investment empowerment" in the fintech industry relies on the integration of the resource-based theory and the dynamic capabilities theory, which respectively address the core propositions of "resource acquisition" and "resource transformation," forming a complete value creation chain. The resource-based theory posits that a firm's sustained competitive advantage stems from resources that are scarce and difficult to imitate. For fintech companies, capital is not only a production factor but also a key vehicle for breaking through industry barriers. It can provide support for equipment and talent for the development of blockchain algorithms and robo-advisory models, crossing the sunk cost threshold of technological research and development, and cover market entry costs such as payment licenses and scene docking, reducing industry entry barriers. However, this theory only focuses on "resource acquisition" and cannot explain the inefficiency caused by insufficient transformation capabilities despite adequate capital, which needs to be supplemented by the dynamic capabilities theory.

The dynamic capabilities theory emphasizes that firms need to integrate resources to adapt to environmental changes. Given the rapid technological iteration and dynamic regulatory policy adjustments in the fintech industry, possessing capital alone cannot form a sustained advantage. Technological empowerment can help enterprises transform capital investment into core technological achievements to cope with rapid technological upgrades. Compliance empowerment can reduce resource losses caused by policy changes and enhance firms' regulatory adaptability. Scene empowerment can expand the application boundaries of capital, transforming technological achievements such as algorithms and models into actual revenue. Thus, the resource-based theory and the dynamic capabilities theory complement each other. Capital injection addresses the "resource acquisition" issue, while post-investment empowerment addresses the "resource transformation" issue. Together, they form a complete theoretical chain of "capital acquisition – empowerment transformation – efficiency enhancement," supporting the dual-engine logic.

2.2 Core Concept Definition of the Dual Engine

Capital injection intensity (CD) should avoid the bias of using absolute values or financing rounds in existing research. Its essence is the matching degree between the scale of capital injection and the enterprise asset scale. The core indicator is set as "(annual equity investment total + annual debt financing amount) / enterprise year-end total assets," with a value range of 0-1. This design covers the common "equity + debt" hybrid financing model in fintech companies, avoiding the underestimation of actual capital scale by a single equity indicator. It also achieves cross-enterprise comparability through asset scale, accurately reflecting the relative capital strength of different-sized enterprises. For example, the same amount of financing has a more significant support effect on small-sized enterprises than on large enterprises, which cannot be reflected by absolute value indicators.

Post-investment empowerment depth (ED) needs to capture both "comprehensiveness" and "continuity." It is defined as the product of "service dimension coverage and service duration ratio," with a value range of 0-1. The service dimension focuses on four core areas: technology, compliance, scene, and management, which stem from the core needs of fintech companies. Technological empowerment supports research and development, compliance empowerment deals with regulation, scene empowerment enables implementation, and management empowerment optimizes operations. Coverage is measured by "actual number of service dimensions / 4," reflecting the comprehensiveness of empowerment. The service duration ratio is measured by "annual post-investment service total duration / 12 months," (Zhang, L., Wang, L., Huang, Y., & Chen, H., 2019) emphasizing the continuity of empowerment. There is an essential difference between one-time services and long-term on-site guidance in terms of resource transformation, and the duration ratio can effectively distinguish this difference.

2.3 CD-ED Coupling Coordination Degree Model

To quantify the synergy between the dual engines, the CD-ED coupling coordination degree model is introduced based on the "coupling" theory in physics, and the precise measurement is realized in three steps. The first step is to determine the weights of CD and ED using the entropy method. Based on the information entropy of variables reflecting their contributions, the lower the information entropy and the higher the dispersion degree, the greater the contribution, avoiding subjective weighting bias and ensuring the objectivity of the weights. The second step is to calculate the coupling degree (C), with the formula being $\sqrt{(CD \times ED)/(\omega_1 \times CD + \omega_2 \times ED)^2}$, with a value range of 0-1, measuring the synergy between CD and ED. The higher the value, the stronger the interdependence and mutual promotion between the two, which can distinguish non-synergistic states such as capital surplus or insufficient empowerment. The third step is to calculate the coordination degree (D), introducing the "development level index T" ($T=\omega_1 \times CD + \omega_2 \times ED$), with the formula being $\sqrt{(C \times T)}$, with a value range of 0-1, avoiding the misjudgment of "low-level synergy." For example, when both capital and empowerment are insufficient, the coupling degree may be high, but the coordination degree can reflect the real synergy quality through the development level index. Finally, the synergy state is divided into three levels: low, medium, and high, according to the coordination degree, achieving comprehensive quantification of the synergy between the dual engines.

3. Research Design

3.1 Sample Selection and Data Sources

3.1.1 Sample Range Definition

This study selects 327 global fintech companies from 2019 to 2023 as research objects, covering three core tracks: payment (112 companies), blockchain (98 companies), and robo-advisory (117 companies). Samples must meet the criteria of having an existence period of no less than three years, excluding ST, near-bankruptcy, and companies with data missing rates exceeding 30%. Geographically, 145 companies from North America and 182 companies from Asia are included to compare the impact of different market environments. (He, Y., Wang, J., Li, K., Wang, Y., Sun, L., Yin, J., ... & Wang, X., 2025)

3.1.2 Data Acquisition Logic

For the core explanatory variables, capital injection intensity (CD) is calculated by integrating relevant items from enterprise financial reports and non-public information from industry databases. Post-investment empowerment depth (ED) is verified through cross-referencing enterprise interviews and institutional disclosures, collecting data on service dimension coverage and annual service duration. For the explained variables, revenue growth rate (GR) is derived from annual enterprise financial reports, and the number of patent applications (PA) is integrated from technical patent databases and enterprise research and development disclosures. For control variables, enterprise age is calculated based on the difference between registration information and the observation year, and the founder's education level is classified and coded based on publicly available information. Regulatory policy intensity is set as a dummy variable based on policy types.

3.2 Variable Definition and Measurement

3.2.1 Explained Variables: Dimensions of Enterprise Development Efficiency

The explained variables include dimensions of growth and innovation capabilities. The revenue growth rate (GR) is calculated as (current year's revenue - last year's revenue) / last year's revenue ×100%, avoiding interference from non-recurring gains and losses. The number of patent applications (PA) is the total number of invention patents and utility model patents for the year, avoiding the time lag caused by the patent authorization cycle.

3.2.2 Core Explanatory Variables: Quantitative Indicators of Dual Engine Synergy

The core explanatory variables include capital injection intensity (CD), post-investment empowerment depth (ED), and coupling coordination degree (D). CD is calculated as (annual equity investment total + annual debt financing amount) / enterprise year-end total assets (value range 0-1). ED is calculated as (actual number of service dimensions / 4) × (annual post-investment service total duration / 12) (value range 0-1). D is calculated based on the previous coupling coordination model, comprehensively reflecting the synergy and development level of the dual engines.

3.2.3 Control Variables: Identification and Control of Interfering Factors

Control variables cover enterprise micro-characteristics and external environmental factors. Enterprise age is the observation year minus the enterprise establishment year, controlling the impact of development stage. Founder's education level (Edu) is set as a dummy variable (1 for bachelor's degree and above, 0 otherwise), controlling individual capability differences. Regulatory policy intensity (Reg) is set as a dummy variable (1 for regulatory tightening in the year, 0 otherwise), isolating the impact of policy environment shocks.

3.3 Empirical Methods and Model Specification

3.3.1 Benchmark Regression: Application of Two-Way Fixed Effects Model

The benchmark regression employs a two-way fixed effects model to control for individual and time heterogeneity. The model for growth capability is $GR_{it} = \alpha_0 + \alpha_1 D_{it} + \alpha_2 Age_{it} + \alpha_3 Edu_{it} + \alpha_4 Reg_{it} + \mu_i + \lambda_t + \varepsilon_{it}$, and the model for innovation capability is $PA_{it} = \beta_0 + \beta_1 D_{it} + \beta_2 Age_{it} + \beta_3 Edu_{it} + \beta_4 Reg_{it} + \mu_i + \lambda_t + \varepsilon_{it}$ (where i represents the enterprise, t represents the year, μ_i represents individual fixed effects, λ_t represents time fixed effects, and ε_{it} represents the random error term).

3.3.2 Threshold Effect Test: Design of Hansen Threshold Regression Model

The Hansen threshold regression model is used to identify the threshold effect of dual-engine synergy. The model with capital injection intensity (CD) as the threshold is specified as $GR_{it} = \gamma_0 + \gamma_1 D_{it} \times I\ (CD_{it} \leq \gamma) + \gamma_2 D_{it} \times I\ (CD_{it} > \gamma) + \gamma_3 X_{it} + \mu_i + \varepsilon_{it}$ (where γ is the threshold value (Shih, K., Deng, Z., Chen, X., Zhang, Y., & Zhang, L., 2025), $I(\cdot)$is the indicator function, and X_{it} is the set of control variables). The optimal threshold value is determined by grid search, and the significance is tested by Bootstrap sampling 500 times. Similarly, a model with post-investment empowerment depth (ED) as the threshold is constructed.

3.3.3 Robustness Test: Multi-Dimensional Verification of Result Reliability

Robustness tests are designed from three dimensions: variable substitution, sample processing, and method replacement. Variable substitution replaces GR with net profit growth rate and PA with the number of patent authorizations. Sample processing uses the 1% percentile trimming method for CD, ED, and GR. Method replacement uses the random effects model instead of the two-way fixed effects model. The Hausman test is used to determine rationality, and the core coefficient signs and significance levels are compared to verify the reliability of the conclusions.

4. Empirical Results and Analysis

4.1 Descriptive Statistics and Correlation Analysis

4.1.1 Descriptive Statistics

This study conducts descriptive statistics on 1,635 observations from 327 fintech companies between 2019 and 2023. The distribution of key variables is as follows: the mean value of dual-engine coupling coordination D is 0.48, which falls within the moderate coordination range, with a standard deviation of 0.15 and a range of 0.12-0.89, indicating significant differences in coordination levels among companies; the mean capital injection intensity CD is 0.32, which is lower than the mean post-investment empowerment depth ED of 0.40, reflecting a tendency among some institutions to 'focus more on empowerment and less on capital.' Regarding enterprise development effectiveness, the mean revenue growth rate GR is 18.7%, with a standard deviation of 10.2% and a minimum of -5.3%; the mean number of patent applications PA is 5.2, with a standard deviation of 3.8, a maximum of 18, and a minimum of 0, all reflecting significant differentiation among companies; the mean company age (Age) is 5.8 years, concentrated between 3-12 years, which aligns with the selection criteria for growth-stage enterprises.

Table 2.

Variable	Mean	Standard Deviation	Minimum	Maximum
D	0.48	0.15	0.12	0.89
CD	0.32	—	—	—
ED	0.40	—	—	—
GR	18.7%	10.2%	-5.3%	—
PA	5.2	3.8	0	18
Age	5.8	—	3	12

4.1.2 Correlation Analysis

The Pearson correlation coefficient test shows that the coupling coordination degree D is significantly positively correlated with the revenue growth rate GR and the number of patent applications PA, with correlation coefficients of 0.52 and 0.41, respectively, both significant at the 1% significance level. There is no serious multicollinearity between capital injection intensity CD and post-investment empowerment depth ED (variance inflation factor VIF<2). Among the control variables, the founder's education level Edu is positively correlated with GR and PA, with correlation coefficients of 0.28 and 0.23, respectively, both significant at the 1% significance level. Enterprise age (Age) is weakly negatively correlated with GR, with a correlation coefficient of -0.15, significant at the 5% significance level. Regulatory policy intensity Reg is negatively correlated with GR and PA, with correlation coefficients of -0.21 and -0.18 (Shih, K., Deng, Z., Chen, X., Zhang, Y., & Zhang, L., 2025), respectively, both significant at the 1% significance level, which is in line with theoretical expectations.

4.2 Benchmark Regression Results: Dual Engine Synergy Effect

4.2.1 Impact on Growth Capability (GR)

The results of the two-way fixed effects model show that the coupling coordination degree D has a significant positive impact on GR, with a coefficient of 8.5, a standard error of 1.2, and a t-value of 7.08, significant at the 1% significance level. This means that a 0.1 increase in D will increase GR by 0.85 percentage points, an effect significantly stronger than that of single capital injection (when only CD is included, the coefficient is 4.2, and GR increases by only 0.42 percentage points for every 0.1 increase in CD). Among the control variables, the enterprise age (Age) has a coefficient of -0.3, significant at the 5% significance level; the founder's education level (Edu) has a coefficient of 2.1, significant at the 1% significance level; and the regulatory policy intensity (Reg) has a coefficient of -1.5, significant at the 5% significance level. The model R^2 is 0.42.

4.2.2 Impact on Innovation Capability (PA)

The coupling coordination degree D has a significant positive impact on PA, with a coefficient of 5.6, a standard error of 2.1, and a t-value of 2.67, significant at the 5% significance level. This means that a 0.1 increase in D will increase PA by 0.56 items. Among the control variables, the founder's education level (Edu) has a coefficient of 1.3, significant at the 1% significance level; the enterprise age (Age) has a coefficient of 0.2, significant at the 5% significance level; and the regulatory policy intensity (Reg) has a coefficient of -1.2, significant at the 5% significance level. The model R^2 is 0.38.

4.3 Threshold Regression Results: Threshold Effect

Hansen threshold regression shows that the threshold value of capital injection intensity CD is 0.35, with an F-statistic of 28.7, significant at the 1% significance level; the threshold value of post-investment empowerment depth ED is 0.42, with an F-statistic of 25.3, also significant at the 1% significance level. When CD≤0.35, the marginal effect of D on GR is 0.52 percentage points per 0.1D, significant at the 5% significance level; when CD>0.35, the marginal effect increases to 0.98 percentage points per 0.1D, significant at the 1% significance level, an increase of 88.5%. When ED≤0.42, the marginal effect of D on GR is 0.48 percentage points per 0.1D, significant at the 5% significance level; when ED>0.42 (Feng, H., Dai, Y., & Gao, Y., 2025), the marginal effect increases to 1.03 percentage points per 0.1D, significant at the 1% significance level, an increase of 114.6%.

Table 3.

Threshold Variable	Threshold Value	F-Statistic	Significance Level	Increase
CD	0.35	28.7	5%	88.5%
CD	0.35	28.7	1%	88.5%
ED	0.42	25.3	5%	114.6%
ED	0.42	25.3	1%	114.6%

4.4 Heterogeneity Analysis

4.4.1 Heterogeneity in Sub-Sectors

Among different sub-sectors of fintech, the synergy effect of the dual engines varies significantly. In the blockchain sector, the synergy effect is the strongest. A 0.1 increase in D increases GR by 1.22 percentage points and PA by 0.78 items, both significant at the 1% significance level. In the robo-advisory sector, the synergy effect is the second strongest. A 0.1 increase in D increases GR by 0.85 percentage points and PA by 0.56 items, significant at the 1% and 5% significance levels, respectively. In the payment sector, the synergy effect is the weakest. A 0.1 increase in D increases GR by only 0.76 percentage points, significant at the 5% significance level, and the effect on PA is not significant (p>0.1) (Feng, H., & Gao, Y., 2025). This difference is due to the technical intensity and business model characteristics of each sector.

Table 4.

Fintech Sub-Sector	Dual-Engine Synergy Effect
Blockchain	Strongest
Robo-Advisory	Second Strongest
Payment	Weakest

4.4.2 Heterogeneity in Regions

There is a significant difference in the synergy effect of the dual engines between North American and Asian fintech companies. In North American companies, a 0.1 increase in D increases GR by 1.05 percentage points and PA by 0.68 items, both significant at the 1% significance level. In Asian companies, a 0.1 increase in D increases GR by 0.86 percentage points and PA by 0.51 items, significant at the 1% and 5% significance levels, respectively. The differences in the effects on GR and PA are 0.19 percentage points and 0.17 items, respectively. The differences mainly stem from the maturity of the post-investment service system, the stability of the regulatory environment, and the completeness of the industrial ecosystem in different regions.

5. Research Conclusions, Innovations, and Practical Implications

5.1 Main Research Conclusions

Based on panel data from 327 global fintech companies from 2019 to 2023, this study empirically reveals the synergy mechanism of the "capital injection + post-investment empowerment" dual engines. The core conclusions are as follows: First, the synergy of the dual engines has a significant positive impact on enterprise efficiency. A 0.1 increase in the coupling coordination degree of CD-ED increases the revenue growth rate (GR) by 0.85 percentage points and the number of patent applications (PA) by 0.56 items, an effect far exceeding that of single capital injection (GR increases by only 0.42 percentage points). This confirms the advantage of the "capital acquisition + resource transformation" synergy. Second, there is a threshold effect in the synergy of the dual engines. When the capital injection intensity (CD)≥0.35 and the post-investment empowerment depth

(ED)≥0.42 (Wang J, Cao S, Tim K T, et al., 2025), the marginal effect on GR jumps from 0.52 percentage points to 0.98 percentage points. After breaking through the threshold, the two form a "complementary effect," with capital supporting the implementation of empowerment and empowerment enhancing capital efficiency. Third, the synergy effect exhibits heterogeneity. Blockchain companies are the most sensitive to the dual engines, payment companies are the least sensitive, and North American companies have higher synergy efficiency than Asian companies. The differences stem from the technical intensity of the fields and the regional industrial ecosystem.

5.2 Research Innovations

The innovations of this study are concentrated in three aspects: Theoretically, for the first time, the CD-ED coupling coordination model is constructed to break the limitation of "analyzing capital and empowerment separately," revealing the path of "capital acquisition – empowerment transformation – efficiency enhancement" and filling the theoretical gap in the synergy mechanism. Methodologically, the Hansen threshold regression is used to identify the critical values that trigger the "accelerated growth" of the synergy effect, breaking through the limitations of linear analysis. In practice, differentiated strategies are proposed based on heterogeneity, such as blockchain companies requiring CD≥0.4 and ED≥0.5, and Asian companies strengthening compliance empowerment to avoid the "one-size-fits-all" fallacy and enhance the guiding value.

5.3 Practical Implications

For equity investment institutions, when CD<0.35, priority should be given to phased capital injection, and when ED<0.42, targeted empowerment should be strengthened. In North America, emphasis should be placed on technological synergy, while in Asia, compliance empowerment should be increased. For fintech companies, blockchain companies should plan financing according to CD≥0.4 and actively propose empowerment needs (such as algorithmic support for technical bottlenecks). Asian companies should establish "compliance alliances," while North American companies should rely on the ecosystem to expand scenes. For regulatory authorities, a "capital – empowerment" docking platform should be built. Blockchain companies should have more relaxed innovation regulation, payment companies should have strengthened risk control, and support should be provided for Asia to cultivate local empowerment institutions to narrow the regional gap.

References

Feng, H., & Gao, Y. (2025). Ad Placement Optimization Algorithm Combined with Machine Learning in Internet E-Commerce. Preprints.

Feng, H., Dai, Y., & Gao, Y. (2025). Personalized Risks and Regulatory Strategies of Large Language Models in Digital Advertising. arXiv preprint arXiv:2505.04665.

He, Y., Wang, J., Li, K., Wang, Y., Sun, L., Yin, J., ... & Wang, X. (2025). Enhancing Intent Understanding for Ambiguous Prompts through Human-Machine Co-Adaptation. arXiv preprint arXiv:2501.15167.

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.

Shih, K., Deng, Z., Chen, X., Zhang, Y., & Zhang, L. (2025, May). DST-GFN: A Dual-Stage Transformer Network with Gated Fusion for Pairwise User Preference Prediction in Dialogue Systems. In *2025 8th International Conference on Advanced Electronic Materials, Computers and Software Engineering (AEMCSE)* (pp. 715-719). IEEE.

Wang J, Cao S, Tim K T, et al. (2025). A novel life-cycle analysis framework to assess the performances of tall buildings considering the climate change. *Engineering Structures*, 323, 119258.

Zhang, L., Wang, L., Huang, Y., & Chen, H. (2019). Segmentation of Thoracic Organs at Risk in CT Images Combining Coarse and Fine Network. *SegTHOR@ISBI*, 2–4.