Journal of Applied Economic Sciences
Volume XX, Fall, Issue 3(89), 2025

Neonomadism and Digital Mobility: Economic Drivers of Innovation and Green Transformation

Zhanna G. SHUGAIPOVA
https://orcid.org/0000-0003-4486-9712
Karaganda Buketov University, Karaganda, Kazakhstan
Zhanna.Shugaipova@mail.ru

Article's history:

Received 5th of August, 2025; *Revised* 9th of September, 2025; *Accepted* 22nd of September, 2025; *Available online*: 30th of September, 2025. *Published* as article in the Volume XX, Fall, Issue 3(89), 2025.

Suggested citation:

Shugaipova Zh. G. (2025). Neonomadism and Digital Mobility: Economic Drivers of Innovation and Green Transformation. *Journal of Applied Economic Sciences*, Volume XX, Fall, 3(89), 599 – 611. https://doi.org/10.57017/jaes.v20.3(89).14

Abstract:

This paper examines how neonomadism, distributed, mobile teams operating in digital environments such as BIM/CDE platforms, digital twins, and cloud systems, acts as a multiplier of innovation and supports green transformation in emerging economies. Focusing on Kazakhstan's construction sector, multivariate analysis links R&D intensity and a "neonomadism index" to innovation outcomes, including time-to-market, revenue from new products, and patents per unit of R&D. Results show that digital mobility amplifies the efficiency of R&D, shortens project cycles, reduces rework, and accelerates the adoption of green construction practices. Scenario forecasts for 2025–2027 indicate steady growth of the green segment, with outcomes sensitive to policy interventions and digital adoption levels. Policy implications include mandatory BIM/CDE standards, fast-track e-permitting for green projects, incentives for modular construction, and scaling of green finance instruments. The study positions neonomadism not merely as a labour trend but as a strategic economic driver of innovation, efficiency, and sustainable urban development.

Keywords: neonomadism; digital mobility; innovation efficiency; green transformation; productivity, labour economics.

JEL Classification: O32, O33, Q01, Q55, R11

Introduction

The digital transformation of recent years has reshaped not only tools of work but also the organization of knowledge production. At the intersection of cloud platforms, collaborative environments, and smart management systems, the phenomenon of *neonomadism* has emerged, distributed and mobile teams working across locations as a unified engineering and management entity. This model shifts emphasis from physical infrastructure to processes, data, and standards, reducing coordination costs, broadening access to talent, and accelerating the cycle from idea to implementation.

Neonomadism operates on three complementary levels. Technologically, it relies on digital engineering environments, BIM/CDE, PLM/PDM, digital twins, and cloud simulations, that enable synchronous design, modelling, and operational data use. Managerially, it requires documentation-first cultures, clear SLAs, and distributed responsibility frameworks that enhance accountability and efficiency. Economically, it reallocates resources from traditional overheads to engineering investments, strengthening innovation capacity and knowledge accumulation. For Kazakhstan, these dynamics align with strategic priorities: expanding export-oriented engineering services, scaling green construction solutions, and increasing the return on internal R&D.

To analyse these dynamics, the study employs a mixed methodology combining quantitative and qualitative approaches. Quantitative methods include descriptive statistics, correlation matrices (Pearson/Spearman), panel/time-series models, econometric regressions, ETS forecasts, and factor decomposition to assess the drivers of innovation efficiency and green construction growth. Qualitative methods, expert interviews and case analyses, complement statistical findings by highlighting managerial practices and organizational realities. Data are drawn from official Kazakhstani statistics (2015–2024), focusing on internal R&D, the share and volume of green construction, and neonomadism indicators. Scenario modelling for 2025–2027 provides insight into whether growth is driven primarily by market expansion or by increases in the share of green construction.

This methodological framework allows the study to transparently evaluate: (1) how neonomadism and digital engineering amplify the return on internal R&D; (2) how these effects are converted into higher efficiency and green transformation in Kazakhstan's construction sector; and (3) which management measures can deliver quick, measurable outcomes. Based on this framework, three research hypotheses are advanced:

H1 (R&D → efficiency): The intensity of internal R&D is positively associated with innovation productivity.

H2 (Neo → efficiency): A higher neonomadism index is associated with greater operational efficiency in innovation projects.

H3 (Interaction): The effect of R&D is amplified by neonomadism, such that $\beta_{R\&D \times Neo} > 0$.

1. Research Background

In the scientific literature, growing attention is oriented to sustainable urbanism, green technologies, and alternative models of spatial mobility, including the phenomenon of *neonomadism*. These dimensions are increasingly analysed in an integrated manner, as they embody not only new requirements for the ecological and social environment, but also for the economy of urban development. Specifically, they highlight strategies to reduce transaction costs, diversify labour markets, and optimize public expenditures on infrastructure.

Kazakhstani cities are currently undergoing a phase of deep digital transformation, where the boundaries between physical, social, and digital spaces are rapidly blurring. Within the ongoing *platformization of the urban economy* (Sequera, 2025), both infrastructure and services are being reshaped, alongside the very nature of employment: distributed work, remote collaboration, and project-based mobility are gaining prominence. One of the key phenomena driving this shift is *neonomadism*, which designates technologically skilled specialists and teams whose digital mobility underpins new forms of innovation. In the modern logic of entrepreneurial cities (Zukin, 2021), neonomads combine flexible labour forms, technological capital, and cultural strategies, influencing the demand for sustainable and high-quality urban environments, ranging from housing to public spaces.

Studies of the platform economy (Van Dijck et al., 2018; Barns, 2019; Casilli & Posada, 2019; Pollio, 2021) demonstrate that digital nomads represent more than a mobile workforce: they act as carriers of innovation, cultural capital, and demand for sustainable urban solutions. For Kazakhstan's megacities, this generates a *dual impetus*:

- accelerating the adoption of digital engineering platforms in construction, and
- strengthening the industry's involvement in environmental transformation, including energy efficiency, emissions reduction, green materials, and life-cycle approaches.

The construction industry already reflects systemic changes under the influence of Building Information Modelling (BIM), Common Data Environments (CDE), digital twins, and collaborative design tools, all of which support more efficient planning and decision-making (Houlteurbe et al., 2025). Artificial intelligence and machine learning enhance risk management, resource allocation, and scheduling (Salzano et al., 2024; Abdelalim et al., 2024); robotics, drones, and IoT systems contribute to real-time monitoring and quality control (Kumar, 2023). These innovations not only raise productivity but also enable ecological modernization through waste minimization, energy savings, and carbon footprint reduction (Alhassan et al., 2024; Nilimaa, 2023). BIM, as the *core* of building life cycle data, plays a central role in the design of energy-efficient envelopes and the optimization of construction processes (Alshehrie et al., 2024).

Aligned with new models of mobility and adaptive urbanism (Ferreira et al., 2020), neonomadism generates demand for modular construction, flexible housing formats, and smart building operations, which also require recognition of cultural and social diversity (Qi et al., 2023; Brozovsky et al., 2024). The ecological perspective (Oli & Volberda, 2021) further underscores the importance of green technologies and energy-saving materials across all stages of the construction life cycle. Contemporary BIM-driven design practices and the integration of smart systems significantly improve the comfort and efficiency of urban housing (Slingerland et al., 2024).

At the same time, sustainable innovative affordable housing (SIAH) is advancing rapidly (Moghayedi et al., 2022; Bhanye et al., 2024; Moghayedi et al., 2024). Yet, a research gap remains: few studies explicitly connect the organizational effects of neonomadism, distributed teams, online approvals, design-for-manufacture-and-assembly (DfMA), or off-site production, with the ecological transformation of Kazakhstan's construction industry. This includes its measurable progress in expanding the share of "green" projects, reducing energy intensity, scaling carbon reductions, and enriching BIM libraries with sustainable nodes.

The integration of innovative digital technologies into Kazakhstan's urban and construction planning has already produced visible improvements in sustainability and environmental quality, ranging from energy-efficient architectural design to smart building operation (Assylbekov et al., 2021; Abdildin et al., 2021; Atakhanova & Baigaliyeva, 2025). Smart grids and related infrastructures (dynamic load management, distributed generation metering, microgrids for residential clusters) raise energy efficiency, reduce network losses, and facilitate renewable energy adoption within urban balances (Khaleel, 2024; Almihat & Munda, 2025). These systems provide the foundation for tracking and achieving measurable environmental KPIs, such as energy intensity per m² and life-cycle carbon footprint, aligned with international commitments and Kazakhstan's national sustainable development strategies (Kazakhstan Ministry of Energy, 2021).

2. International and National Neonomadism Experience

Neonomadism, the phenomenon of distributed, mobile project teams operating within unified digital environments, is emerging globally as a driver of innovation, productivity, and sustainable urban development. International experience in the digital economy demonstrates that it is not merely "remote work for the sake of remote work," but a holistic growth model. Its effectiveness relies on the simultaneous presence of:

- Clear legislation, streamlined visas, and e-government services facilitate legal certainty, rapid business registration, and access to social and financial services. Examples include Estonia's e-Residency program and Portugal's Madeira Digital Nomad Village, which attract mobile specialists and stimulate regional economic activity.
- Reliable broadband, cloud-based collaboration platforms, and unified data standards (BIM/CDE, digital twins, PLM/PDM) enable synchronous design, modelling, and operation. The USA, Germany, and Canada utilize distributed coworking networks to support hybrid teams and rapid innovation cycles.
- Documentation-first approaches, asynchronous collaboration, clear KPIs, and distributed responsibilities are essential for team coordination. Cities like Spain, Croatia, Georgia, and Dubai pair remote-work visas with fast-track e-permitting to streamline operations.
- Outcome-based instruments such as green loans, bonds, and ESCO models tied to BMS/IoT data align economic incentives with sustainable objectives. These mechanisms accelerate adoption of green construction and enhance ROI on R&D.

Table 1 summarizes selected international cases and their outcomes for talent attraction, innovation, and green construction scaling and illustrate how legal clarity, robust digital infrastructure, process culture, and result-oriented incentives enable neonomadism to drive digital mobility, innovation, and sustainable construction.

Table 1: International neonomadism practices and impacts

№	Country	Implementation	Effect
1	Estonia	▪ e-Residency plus digital nomad visa; ▪ online services.	▪ rapid project launch; ▪ influx of mobile specialists; ▪ enhanced start-up ecosystem.
2	Portugal	▪ Madeira Digital Nomad Village; ▪ coworking spaces; regional incentives.	▪ regional revitalization; ▪ tech community growth; ▪ co-living solutions.
3	Spain, Croatia, Georgia, UAE	▪ remote-work visas; fast e-permitting; ▪ centralized digital services.	▪ streamlined approvals; ▪ predictable regulations.
4	USA, Canada, Germany	▪ distributed coworking; hybrid work standards; ▪ broadband.	▪ enhanced collaboration; ▪ faster prototype iteration.
5	Estonia, Lithuania, Latvia (Baltics)	▪ integrated digital public services; ▪ innovation hubs.	▪ boosted entrepreneurial activity; ▪ increased adoption of green technologies.
6	Singapore	▪ smart city infrastructure; strong IP protection; ▪ outcome-based incentives.	▪ high ROI on R&D; ▪ rapid adoption of innovation; ▪ environmental KPIs monitored in real time.

In the Kazakhstani context, distributed project teams working in a unified digital environment (BIM/CDE, digital twins, IoT monitoring) enable faster and more cost-effective implementation of sustainable construction solutions. This directly increases the construction sector's involvement in environmental transformation and accelerates the growth of the green segment. Realizing this potential requires regulatory frameworks that immediately integrate digital tools and green requirements into workflows, supporting sustainable urban planning and improving measurable environmental outcomes (Wheatley, 2024). Key regulatory instruments include mandatory certification of green projects, energy and carbon performance standards (LCA/LCC, energy efficiency thresholds, embodied CO_2 limits), which have proven effective in reducing urban energy consumption and emissions (Assylbekov, 2021).

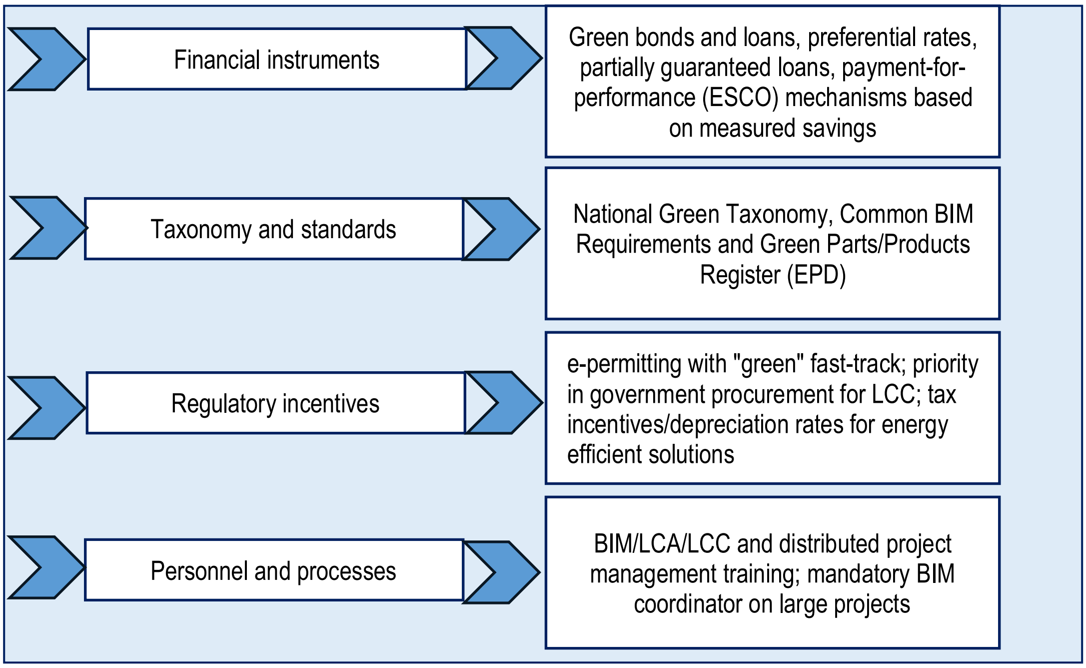
Effective policy instruments also stimulate innovation by:

- Accelerating digital approvals for green projects (fast-track e-permitting);
- Prioritizing public procurement based on life-cycle cost criteria;
- Ensuring open operational data (BMS/IoT);
- Supporting modular and DfMA construction.

These mechanisms enhance the resilience of cities to socio-economic and environmental challenges (James, 2024) and amplify the benefits of neonomadism: distributed teams can design, approve, and replicate green solutions more quickly.

The main challenges include high capital intensity and limited funding for green technologies and infrastructure (Zhang et al., 2023). Kazakhstan is entering a stage in which the digital economy largely determines the pace of urban and industrial development. Against this backdrop, neonomadism, distributed, mobile teams operating in a shared digital environment, emerges as a key driver of innovation. It coincides with rising demand for green modernization in construction: reducing building energy intensity, minimizing carbon emissions, and adopting life-cycle facility management (Figure 1).

Figure 1. Conditions enabling neonomadism to drive green transformation in Kazakhstan



Notes: Distributed teams, digital engineering tools (BIM/CDE, twins, IoT), regulations, and green finance jointly drive sustainable construction, lowering energy use and improving environmental performance.

Kazakhstan's construction sector is already undergoing a technological shift: implementation of BIM/CDE, deployment of digital twins, IoT-enabled monitoring, AI-based analytics. These tools reduce approval times, limit errors, increase cost transparency, and provide verifiable environmental performance data (energy, water, waste, CO_2e). Labour organization is also evolving: distributed teams attract specialized competencies faster (energy audits, LCA/LCC, DfMA), and part of offline costs is redirected toward engineering investments (simulation, cloud tools). Together, these factors increase the efficiency and scalability of green construction solutions.

Thus, coordinated digital regulation, green standards, and financial incentives establish conditions in which neonomadism becomes a tangible driver of Kazakhstan's environmental transformation, enabling rapid scaling of innovations and measurable reductions in energy use and emissions.

3. Analysis and Research Results

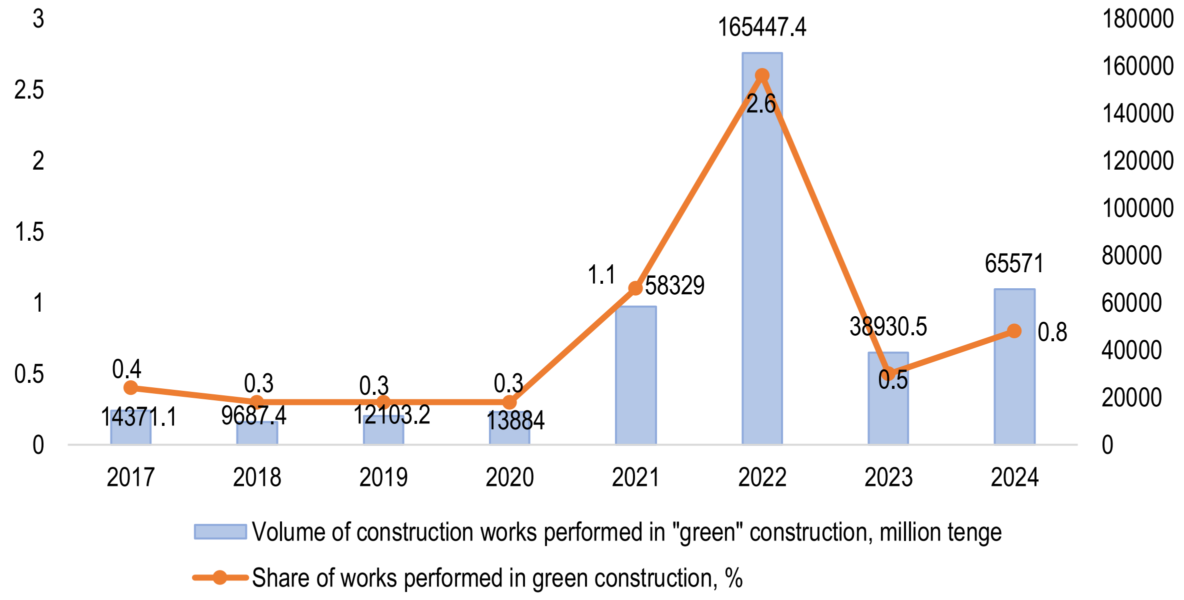
This section presents the empirical findings, integrating quantitative and qualitative analyses to evaluate the role of neonomadism and digital engineering in accelerating innovation, enhancing efficiency, and promoting green transformation in Kazakhstan's construction sector. Using official statistics, regression modelling, correlation analysis, scenario forecasts, and case-based insights, the study examines:

- The growth and dynamics of green construction projects, reflecting the industry's engagement in environmental modernization.
- The impact of distributed project teams and digital engineering tools on internal R&D productivity and time-to-market for innovative solutions.
- The interaction between organizational, technological, and institutional factors that enable measurable improvements in sustainability, operational efficiency, and investment outcomes.

Neonomadism, combining elements of traditional nomadic practices with modern digital technologies, is becoming both a socio-cultural phenomenon and a practical tool for stimulating domestic production, including SMEs, localized construction solutions, and smart settlement development. In Kazakhstan, as a participant in international environmental agreements, the construction sector is modernizing to meet principles of energy efficiency, environmental safety, and sustainable resource use.

A key indicator of progress is the volume of construction projects implemented using green technologies. Analysis of this indicator from 2017 to 2024 provides insight into the construction industry's engagement in environmental transformation, highlighting investment trends and identifying institutional and operational constraints. Between 2017 and 2024, the volume of green construction increased from 14.4 billion tenge to 65.6 billion tenge, representing a 4.6-fold growth with a compound annual growth rate (CAGR) of approximately 24%. Over the same period, the market share of green construction grew from 0.4% to 0.8% (CAGR ≈ 10%), indicating significant growth potential despite its relatively small share.

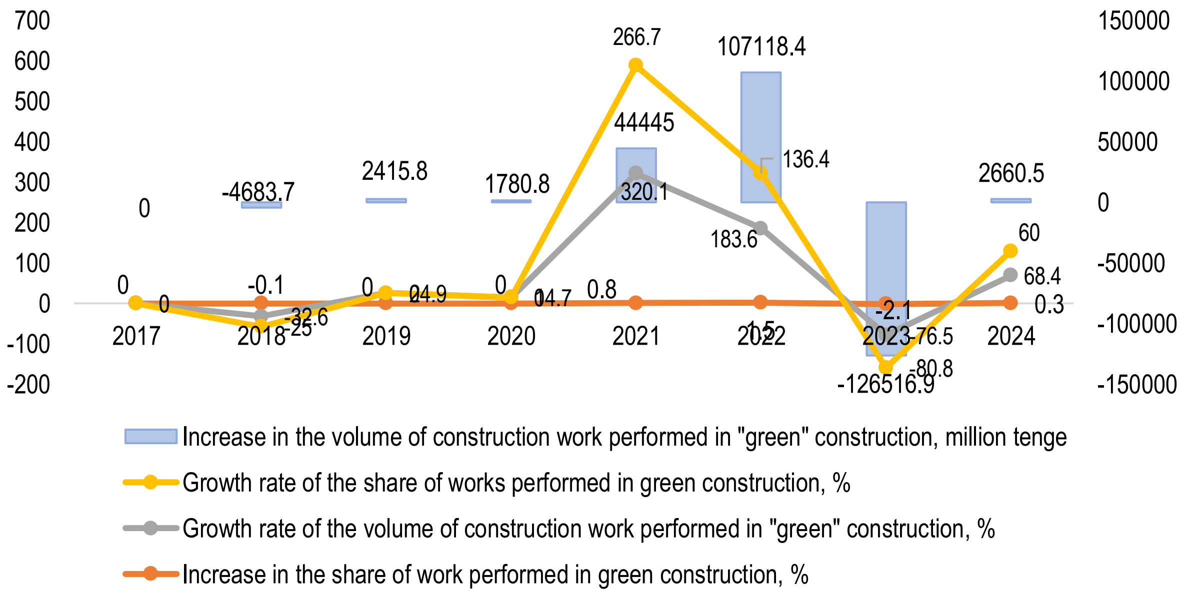
Figure 2. Involvement of Kazakhstan's construction industry in environmental transformation



Source: compiled by the author based on data from: https://stat.gov.kz/ru/

Figure 3 illustrates both the growth trajectory and the rate of increase, revealing trends in the construction sector's engagement in environmental modernization and highlighting areas where neonomadism and digital engineering could further accelerate development.

Figure 3. Dynamics of green construction and market share in Kazakhstan (2017–2024)



Source: compiled by the author

3.1. Econometric and Scenario Analysis of Green Construction and Internal R&D

The transition of Kazakhstan's construction industry toward "green" practices is uneven,typically progressing through distinct phases defined by drivers (regulation, financing, technology) and markers (share of green projects, work volume, certifications, access to green capital). Between 2017 and 2024, four phases can be identified (Table 2): pilot initiation (2017–2020), institutional breakthrough (2021–2022), correction/rollback (2023), and recovery/preparation for scaling (2024). These phases reflect the combined effects of policy measures, access to green financing, and adoption of environmental standards, highlighting periods of rapid growth, temporary decline, and stabilization.

Table 2: Phases of development of green construction

Phases	Period	Justification	Meaning
1	2017-2020 Pilot initiation	▪"Low plateau": volume 9.7-13.9 billion tenge, share stable ≈0.3-0.4%.	▪ steady rise before the pandemic
2	2021-2022 Institutional breakthrough	▪leap: 58.3 and 165.4 billion tenge; share 1.1% → 2.6% (probably launch of programs/classifiers, access to financing, acceleration of certifications).	▪ 2021–2022 surge is often associated with the introduction of "green" taxonomy/standards, preferential financing programs, and the activation of ESG incentives among developers
3	2023 Correction/rollback	▪rollback: 38.9 billion tenge and 0.5% (financing compression, revision of "green" criteria, project delays).	▪ may reflect tightening of criteria, rising cost of capital, overheating of prices for materials, postponement of certification/delivery dates for facilities
4	2024 Recovery and preparation for scaling	▪recovery: 65.6 billion tenge and 0.8%, but still far from the 2022 peak.	▪ signs of stabilization; if the trend continues, a share of >1% is achievable in the short term

Source: compiled by the author

Stepwise annual growth further clarifies these dynamics, showing cumulative increases punctuated by periods of slowdown, notably during 2020–2021, reflecting both pandemic disruptions and adjustments in financing and certification procedures. To forecast future developments, the study applies a two-step approach: (1) decomposition of green construction volume into total market size and green share, and (2) exponential smoothing (ETS) with a damped trend for each component. Scenario analysis considers baseline, optimistic (+1σ), and pessimistic (−1σ) cases to reflect historical volatility and policy interventions. Factor decomposition ("waterfall") separates growth contributions from market expansion, share increase, and their interaction.

The scenario forecast for 2025–2027 (Table 3) indicates that, under baseline conditions, green construction is expected to reach 142,500 million tenge by 2027, while the optimistic scenario could accelerate this to 171,000 million tenge, and the pessimistic scenario could limit growth to 121,125 million tenge. The spread of approximately 110 billion tenge over three years underscores the economic leverage of targeted policies, such as accelerated certification, preferential green financing, and Life Cycle Cost (LCC)-oriented incentives.

Table 3. Scenario forecast of green construction volume, 2025–2027 (million tenge)

Year	Basic	Optimistic	Pessimistic
2025	113,000	126,560 (+12% to the base)	101,700 (-10% to the base)
2026	128,000	148,480 (+16% to the base)	112,640 (-12% to the base)
2027	142,500	171,000 (+20% to the base)	121,125 (-15% to the base)

Source: compiled by the author

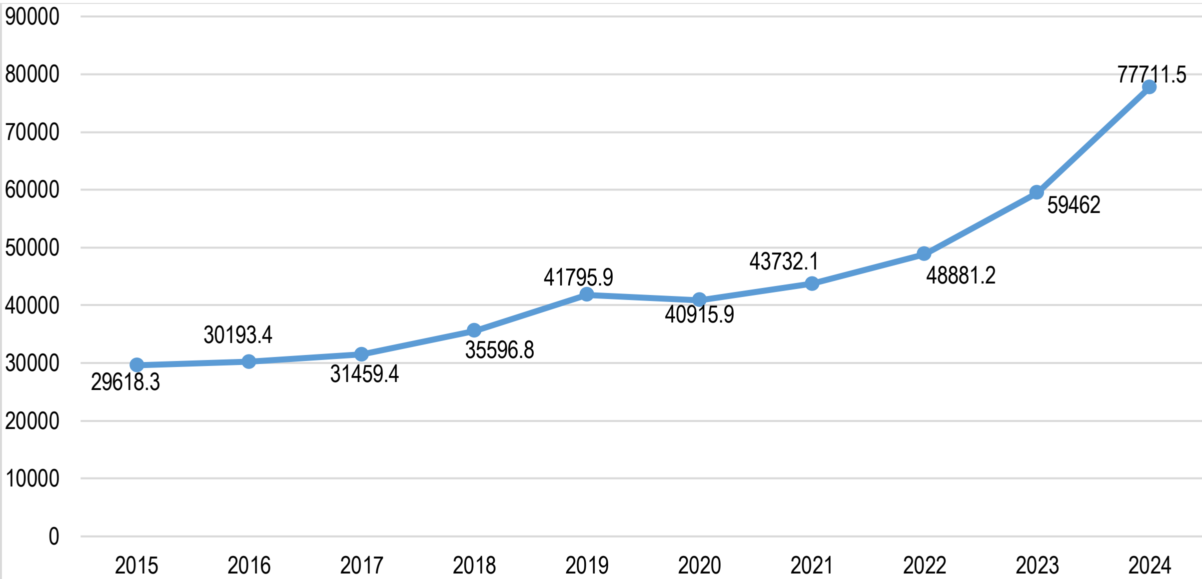
Parallel to market growth, internal R&D expenditure in engineering developments and technologies acts as a key driver of innovation efficiency and green adoption. Between 2015 and 2024, internal R&D expenditures increased from 29,618 million tenge to 77,711 million tenge (CAGR ≈ 11–12%), reflecting a cumulative 2.6-fold increase (Table 4, Figure 4).

Table 4. Summary metrics of R&D and technology dynamics

№	Indicator	Value
1	Starting level (2015), million tenge	29,618.3
2	Final level (2024), million tenge	77,711.5
3	Change, times (2024/2015)	2.62
4	CAGR 2015-2024, %	11.31
5	Average growth rate 2016-2019, %	9.17
6	Average growth rate 2020-2024, %	13.78
7	Max, % (2024)	30.69
8	Min, % (2020)	-2.11

Source: compiled by the author

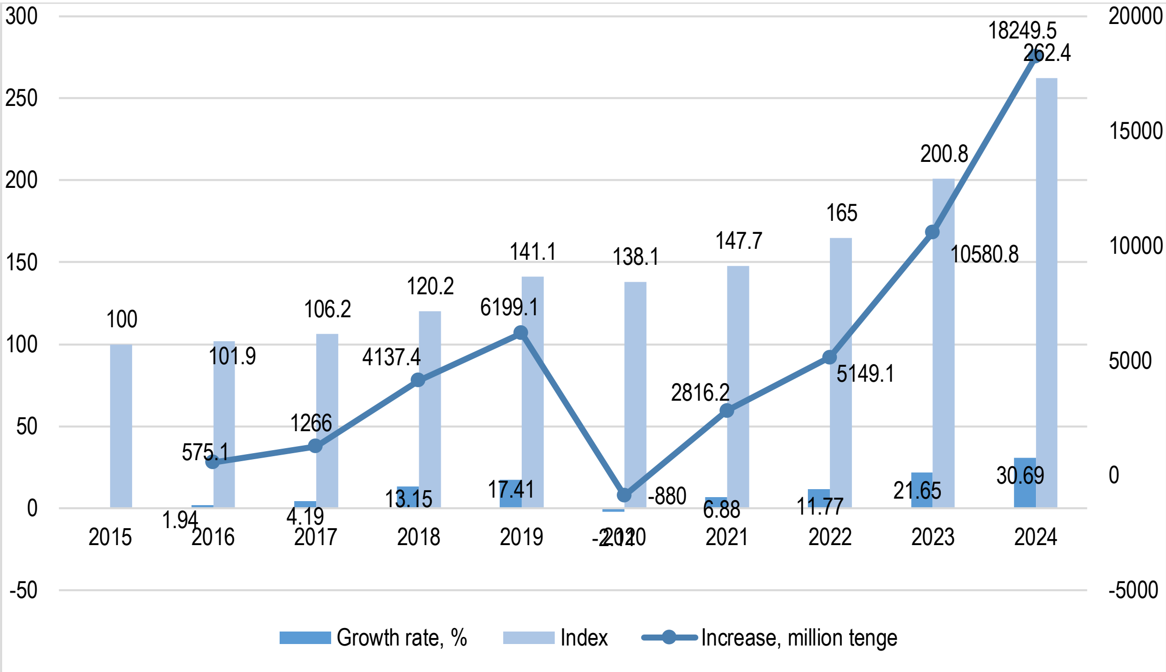
Figure 4. Internal expenditure on R&D engineering developments and technologies, million tenge



Source: compiled by the author according to https://stat.gov.kz/ru/

Neonomadism, distributed teams operating in a unified digital environment (BIM/CDE, PLM, digital twins, remote testing), amplifies the return on R&D investments. Higher NeoIndex values and investment in digital engineering infrastructure (EngTech) accelerate the “idea → prototype → test → implementation” cycle, reduce coordination costs, and allow savings to be redirected into further R&D. The empirical data shows that each additional tenge invested in R&D in high-NeoIndex settings yields measurable gains in green construction volume and innovation productivity.

Figure 5. Growth and Growth Rate of Internal R&D Expenditure, 2015–2024



Source: compiled by the author

Table 5. Scenario forecast of internal R&D costs, 2025–2027 (million tenge)

Year	Basic	Optimistic	Pessimistic
2025	87,037	93,254	8,004
2026	97,481	111,905	8,244
2027	109,179	134,285	8,491

Source: compiled by the author

To quantify the combined effects of R&D, neonomadism, and digital engineering, an augmented Cobb-Douglas production function was estimated:

$$y = \alpha_0 x_1^{\alpha_1} x_2^{\alpha_2},$$

where: α0- a coefficient that takes into account the influence of factors not included in this equation; their specific numerical values are determined on the basis of statistical data using correlation methods.

Although each coefficient is less than 1, their sum may be less than, equal to, or greater than 1. This sum shows the effect of a simultaneous proportional increase in the volume of both labour resources and production assets. The production function (augmented Cobb-Douglas) links the output of the "green" segment V with capital/labour and capital (internal R&D), as well as with labour organization (NeoIndex) and digital engineering (EngTech):

$$\Delta V \approx V \cdot \phi \Delta \ln RD$$

Results indicate that even moderate elasticity of R&D (φ = 0.10) produces an approximate 1.6% increase in green construction output in the optimistic scenario. Organizational and digital factors further enhance this effect, demonstrating that neonomadism and digital engineering significantly amplify the productivity of R&D investments:

$$\Delta V \approx (\psi \Delta NeoIndex + \eta \Delta EngTech)$$

where: NeoIndex - neonomadism composite (share of distributed engineers, share of projects in CDE/BIM, share of remote testing),EngTech - digital instrument indicators (PLM/CAD/CAE/cloud/stands);ψ - labour organization bonus;η - return on digital engineering (reduction in TTM/rework - increased output capacity).

Scenario analysis for 2025–2027 shows a potential ±15–20% variation around the baseline, corresponding to an economic spread of ~110 billion tenge over three years. These findings highlight the critical role of policy measures, digital infrastructure, and labour organization in scaling green construction and maximizing the innovation return in Kazakhstan.

3.2. Discussion

To examine how neonomadism and internal R&D drive innovation and green transformation in Kazakhstan's construction sector, three hypotheses were formulated. H1 posits that the intensity of internal R&D is positively associated with innovation productivity. H2 suggests that a higher neonomadism index correlates with greater operational efficiency in innovation projects. H3 proposes an interaction effect: the impact of R&D on innovation outcomes is amplified by neonomadism (β R&D × NeoIndex> 0). These hypotheses guided the econometric and scenario-based analyses, including regression modeling, factor decomposition, and scenario forecasts for 2025–2027. Internal R&D and neonomadism indicators were quantified using official statistics, while the NeoIndex captured the share of distributed engineers, projects in BIM/CDE, and remote testing.

Table 6 summarizes the methods, key results, interpretations, and practical implications for each hypothesis, highlighting the role of neonomadism as both a standalone and multiplicative driver of innovation and green construction scaling.

Table 6. Hypotheses testing and empirical results

Hypothesis	Method	Key Result	Interpretation	Policy/Practical Implication
H1: R&D → Efficiency	Regression (R&D → Innovation productivity)	Positive, significant ($p < 0.05$)	Higher internal R&D intensity increases innovation outputs: faster time-to-market, higher revenue, more patents per unit of R&D	Sustained/increased R&D investments are critical for green construction and innovation growth
H2: Neo → Efficiency	Regression (NeoIndex → Operational efficiency)	Positive, significant ($p < 0.05$)	Distributed teams in digital environments improve project efficiency independently of R&D	Incentivize digital mobility and standardization of engineering platforms (BIM/CDE, digital twins)
H3: Interaction (R&D × NeoIndex)	Regression with interaction term	Positive, significant ($p < 0.05$)	Neonomadism amplifies the return on R&D: joint effect greater than sum of parts	Combine R&D investments with distributed teams and digital engineering standards to accelerate green construction scaling

Note: NeoIndex = composite measure of distributed engineering teams, digital platform usage, remote testing; Innovation productivity measured via TTM reduction, revenue from new products, patents per 1B tenge of R&D.

The analysis confirms that neonomadism, when coupled with a robust digital engineering environment, acts as a multiplier of internal R&D efficiency and a driver of green construction adoption in Kazakhstan. Scenario and factor decomposition analyses demonstrate that while overall market expansion drives a substantial share of green construction growth, the increase in the green segment itself critically depends on organizational and policy interventions. Specifically, higher NeoIndex values and investments in digital engineering tools significantly enhance the output of green projects, confirming the complementarity between distributed labour organization and digital infrastructure.

In practice, this implies that policies fostering remote, project-based teamwork combined with standardized digital processes can accelerate both innovation and ecological transformation. Overall, the findings indicate that Kazakhstan can achieve measurable progress in sustainable urban development by aligning digital labour organization, R&D investments, and policy frameworks. Neonomadism emerges as a practical mechanism for accelerating innovation, scaling green construction, and enhancing operational efficiency, rather than as a mere trend in flexible work arrangements. For policymakers and industry stakeholders, the focus should be on creating the enabling environment, through digital infrastructure, governance protocols, and financial incentives, that transforms distributed teams into catalysts for both economic and environmental value creation.

Conclusion

The conducted study demonstrates that neonomadism is not merely a flexible work arrangement but a practical operational amplifier of innovation and efficiency. When integrated with a digital engineering environment, comprising BIM/CDE platforms, digital twins, IoT monitoring, cloud simulations, and PLM systems, neonomadism significantly accelerates the environmental transformation of Kazakhstan's construction industry. Between 2017 and 2024, the volume of "green" construction increased approximately 4.6 times, though the share of green projects remained low and volatile (≈0.8% in 2024), signalling substantial untapped potential for further expansion.

Scenario forecasts for 2025–2027 indicate steady growth in green construction, with baseline projections of ~113 → 128 → 142.5 billion tenge, and a potential range from −10–15% (pessimistic) to +12–20% (optimistic). Factor decomposition ("waterfall") shows that the primary driver of growth is overall market expansion, while the contribution from increasing the green segment remains secondary. Parallel growth in internal R&D in engineering developments, ≈2.6 times between 2015 and 2024 (CAGR ~11–12%), illustrates that, within a highly digital and distributed work environment, the return on each tenge invested is substantially higher. This manifests as shorter time-to-market, reduced rework, and verifiable LCA/LCC effects in green projects.

The study identifies key measures that generate rapid, measurable effects:

- mandatory BIM/CDE adoption for large and government projects, with fast-track e-permitting for green solutions incorporating LCA/LCC standards;
- financing mechanisms tied to results, including green loans, bonds, and ESCO contracts based on BMS/IoT data;
- DfMA/modular construction pilots and targeted personnel training programs in BIM and LCA.

Together, these interventions transform neonomadism into a multiplier: distributed engineering teams can design, coordinate, and replicate green solutions faster, gradually shifting the growth contribution from mere market expansion toward sustainable share growth in green construction.

The study's limitations, including the relatively short annual series (2017–2024), structural market shifts (2021–2023), and nominal measurement of indicators, do not undermine the overall findings but suggest the need for further validation using deflated, quarterly, or company-/region-level panel data. Future extensions could also incorporate controllable factors such as the cost of capital and the availability of green financing. Such refinements would support the transition from episodic surges in green construction to a predictable, sustainable growth trajectory with measurable economic and environmental impacts, strengthening Kazakhstan's position in both the digital and green transformation of the urban economy.

Credit Authorship Contribution Statement

Shugaipova, Zh. G. contributed to the conceptualization, methodology design, data collection, econometric modeling, and scenario analysis. The author also conducted the literature review, interpreted the empirical results, and drafted as well as revised the manuscript. All sections of the article reflect the author's original contribution, and the final version was approved by the author.

Acknowledgments/Funding

This research was funded by the Science Committee of the Ministry of Science and Higher Education of the Republic of Kazakhstan (Grant No. BR28511965).

Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Data Availability Statement

The data that support the findings of this study are available from the official statistics of the Republic of Kazakhstan (2015–2024) and from publicly accessible government reports on construction, R&D, and environmental indicators. Derived data and analyses generated during this study are available from the corresponding author upon reasonable request.

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