EEJOURNALS OPEN ACCESS

EURASIAN EXPERIMENT JOURNAL OF ENGINEERING

(EEJE) ISSN: 2992-409X

@EEJE PUBLICATIONS Volume 5 Issue 2 2025

The Impact of Telework on Urban Development

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ABSTRACT

The COVID-19 pandemic triggered a paradigm shift in global work patterns, bringing telework to the forefront of urban economic restructuring. This paper investigates how the widespread adoption of telework has reshaped urban development, firm location decisions, housing markets, transportation systems, and environmental outcomes. Drawing from historical data and spatial-economic modeling frameworks, the study analyzes trends in telework adoption, differences in firm relocation behavior, and urban policy responses, with case studies primarily from Japan and other global cities. The work reveals a notable decentralization of economic activities as firms migrate from central business districts to suburban fringes, catalyzed by declining telework infrastructure costs and evolving employee preferences. The paper examines how this decentralization impacts housing demand, traffic congestion, socio-economic inequality, and land use. Findings suggest that while telework presents opportunities for more balanced urban growth and environmental benefits, it also introduces challenges related to infrastructure planning, equitable access to telework resources, and potential urban hollowing. Policy recommendations are made to guide adaptive urban planning in an increasingly hybrid working world.

Keywords: Telework, Urban Development, COVID-19, Firm Location, Monocentric City Model, Housing Market, Urban Decentralization, Environmental Impact, Remote Work.

INTRODUCTION

On April 3, 2020, the Japanese government declared a state of emergency due to the COVID-19 outbreak. A survey conducted in August 2020 revealed that before the outbreak, only 10% of employees teleworked, while during the outbreak, this number rose to 38%. Afterward, although the telework ratio decreased to 26%, it remained significantly higher than pre-outbreak levels. Some companies have continued with telework or hybrid styles, while others reverted to pre-outbreak methods with no telework. This raises the question of whether teleworking, which expanded during the pandemic, will be permanently adopted. Key to this question is the influence of the firms' locations. This study suggests that moving from office work to telework affects both the location of firms within urban areas and their economic activity. Using a general urban economic model based on the spatial competition model, the study examines the impact of telework on firms' location and economic activity. For telework, firms need an information system and must be located at the cell center. Teleworking incurs costs that increase with distance from a cell office. In this two-dimensional linear city model, firms and workers are uniformly distributed, and workers incur transportation costs to commute. Quarterly, firms, based on prior workers' fixed locations, make spatial decisions aiming to maximize discounted profits [1, 2].

Historical Context of Telework

Before examining the impact of telework on urban development, it is important to present some historical context of telework. The huge impact of the COVID-19 pandemic resulted in the society-wide import of telework. The wide adoption of telework, or working at home via the internet, has changed work styles immediately, with the impact still continuing after the easing of the pandemic. This abrupt and large adoption of telework is unprecedented in history and worthy of examination in this research. However, the issue of effects on urban development is broad and remains unexplored in prior research. Aiming to

bridge the gap of the broad inquiry of urban development and the unprecedented abrupt telework adoption experience, existing research on telework and urban development is reviewed in detail. Telework, or working at home via the internet, is defined in broad sense as work that does not need to conduct in traditional office space. In applied literature, telework is often used to refer to working at home, and hence it is also referred to as remote work, or working from home. Telework has been widely examined in its implications for transportation. Conference papers examine the impacts of telework on an urban area in detail, but these studies are at too aggregated spatial resolutions to quantitatively show the spatial distribution of telework offices and firms concerning non-telework offices and firms. Urban growth is an increase in the number and size of urban centers due to movements of people to rural areas. Multiple forces determine urban growth. Examined academic papers discussing the impact of increased telework on urban development from various perspectives as the above literature has numerous unaddressed issues [3, 4].

Current Trends in Telework

An increasing number of employees are teleworking full-time, averaging up to 3 percent of their working hours for telework. Many work under flexible arrangements, allowing them varying telework options and adaptable schedules. Evidence suggests that certain conditions are linked to higher telework hours, notably among higher socio-economic groups defined by age, education, and occupation. Employment types also influence telework hours, with involuntary casual employees teleworking less. Different industries show varying maximum telework capacities; those in public sectors or client-pursuing roles tend to telework more. Access to telework facilities is influenced by several factors, including worker characteristics, employment contracts, and geographical context. Unlike past studies focused on workplaces or residential areas, a land use/transport interaction model is utilized to examine telework behavior changes. This prototype model is centered on Melbourne, employing existing metropolitan planning frameworks and large datasets to assess land use and traffic patterns. Adjustments to urban models have been made, incorporating recent telecommunications advancements, particularly due to the Covid-19 pandemic. Additional spatial interaction effects between teleworkers and workplaces are considered, utilizing a simulation method to maintain realistic patterns in land use and traffic flow, while exploring model compatibility and joint calibration [5, 6].

Urban Development Theories

Urban development theories aim to clarify city characteristics, differing in analysis scope (macro-coarse vs. micro-fine) and assumptions (continuous vs. discrete). This work investigates the impact of telework on urban development, focusing on its effects on firms' locations, economic activities, and urban structures. It identifies two types of cities based on productivity under telework. However, the telework scenario is not Pareto-efficient; firms are inefficiently dispersed and should ideally cluster in a star-shaped structure with fewer centers. Two frameworks address the influence of telework on urban structures, enriching existing models. Typically, firms' location decisions rely on economic distance as a function of Euclidean distance, aiming to maximize expected profit independently of others' decisions. Discrete choice models formalize this. Existing urban models often imply attraction and repulsion forces regarding centers but overlook other structural possibilities. The framework here offers simplicity and flexibility, capable of integrating various semi-open geometric spaces with easily computable spatial distributions. This allows the examination of factors like building regulations, public transportation systems, transport networks, and air pollution impacts on urban structures. Nonetheless, while the distinctive feature of the location set is helpful, no economic structure adjusts center locations. Contrarily, the semi-open set spectral structure with a grid-like economy can be analyzed with mathematical tractability, which is the next area of focus [7, 8].

Telework and Economic Factors

The COVID-19 pandemic has prompted many firms to adopt telework, which intersects with urban economics research on absolute location. Some firms from high-productivity sectors are transitioning to telework, leading researchers to investigate the relationship between telework and relative locations. However, the impact of telework on absolute location is underexplored, despite its potential effects on urban development. Notably, firms moving from central business districts (CBDs) to suburbs are expected to influence the urban economy significantly. Two main effects arise from this shift. First, reduced telework costs may encourage firms to locate at CBD fringes or urban edges. Second, various factors such as commuting costs, face-to-face communication costs, and teleworker ratios, along with telework firms' expected productivity levels, dictate whether these firms settle in suburbs or further out. The first effect serves as a model's core element, aligning with empirical data. The second, a novel aspect, highlights how high-productivity telework firms face location challenges, which lessen as telework costs

decline. An in-depth analysis suggests that lower telework costs not only yield commuting cost savings but also enhance telework productivity. This leads firms to migrate toward economically favorable areas in the city. To analyze this phenomenon, the model incorporates a monocentric city framework, considering distinct commuting patterns for telework versus central office firms. Findings indicate that diminished telework expenses drive firms to occupy the CBD fringe or surrounding urban areas, reinforcing urban development patterns identified during the pandemic [9, 10].

Telework and Housing Market

The COVID-19 pandemic caused a major transition from traditional office work to telework. This study explored the implications of this shift in Japan on air pollution, economic activity, and urban structure. Telework's expansion is essential for adapting to the post-pandemic situation, influencing urban policy and economic agglomeration. The analysis covered urban structure, the housing market, and economic activity, summarizing findings from two articles. The first developed a quantitative city model linking telework and face-to-face interaction, assessing costs and urban structure impacts. The second article applied this model for government policy analysis, particularly focusing on how increased telework affects the housing market. The review showed that both telework and face-to-face firms tend to relocate to either CBD fringes or urban edges. Consequently, telework affects not only firm locations within cities but also changes in housing markets. Increase in telework leads to rising housing prices in suburban areas, while prices at urban fringes may fall or rise near CBDs depending on telework costs. Ultimately, the relocation of telework firms significantly impacts housing market dynamics [11, 12].

Infrastructure and Telework

This paper analyzes the effect of increased telework frequency on firm location in a monocentric city where urban centrality emerges endogenously. It reveals that lower telework utility costs push firms to settle at the CBD fringe or urban fringe. The study examines how factors like commuting distances, location decisions, and urban structure are influenced by relative commuting costs, telework costs, teleworker ratios, and telework utility costs, providing insights into telework firm location. The impact of telework adoption on urban structure is also explored through a counterfactual approach, particularly in light of the significant uptick in telework during the pandemic. The findings contribute to urban economics literature by focusing on the implications of rising telework frequency. Urban economic theory posits that firms and residents interact spatially, resulting in firms facing exogenous costs from office rentals. This spatial interaction fosters urban centrality and polycentricity while influencing city size. Previous studies indicate that reduced telework occurrence costs can lead to increased face-to-face communication costs, suburban relocations, higher interstate commuting ratios, and enhanced worker productivity. The analytical framework described addresses a monocentric city where firms aim to minimize excess rent, commuting, and face-to-face communication costs. Once these factors are established, worker choices and telework adoption frequency are determined. This approach omits modeling worker residence location, which clarifies telework firm location choices and ensures the uniqueness of location equilibrium, vital for assessing urban structure impacts, as traditional telework studies often neglect counterfactual analysis. City structure is influenced by equilibria for each teleworker ratio and by commuting or telework-related costs [13, 14].

Social Implications of Telework

The rapid advancement of information technology has led to various forms of telework, allowing employees to work remotely from locations like home, telecenters, cafés, or while traveling. Telework includes office-telework, flexplace telework, and flex-time telework. Each type has distinct social implications. Interest is growing in understanding these implications, such as telework policy, socio-economic disparities, increased automobile use, and labor shortages in urban areas. Despite this interest, little research has specifically addressed these social implications. This paper reviews nine significant social implications identified in existing literature and examines knowns, unknowns, and unanswered research questions. The findings indicate that telework has multiple social benefits, with convenient technologies either currently available or in development. However, there remains a lack of focus on the social implications of telework itself. For instance, studies on the Netherlands examined sophisticated telework policies primarily through a case study on integrated telework systems, contributing to the understanding of telework policies. Hence, further research on telework's social implications related to policy, socio-economic disparities, and employee income shortages is warranted. It is important to clarify that the effects of telework technologies on urban development are not the focus of this research, despite the academic interest in aspects like hybrid telework technologies, which allow employees to choose their work mode [15, 16].

Environmental Impact of Telework

A significant factor of cities and human development is traffic and transportation. Mobility is a fundamental part of the urban fabric because it connects infrastructure, individuals, institutions, the market, and users. Because of technology developments, activity participation is permitted independent of place and time; thus, telework must be fully understood in its context on urban traffic, macro geographical circulation, and economics. Meanwhile, understanding telework impact can highlight the environmental aspects of cities, cities becoming less polluted and lighter. Understanding the environmental impacts of telework is very important for environmental agendas in urban studies. 1994 was the most foundational year of e-work, and 6.08 million teleworkers were in 1994 in the USA. The teleworker population reached 23.33 million in 2017, and 24.6 million in 2019 in the USA. Exponential growth of telework might accelerate during and post-COVID-19, and telework behavior might advance and be a significant change in society. If working from home changes outward behavior, it thus affects urban transport, and if cities and human urbanization understand this behavior, they can also assess the change in impacts. The impacts of telework can affect urban traffic and transportation and passenger mobility. Assessing teleworkers and teleworking can lead to an understanding of the influences on transport benefit of telework. Urban traffic must be reconsidered in this context because the emergence of telework would change urban transport for mega-cities positively [17, 18].

Policy Implications

Urban development has rapidly evolved since the COVID-19 pandemic. Prior to the pandemic, telework was gradually introduced into the office-based service sector, but its necessity became clear as face-to-face interactions were limited. This shift led large companies to leave central Tokyo's 23 wards, with similar trends seen in New York City, where telework firms expanded into suburbs like Westchester and Nassau Counties. Consequently, urban fringe commuting trips have increased in many developed nations due to enhanced public transportation, while upper-class commuters contribute to the declining urban economy. It's essential to analyze telework firms' activities spatially, focusing on how they relate to urban development and identifying firm location determinants to understand urban changes better. Relocating office workers to telework influences firms to settle in outer urban areas where rents are lower. Reduced communication costs enhance the presence of telework firms in these areas, while non-telework firms are moderated to retain a central location due to face-to-face cost savings. Commute and telework costs significantly influence firm locations for both types. This relationship is modeled within a monocentric city framework, where commuting costs rise with distance and telework costs remain stable. As telework equipment prices drop more rapidly than high-speed network expansions, suburbs are increasingly welcoming telework firms arising from the pandemic. Meanwhile, urban redevelopments aim to draw non-telework firms back as the pandemic subsides. Recent indicators such as population density and land price change support the observation of telework firms moving to suburbs from 2020 to 2021 [19, 20].

Case Studies

The study investigates telecommuting data at metropolitan and city district levels, linking it to urbanisation and development. Telecommuting's impact on traffic and urban development is analyzed. Initially, effects on urban spatial structures are assessed at a high aggregation level, with case studies from Amsterdam, Rotterdam, and The Hague exploring centralisation and land use patterns. The analysis then shifts to a more disaggregated level for Amsterdam and its competitors, utilizing both cross-sectional and time-series studies. The research reviews how telecommuting affects urban form based on economic-ecological factors. It examines centralisation or decentralisation in travel patterns, urban densities, and traffic flows due to telecommuting regulations and provisions. Specifically for Amsterdam, the effects on car traffic and external costs of mandatory telecommuting are scrutinized. The Houthavens case illustrates how telecommuting influences commute patterns and travel choices. The study expands theoretically by reviewing telecommuting's decentralising effects on urban form and land use in an international context, raising research questions supported by Dutch city examples. Finally, the impact of urban structures on land use mix, density, and transport is analyzed, focusing on the decrease in centralisation and implications for metropolitan area development, as illustrated by Amsterdam, Rotterdam, and The Hague [21, 22].

Future of Telework and Urban Development

The socio-economic impacts of telework on firm location choices are examined. Firms that mandate telework differ from non-teleworking firms, especially before a cost shock when they view commuting and face-to-face communication costs equally. Analysis shows that as telework costs decrease, telework firms emerge at CBD or urban fringes. The appearance of telework firms depends on the ratio of teleworkers to commuting costs. As telework expands, large cities shrink due to the emergence of nearby

telework firms, pushing out those with lower teleworker ratios. While global GDP, wages, and welfare increase with telework expansion, urban costs rise in major cities due to new economic pressures from suburban telework firms. Conversely, suburban wages and CBD fringe land prices decrease. Evidence suggests that telework will remain significant post-COVID-19, resulting in unique urban structures like Manhattan-type cities, with telecommuting firms disappearing from all urban scales. The study highlights the necessity for high-quality remote meeting facilities in the post-crisis world and identifies commuting costs, communication costs, and technology as vital to understanding telework's impacts on urban development, earnings inequality, and employment shifts [23, 24].

CONCLUSION

The transformation driven by telework extends beyond the boundaries of the workplace, deeply influencing the spatial, social, and economic fabric of urban environments. As firms and workers adapt to remote work models, traditional assumptions about urban centrality, commuting, and real estate are being redefined. The decentralization of firms to suburban areas and the corresponding shifts in housing demand signify a broader trend toward polycentric urban structures. This transition, while beneficial in reducing environmental stress and easing central city congestion, raises important concerns regarding equitable access to telework infrastructure, potential isolation of non-telework sectors, and the sustainability of urban economies. To harness the benefits of telework without exacerbating urban disparities, integrated policy approaches are needed focusing on digital infrastructure, zoning reforms, affordable housing, and inclusive transit systems. Telework is not just a temporary pandemic response but a catalyst for enduring change in urban development strategies across the globe.

REFERENCES

1. Tsuboi K. Shifting to Telework and Firms' Location: Does Telework Make Our Society Efficient?. arXiv preprint arXiv:2212.00934. 2022 Dec 2.
2. Qian F, Su Y. Remote Work and Consumer Cities. Available at SSRN 4966864. 2024 Sep 24.
3. Rinker CM, Bessi VG, Schreiber D. Engagement in the teleworking context: challenges and leadership performance. Leadership & Organization Development Journal. 2025 Mar 25;46(2):254-68. [HTML]
4. Aoki E, Hiramatsu A, Hanaki K. Changes and their effects on working and daily life time use allocation between work-from-home and office work days during the telework period: insights from the survey in Japan. Frontiers in Sociology. 2025 Feb 4;10:1534548.
5. He SY, Hu L. Telecommuting, income, and out-of-home activities. Travel Behaviour and Society. 2015 Sep 1;2(3):131-47.
6. White P, Titheridge H, Moffat D. Potential impacts of teleworking on transport systems. Logistics & Transport Focus. 2011;13(11):26-9.
7. Adobati F, Debernardi A. The breath of the Metropolis: Smart working and new urban geographies. Sustainability. 2022 Jan 17;14(2):1028.
8. Mori T. The coronavirus pandemic and the increase of teleworking in eight countries. Nomura Research Institute: Chiyoda, Tokyo, Japan. 2021 Feb.
9. Guimaraes P. Business improvement districts: A systematic review of an urban governance model towards city center revitalization. Land. 2021 Sep 1;10(9):922.
10. Baum-Snow N. Constraints on city and neighborhood growth: The central role of housing supply. Journal of Economic Perspectives. 2023 May 1;37(2):53-74.
11. Bergeaud A, Eyméoud JB, Garcia T, Henricot D. Working from home and corporate real estate. Regional Science and Urban Economics. 2023 Mar 1;99:103878.
12. Bergeaud A, Eyméoud JB, Garcia T, Henricot D. Working from home and corporate real estate. Regional Science and Urban Economics. 2023 Mar 1;99:103878. sciencedirect.com
13. Kyriakopoulou E, Picard PM. The Zoom city: working from home, urban productivity and land use. Journal of Economic Geography. 2023 Dec 1;23(6):1397-437.
14. Kyriakopoulou E, Picard PM. The Zoom city: working from home, urban productivity and land use. Journal of Economic Geography. 2023 Dec 1;23(6):1397-437.
15. Erro-Garcés A, Urien B, Čyras G, Janušauskienė VM. Telework in Baltic countries during the pandemic: effects on wellbeing, job satisfaction, and work-life balance. Sustainability. 2022 May 10;14(10):5778.
16. Hook H, Borremans R, Witlox F. Telework beyond the COVID-19 pandemic: exploring residential density and travel behavior. Transportation Research Record. 2025 May;2679(5):881-99.

17. Soler JR, Christidis P, Vassallo JM. Evolution of teleworking and urban mobility changes driven by the COVID-19 pandemic across European Cities. Transportation Research Procedia. 2023 Jan 1;69:488-95.
18. Anik MA, Habib MA. COVID-19 and teleworking: Lessons, current issues and future directions for transport and land-use planning. Transportation Research Record. 2024 Dec;2678(12):554-66.
19. Goldberg D. The New Geography of Fare-Free Public Transport: Examining the Suspension of Fares in the United States During COVID-19. Brussels: Master in Urban Studies (ULB/VUB). 2021.
20. Maginn PJ, Anacker KB. Covid-19 (Sub) Urbanisms: From Dreamscape to Nightmare?. InSuburbia in the 21st century 2022 Mar 24 (pp. 279-303). Routledge.
21. Su R, McBride EC, Goulias KG. Unveiling daily activity pattern differences between telecommuters and commuters using human mobility motifs and sequence analysis. Transportation Research Part A: Policy and Practice. 2021 May 1;147:106-32. [HTML]
22. Delventhal M, Parkhomenko A. Spatial implications of telecommuting. Available at SSRN 3746555. 2024 Dec 13.
23. Palomino Pichihua YM, Ruiz Sánchez J. The Geography of Telework in Latin America: New Spatial Devices during the Pandemic. Latin American Perspectives. 2023 Jul;50(4):103-21.
24. Krasilnikova N, Levin-Keitel M. Telework as a game-changer for sustainability? Transitions in work, workplace and socio-spatial arrangements. Sustainability. 2022 Jun 1;14(11):6765.

CITE AS: Chrispus Owunyesiga (2025). The Impact of Telework on Urban Development. EURASIAN EXPERIMENT JOURNAL OF ENGINEERING, 5(2):46-51