

DRIVERS OF URBAN SPRAWL AND THEIR IMPLICATIONS FOR SUSTAINABLE URBAN DEVELOPMENT: A LITERATURE-BASED ANALYTICAL REVIEW

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Abstract

Urban sprawl presents a critical challenge to global sustainability, transforming landscapes and altering the socio-economic and environmental fabric of modern cities. This paper investigates the primary drivers triggering urban sprawl and evaluates their broader implications for sustainable urban development. Utilizing a comprehensive spatial-temporal analytical framework alongside socio-economic indicators, the study identifies key catalysts behind dynamic urban expansion, including population growth, rapid economic development, land speculation, infrastructure development, and policy variations. The findings reveal that unmanaged sprawl significantly accelerates land degradation, intensifies resource consumption, increases carbon emissions, and deepens socio-spatial segregation within inner-city environments and peri-urban fringes. This research highlights the critical trade-offs between horizontal urban growth and environmental preservation. To mitigate these adverse impacts, the paper proposes an integrated planning model that incorporates scenario analysis, GIS-based spatial tracking, and collaborative governance strategies. Ultimately, this study offers actionable insights for urban planners and policy makers to foster compact, resilient, and environmentally sustainable urban growth strategies.

1. Introduction

Urbanization is one of the defining spatial transformations of the contemporary period. The challenge for planners is not simply that cities are growing, but that the amount, location, and pattern of land consumed by growth can differ substantially from the demographic increase that generates demand for urban space. UN-Habitat (2022) emphasizes that future urban growth will involve substantial expansion of city land, particularly in lower-income settings, making the

management of urban form central to sustainable development.

Urban sprawl describes a particular pattern of expansion rather than urban growth in general. A city can grow while remaining relatively compact, connected, and accessible; conversely, a metropolitan area can expand spatially even where population growth is modest. Brueckner (2000) identifies population growth, rising incomes, and falling commuting costs as fundamental forces behind urban expansion, while noting that market failures can cause excessive spatial expansion. Galster et al. (2001)

similarly argue that sprawl should be understood through several dimensions of urban form, including density, continuity, concentration, clustering, centrality, mixed use, and proximity.

The environmental and social significance of sprawl arises because low-density and fragmented development tends to increase the amount of land, road infrastructure, energy, and travel required to support urban life. The EEA (2006) links sprawl with transport pressures, soil sealing, landscape fragmentation, increased resource consumption, and loss of open space. Research on the costs of conventional development also indicates that sprawling patterns can increase the consumption of undeveloped land and road infrastructure relative to managed growth (Burchell et al., 2003).

The issue is especially important in rapidly urbanizing countries such as Pakistan. World Bank assessments describe Pakistan's urbanization as increasingly extending beyond formal administrative boundaries and note persistent challenges involving low-density outward growth, infrastructure, housing, mobility, governance, and planning capacity (World Bank, 2015, 2024). Recent work on Lahore further demonstrates that spatial growth strategies may fail to produce intended outcomes when implementation is constrained by administrative, fiscal, and enforcement problems (Hussain et al., 2021). The overall aim of the research is to synthesize and critically assess the principal drivers of urban sprawl and their implications for sustainable urban development, with particular attention to Pakistan and comparable international experiences.

2. Methodological Approach

This manuscript is structured as a literature-based analytical review rather than a primary empirical investigation. The review combines: urban-economic literature on market failures and development incentives; policy reports on urban expansion and sustainable urbanization; Pakistan-focused literature on urban planning and spatial change; Recent and authoritative sources were used to strengthen the conceptual and policy sections, while the original

manuscript's substantive themes were preserved and rewritten in original language.

1. Conceptualizing Urban Sprawl

Urban sprawl has no single universally accepted operational definition. This is partly because the concept combines a spatial pattern with a set of processes and consequences. Galster et al. (2001) proposed an eight-dimensional framework based on density, continuity, concentration, clustering, centrality, nuclearity, mixed use, and proximity. Ewing (1997) emphasized the importance of accessibility and open space, distinguishing sprawl from suburbanization in general. Ewing et al. (2002) subsequently developed a multidimensional measurement approach organized around residential density, land-use mix, strength of the urban centre, and street-network accessibility.

For planning purposes, a useful distinction is therefore: urban growth refers to an increase in the size or population of an urban system; urban expansion refers to the outward extension of built-up land; suburbanization describes population or activity moving from central areas toward suburban locations; and sprawl refers to a dispersed, fragmented, low-density, poorly connected, or otherwise inefficient pattern of expansion. These concepts overlap but should not be treated as synonyms.

Sprawl should also not automatically be equated with every form of peripheral development. Peripheral growth may be necessary when a city has strong population and economic growth. The sustainability concern arises when expansion consumes land faster than necessary, fragments ecosystems or agricultural areas, duplicates infrastructure, increases travel dependence, or occurs without adequate coordination between land use and transport planning.

4. Major Drivers of Urban Sprawl

4.1. Demographic Growth and Migration

Population growth creates genuine demand for additional housing, employment, services, and infrastructure. Natural increase and migration can therefore expand the urban footprint. However, population growth does not mechanically produce sprawl. The same

additional population can be accommodated through infill, redevelopment, higher densities, planned extensions, or dispersed peripheral development. The determining factor is the relationship between population growth and the amount and spatial distribution of new urban land.

In Pakistan, migration toward urban and economically active areas has historically contributed to urban growth. World Bank evidence indicates that natural population increase and rural-to-urban migration remain important components of urban expansion (World Bank, 2024). The planning challenge is to ensure that new residents can access affordable housing and services without forcing development into poorly serviced peripheral locations.

4.2. Rising Incomes and Housing Demand

Rising household incomes can increase demand for larger dwellings, private outdoor space, parking, privacy, and perceived environmental amenities. When peripheral land is substantially cheaper than serviced land in established urban areas, households may trade longer travel distances for larger plots or newer housing. Brueckner (2000) identifies rising incomes as one of the fundamental forces supporting urban spatial expansion.

Housing preferences become a driver of sprawl when planning systems and markets make low-density peripheral housing easier or cheaper to provide than compact, well-serviced alternatives. This suggests that anti-sprawl policy should not rely only on restricting land supply; it should also expand the supply of attractive, affordable, well-connected housing within existing urban areas.

4.3. Land Prices, Speculation, and Expectations of Appreciation

Differences in land prices between the urban core and fringe can encourage outward development. Speculators may acquire or withhold peripheral land in anticipation of future appreciation, while fragmented ownership can leave developable parcels unused and encourage leapfrog development. The resulting pattern can contain vacant or agricultural land between newly developed

clusters, increasing infrastructure costs and reducing spatial efficiency.

Brueckner (2000) explains that inefficient development can arise when the private cost of peripheral development does not include the full social value of open space, congestion, and infrastructure provision. The policy implication is that land-market monitoring, transparent development permissions, infrastructure cost recovery, and land-value-based instruments can reduce incentives for premature or poorly located development.

4.4. Transportation Infrastructure and Accessibility

Transportation is both a response to urban expansion and a powerful driver of it. New highways and arterial roads reduce travel times to peripheral locations, increasing the attractiveness and development potential of previously inaccessible land. Where private vehicles dominate, residential and employment activities can separate spatially because households are able to travel longer distances.

The relationship is not simply 'roads cause sprawl.' Transport infrastructure is essential to economic activity, but its spatial effects depend on land-use controls, development timing, public transport availability, and the location of jobs and services. Research has linked transport accessibility and built-form characteristics to travel behaviour and vehicle use (Ewing & Cervero, 2010). Therefore, the objective should be integrated transport-land-use planning rather than the suppression of mobility infrastructure.

4.5. Road Width, Street Connectivity, and Automobile Dependence

Low street connectivity and separated land uses can increase dependence on private vehicles. At the same time, excessively large road corridors and peripheral highways can open new areas for development. A sustainable alternative is a connected street network that supports walking, cycling, public transport, and local access while directing higher-density growth toward transit-served locations.

4.6. Industrialization and Commercial Development

Industrial parks, logistics facilities, wholesale markets, and large-format retail often require substantial land and road access. When these activities are located at the urban edge, they can become anchors for subsequent housing and commercial development. The Bucharest case reviewed in the original manuscript illustrates how transport infrastructure, beltways, retail areas, land abandonment, and housing preferences can interact to create new development nuclei.

Industrial and commercial development should therefore be planned through metropolitan-scale land-use strategies that consider freight movement, employment accessibility, infrastructure capacity, environmental constraints, and the potential for mixed-use or transit-oriented development.

4.7. Planning Regulations and Weak Enforcement

Planning systems can unintentionally produce sprawl through low-density zoning, excessive separation of land uses, inconsistent development standards, or restrictions that push demand into neighbouring jurisdictions. More importantly, even well-designed plans have limited effect when development permissions, building regulations, infrastructure investment, and enforcement are poorly coordinated.

Evidence from Lahore shows that some spatial growth strategies were not fully implemented because of administrative, fiscal, and enforcement constraints, contributing to unintended land-use conversion and sprawl (Hussain et al., 2021). This demonstrates that a master plan is not an outcome by itself; institutions, financing, monitoring, and enforcement are essential components of spatial planning.

4.8. Fragmented Governance and Independent Development Decisions

Metropolitan growth frequently crosses municipal boundaries. If neighbouring jurisdictions compete for development, tax revenue, investment, or housing demand without a shared spatial strategy, development

can leap across administrative borders. UN-Habitat (2017) argues that metropolitan-scale governance is increasingly important because urban populations and built-up areas extend beyond traditional municipal limits.

For Pakistan, fragmented mandates and limited local technical and financial capacity have been identified as barriers to coordinated urban development (World Bank, 2015, 2026). Strengthening inter-jurisdictional coordination is therefore as important as revising zoning regulations.

4.9. Housing Affordability and Large-Lot Development

A shortage of affordable housing in established areas can push lower- and middle-income households toward peripheral locations. Conversely, high-income demand for large plots can generate low-density enclaves. The sustainability problem occurs when peripheral housing is delivered without corresponding employment, schools, health facilities, public transport, drainage, water, and waste services.

Affordable housing should consequently be treated as a spatial-planning instrument. Increasing the supply of affordable, appropriately dense housing near jobs and transport can reduce the pressure for distant, low-density settlement.

4.10. Physical Geography and Environmental Constraints

Rivers, wetlands, floodplains, steep slopes, protected areas, and other physical constraints can prevent continuous expansion and produce leapfrog patterns. Such constraints should not automatically be treated as obstacles to be overcome. In sustainable planning they are often ecological assets or risk buffers that should guide development away from high-risk or environmentally sensitive land.

4.11. Credit, Investment, and Development Incentives

Easy access to credit and strong expectations of future land appreciation can accelerate housing construction ahead of actual population demand. When developers can externalize part of the infrastructure and environmental costs of new development, peripheral projects may

appear financially attractive even when their social costs are high. Development charges, infrastructure cost recovery, transparent impact assessment, and location-sensitive taxation can help align private decisions with public costs (Brueckner, 2000; Brueckner & Kim, 2003).

4.12. Household Structure and Lifestyle Preferences

Changes in household size can increase the number of dwellings required even when

population growth is moderate. Preferences for privacy, gardens, parking, perceived safety, and newer housing can reinforce suburbanization. These preferences should be acknowledged rather than assumed away. Compact development becomes more attractive when it offers quality public spaces, reliable services, safe streets, adequate dwelling sizes, parking management, and access to employment and education.

5. Integrated Driver Framework

Driver group	Mechanism	Typical spatial outcome	Planning response
Demographic	Population increase and migration increase housing/service demand	Expansion of built-up area; pressure on fringe	Compact extensions, infill, serviced land supply
Economic	Income growth and employment expansion increase land and housing demand	Suburban housing, commercial and industrial corridors	Mixed-use centres; employment-housing integration
Land market	Low peripheral land prices and speculation	Leapfrog growth and vacant parcels	Land-value monitoring; development phasing; cost recovery
Transport	New roads improve peripheral accessibility	Linear corridors and dispersed nodes	Transit-oriented growth; connected streets; accessibility-based zoning
Housing	Demand for affordability, larger plots and privacy	Low-density peripheral settlements	Affordable infill; diverse housing types; density bonuses
Governance	Fragmented jurisdictions and weak coordination	Cross-boundary sprawl	Metropolitan governance and shared spatial frameworks
Regulation	Low-density zoning and weak enforcement	Separated uses and uncontrolled conversion	Mixed use; enforceable zoning; monitoring
Environment	Floodplains, wetlands and terrain constrain continuous growth	Leapfrog or environmentally risky development	Ecological constraints and risk-sensitive growth boundaries

6. Implications for Sustainable Urban Development

6.1. Land and Agricultural Loss

Peripheral expansion can convert agricultural land and open landscapes into built surfaces. The loss is not limited to the land directly occupied by buildings; fragmented remaining parcels can become less viable for agriculture and ecological functions. EEA evidence demonstrates that economic infrastructure and diffuse residential development are important pathways through which cultivated land is converted (EEA, 2006).

6.2 Infrastructure and Public-Service Costs

Dispersed development increases the length of roads, water and sewer networks, drainage systems, electricity distribution, and waste-collection routes needed to serve the same population. Burchell et al. (2003) found higher land and road consumption under conventional sprawling development than under managed growth scenarios. Where development charges do not recover these costs, the fiscal burden can be transferred to governments and existing residents.

6.3 Transport, Congestion, and Energy Use

Low-density development commonly separates homes from employment and services, increasing trip distances and the feasibility of private vehicle travel. The resulting transport demand can contribute to congestion, energy consumption, and emissions. However, transport outcomes depend on local modal structure and built form; therefore, the appropriate response is to coordinate land use with public transport and active mobility rather than simply increase road capacity.

6.4 Environmental Degradation and Climate Risks

Conversion of vegetation, farmland, and wetlands reduces ecological functions and can increase impervious surfaces. Recent research on Pakistani cities found substantial changes in built-up land and associated increases in land-surface temperature in several cities, including Multan (Hussain et al., 2024). This provides a useful local indication of why urban expansion should be assessed together with vegetation,

water bodies, heat exposure, and climate resilience.

6.5 Social Segregation and Inequality

Sprawl can create spatial separation between households, jobs, services, and public facilities. Peripheral residents may face longer commutes and higher transport costs, while low-income households can be pushed toward locations with weaker service provision. At the same time, suburbanization can provide valued housing choices. Sustainable planning should therefore focus on accessibility, affordability, and service quality rather than treating location preference itself as a planning failure.

6.6 Governance and Institutional Fragmentation

When urbanized areas extend beyond formal boundaries, infrastructure and land-use decisions can become fragmented. UN-Habitat (2017) highlights the need for metropolitan governance arrangements capable of coordinating mobility, land use, environmental management, and economic development. This is particularly relevant to Pakistani metropolitan regions where administrative and functional urban boundaries often differ.

7. International Case Evidence

7.1 Bucharest Metropolitan Area

The Bucharest case retained from the original manuscript illustrates how several drivers can reinforce one another. Transport infrastructure and accessibility opened new areas; beltway development contributed to land speculation; large retail and commercial facilities acted as development anchors; and housing preferences and relatively cheap agricultural land supported new residential concentrations. The case demonstrates that sprawl is often a cumulative process rather than the consequence of a single policy or demographic variable.

The main planning lesson is the need to anticipate development around major infrastructure before land conversion accelerates. Transport investment should therefore be accompanied by land-use controls, development sequencing, agricultural-land protection, and infrastructure financing mechanisms.

7.2 Tokyo, Japan

Tokyo demonstrates that very large metropolitan growth can be managed through coordinated land use, transport, and urban intensification. The original manuscript highlights urban promotion and control areas, station-area intensification, rail-oriented development, flexible floor-area regulation, and land readjustment. These mechanisms illustrate a broader principle: transport accessibility can support compact development when land-use regulation and investment are coordinated.

The lesson is not that Tokyo's institutional model can simply be copied. Rather, it shows the importance of integrating transit, density, mixed uses, land readjustment, and infrastructure financing.

7.3 Dhaka, Bangladesh

Dhaka provides a contrasting example of rapid urbanization under severe land and infrastructure pressures. The original manuscript documents conversion of open land and water-related areas to built-up uses, traffic congestion, waterlogging, environmental pressure, and the importance of modelling future land-use scenarios. The case supports the use of remote sensing and spatial simulation to anticipate where growth is likely to occur and to test alternative development strategies.

For rapidly growing South Asian cities, scenario planning is particularly valuable because infrastructure decisions made today can lock in future patterns of land use and travel.

7.4 Lviv and Riga

The Lviv and Riga cases illustrate how economic restructuring, household changes, migration, land markets, and weak planning can produce peri-urbanization even where population growth is limited. The original manuscript notes fragmentation of agricultural land, demand for new roads, and the influence of household preferences. These cases reinforce the argument that sprawl is not synonymous with population growth; economic and institutional conditions can generate spatial expansion independently of strong demographic growth.

8. Pakistan: Urban Sprawl and Planning Challenges

Pakistan's urban transition has created substantial pressure on land, housing, infrastructure, and governance. World Bank assessments describe a pattern of 'messy and hidden' urbanization in which formal administrative boundaries do not always capture the functional extent of urban development and where low-density outward growth creates challenges for mobility and service provision (World Bank, 2015). More recent World Bank work similarly emphasizes rapid urbanization, the need for active planning and investment, and the importance of secondary cities in accommodating future growth (World Bank, 2024).

The planning context is complicated by fragmented responsibilities, limited local technical capacity, weak data systems, and difficulties in implementing spatial plans. A World Bank assessment of Pakistan's spatial change highlighted gaps in skilled personnel, data, mapping, and the coordination of infrastructure planning with newly urbanizing areas (World Bank, 2014). These institutional constraints can transform otherwise reasonable plans into ineffective or outdated instruments.

Research on Lahore provides a direct example. Hussain et al. (2021) analysed spatial growth strategies from 1966 to 2016 using GIS and Landsat imagery alongside expert interviews. Their findings indicate that some strategies reflected ground realities but were not fully implemented because of administrative, fiscal, and enforcement issues, contributing to unintended land-use conversion and urban sprawl.

The implications for Pakistan extend beyond major metropolitan areas. Intermediate cities require proactive spatial planning before peripheral land markets become heavily fragmented. A 2026 World Bank assessment of Punjab's intermediate cities reports that GIS-based asset inventories and rolling development plans can strengthen data-driven municipal investment and service delivery (World Bank, 2026). This provides a practical basis for linking spatial planning with infrastructure management.

9. GIS, Remote Sensing, and Urban Growth Modelling

GIS and remote sensing provide an effective foundation for monitoring urban expansion because they allow planners to observe changes in built-up land, vegetation, agriculture, water bodies, roads, and other land-cover classes across time. The original manuscript appropriately identifies remote sensing and GIS as tools for land-cover classification and change detection. Their value is particularly strong where conventional land records are incomplete or administrative boundaries do not reflect actual urbanization.

A robust empirical workflow can include: (1) acquisition of multi-temporal satellite imagery; (2) atmospheric and geometric preprocessing; (3) supervised land-cover classification; (4) accuracy assessment using independent validation samples; (5) calculation of built-up growth, density, fragmentation, and land-consumption indicators; (6) creation of accessibility surfaces based on roads and public transport; (7) integration of demographic and socioeconomic variables; and (8) scenario modelling.

Cellular automata and CA-Markov approaches can simulate the spatial consequences of alternative growth assumptions. Such models are useful for exploring future scenarios, but their outputs should not be presented as deterministic forecasts. Model calibration, validation, transition rules, driving variables, and uncertainty must be reported transparently. For Pakistan, combining GIS-based monitoring with scenario planning can help development authorities identify high-risk growth corridors before they become difficult and expensive to manage.

10. Proposed Integrated Planning Framework

The evidence reviewed suggests that no single intervention can eliminate sprawl. A more realistic strategy is a coordinated framework built around six mutually reinforcing components.

- Compact growth and infill: Prioritize redevelopment of vacant, underused, or fragmented land within existing urban areas before opening large new peripheral areas.

- Connected and mixed-use neighbourhoods: Encourage a compatible mix of housing, employment, education, retail, services, and public space so that daily needs can be met closer to homes.
- Transit-supportive expansion: Direct higher-density development toward public-transport corridors and nodes while maintaining walkable street networks.
- Protection of productive and ecological land: Identify agricultural land, wetlands, floodplains, green corridors, and other sensitive areas as spatial constraints rather than development reserves.
- Development-cost alignment: Require new development to contribute appropriately to the infrastructure and service costs it generates, reducing incentives for premature peripheral growth.
- Metropolitan governance and monitoring: Coordinate land-use, transport, infrastructure, environmental management, and development approvals across administrative boundaries, supported by GIS dashboards and periodic spatial audits.

11. Policy Recommendations for Pakistan

- Prepare spatial plans at the functional metropolitan or city-region scale where urban growth crosses municipal boundaries.
- Use GIS and regularly updated satellite imagery to monitor built-up expansion, agricultural-land conversion, informal development, and infrastructure gaps.
- Prioritize serviced infill and redevelopment before approving extensive new peripheral housing schemes.
- Introduce clear development phasing so that major housing and commercial projects are tied to confirmed water, sewerage, drainage, road, public-transport, and social-infrastructure capacity.
- Strengthen enforcement mechanisms and make planning approvals transparent, time-bound, and digitally traceable.
- Protect high-value agricultural and environmentally sensitive land through explicit spatial overlays and development restrictions.
- Expand affordable and medium-density housing choices within accessible urban

locations so that affordability does not depend on peripheral land.

- Coordinate road investment with land-use planning; avoid opening major corridors without a clear strategy for managing induced development.
- Develop metropolitan coordination mechanisms for neighbouring local governments, development authorities, transport agencies, and utility providers.
- Adopt scenario planning and climate-sensitive growth models so that future development is tested against heat, flood, water, mobility, and infrastructure risks.
- Build local planning capacity through trained planners, GIS specialists, data systems, and continuous professional development.
- Link master plans to implementation programmes, annual budgets, monitoring indicators, and periodic review rather than treating the plan as a static document.

12. Discussion

The central finding of this review is that urban sprawl is best understood as an interaction between demand and the institutional structure through which demand is spatially accommodated. Population growth, income, and housing preferences create demand for urban space, but land prices, transport infrastructure, zoning, development incentives, governance boundaries, and enforcement determine where and how that demand is translated into built form. This explains why similar demographic conditions can produce very different urban patterns.

The review also indicates that sprawl policy should avoid simplistic assumptions. Compact development is not automatically sustainable if it produces overcrowding, unaffordable housing, inadequate public space, or poor-quality infrastructure. Conversely, peripheral development is not automatically unsustainable if it is properly planned, connected to public transport, adequately serviced, environmentally sensitive, and integrated with employment and social facilities. The policy objective should therefore be efficient and equitable urban form rather than density for its own sake.

For Pakistan, institutional implementation is a particularly important part of the problem. The evidence on Lahore, broader World Bank

assessments, and the emerging emphasis on GIS-supported municipal planning all point toward a need to connect spatial plans with actual investment, land management, enforcement, and monitoring. A technically strong master plan without implementation capacity can have little effect on the trajectory of urban expansion.

The review further suggests that GIS and remote sensing should be integrated into routine planning rather than used only for academic studies. Periodic measurement of built-up growth, land consumption per capita, fragmentation, road expansion, and development around infrastructure corridors can create an evidence base for early intervention. This would shift planning from reactive control toward anticipatory management.

Urban sprawl is not caused by a single factor. It results from the interaction of demographic demand, rising incomes, housing preferences, peripheral land prices, speculation, transportation accessibility, industrial and commercial development, fragmented governance, weak planning enforcement, and development incentives. The most important distinction is between urban growth that is planned and connected and urban expansion that is spatially inefficient, fragmented, or inadequately serviced.

The sustainability consequences of unmanaged sprawl include conversion and fragmentation of agricultural and ecological land, higher infrastructure and service costs, longer travel distances, automobile dependence, environmental degradation, and difficulties in coordinating metropolitan governance. Evidence from Pakistan indicates that these issues are intensified by institutional and implementation constraints, while case evidence from Tokyo, Bucharest, Dhaka, Lviv, Riga, Lahore, Rawalpindi and Multan demonstrates that the specific mechanisms vary by context.

Sustainable urban development therefore requires an integrated approach: compact and connected growth, affordable housing, mixed land use, public transport, protection of productive and sensitive land, infrastructure cost alignment, effective plan implementation,

metropolitan governance, and continuous GIS-based monitoring. Rather than attempting to stop urban growth, planners should shape where growth occurs, how much land it consumes, what infrastructure accompanies it, and whether it improves accessibility and environmental resilience. For Pakistani cities, early investment in spatial data, institutional coordination, and implementation capacity is likely to be more effective and less costly than attempting to retrofit sprawling development after it has become established.

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