A Comparative Study of Urbanization across Asian Countries Using the Degree of Urbanization

Leiwen Jiang, Yinglei Yang, Yuanfei Li, Kaoru Kakinuma, O Kim, Geunho Choi, Patrick Devahastin, Ajith Kaliyath, Siow Li Lai, Samiur KC, Carlos Orlando Olaya-Bucaro, Sunethra Perera, Yuxin Lei, Maria Fernanda Abello Lorenzo-Luaces, Michele Melchiorri, Marcello Schiavina

Abstract:

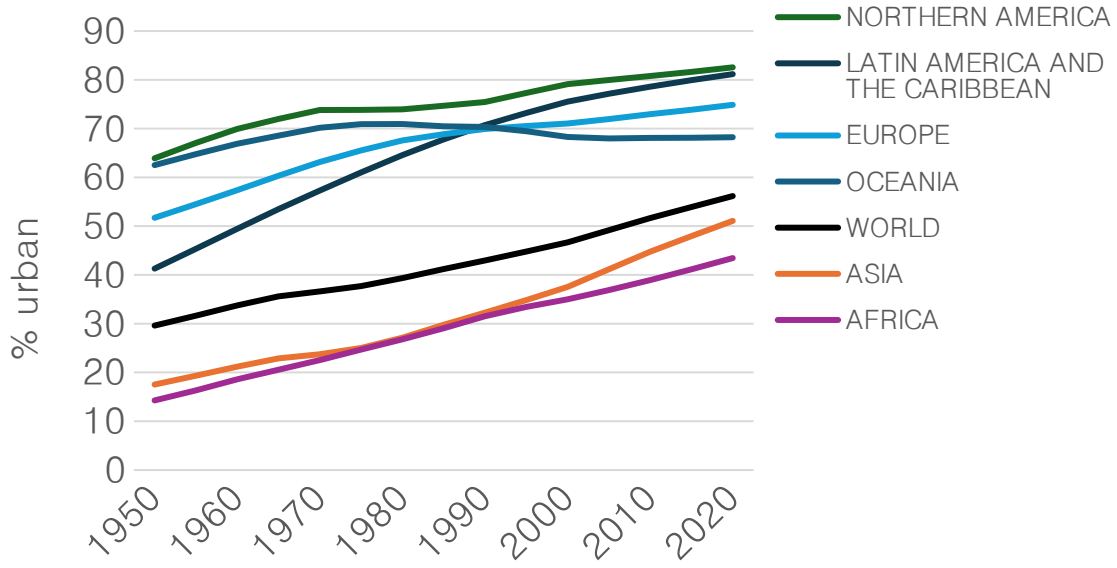
Asia is home to over half of the world's urban population, yet its urbanization remains uneven compared with other regions. In 2020, only 47% of Asia's population resided in areas officially classified as urban, reflecting the continent's diverse development pathways, from megacities in East Asia to sparsely urbanized regions in South Asia. National definitions of urban areas vary widely, driven by administrative, statistical, and historical criteria, complicating cross-country comparisons and international monitoring. This study applies the Degree of Urbanization (DoU) framework to harmonize urban classifications across ten Asian countries and territories — China, India, Japan, Korea, Malaysia, Nepal, Pakistan, Sri Lanka, Thailand, and Hong Kong — using census data, spatial boundaries, and gridded population datasets. The DoU method classifies 1×1 km population cells into urban centers, dense towns, semi-dense areas, suburban, village, disperse rural, and mostly uninhabited areas based on population density, size, and contiguity, enabling functional, spatially consistent measures of urbanization. Preliminary results reveal that countries/regions with statistical, density-based definitions, such as Japan, Korea, China, and Hong Kong, show strong alignment between DoU-derived and official urbanization levels, whereas administrative or hybrid systems, including India, Thailand, Nepal, Pakistan, and Sri Lanka, display substantial discrepancies. Functional urban areas often extend beyond official boundaries, particularly in peri-urban corridors and secondary towns. DoU analysis also highlights variations in settlement morphology, from compact megacities to polycentric metropolitan networks and dispersed semi-dense towns. By harmonizing urban classification, this study clarifies the spatial and demographic patterns of urbanization in Asia, quantifies definitional biases, and provides evidence to support comparative research and informed urban policy in rapidly transforming contexts.

Extended Abstract

Introduction

Urbanization has become one of the defining forces shaping demographic, social, and environmental change worldwide. As of 2024, roughly 57% of the global population resides in urban areas, compared with 30% in 1950, and this share is projected to reach 68% by 2050 (UN DESA, World Urbanization Prospects, 2024). Beneath these aggregate trends, however, lies considerable regional diversity (Figure 1). Latin America and the Caribbean are already highly urbanized, with over 80% of their populations living in cities, while Europe and North America have stabilized at around 75–82%. Asia, by contrast, has an urbanization rate of about 51%, reflecting its transitional position between the still-rural Global South and the post-industrial urban North. Given that Asia accounts for more than 50% of the world's population, even modest changes in its urbanization rate have significant implications for global infrastructure demand, environmental impact, and economic transformation.

Figure 1 Urbanization levels and trends of global regions



Within Asia, the pace, pattern, and meaning of urbanization vary widely. East and Southeast Asia have experienced rapid and spatially extensive urban growth. China's urbanization level increased from 26% in 1990 to 66% in 2023, accompanied by the emergence of numerous large cities and vast peri-urban zones. Japan, one of the earliest urbanized countries in the region, reached an urbanization rate above 91% by 2020, yet now faces challenges related to urban aging and population decline. In contrast, South Asia remains relatively less urbanized, with India at 36%, Nepal at 23%, and Sri Lanka at 19% in 2023. These disparities reflect differences in economic development, geography, governance, and historical trajectories. Countries with mountainous or archipelagic terrain, such as Nepal or the Sri Lanka, display more dispersed urban patterns, whereas continental states like China and India exhibit pronounced core–periphery contrasts.

The forms and types of urbanization also differ across the region. Some countries have witnessed rapid metropolitan expansion and city-region formation, while others experience in-situ urbanization, involving the gradual transformation of rural settlements into small towns. In China, the growth of county-level cities and towns has blurred the boundary between rural and urban, creating extensive intermediate zones. In Thailand and Malaysia, tourism and industrial corridors have stimulated the emergence of secondary cities. In Japan and Korea, suburban densification and shrinking rural settlements coexist, illustrating a complex interplay of demographic, economic, and spatial forces. This diversity underscores both the opportunity and challenge of comparative urban research in Asia, particularly regarding the measurement of urbanization.

National censuses and statistical systems define "urban" in markedly different ways across Asia, reflecting administrative history, policy priorities, and data traditions. In Japan, the concept of Densely Inhabited Districts (DIDs), introduced in the 1960 Census, identifies urban areas based on population density (at least 4,000 people per km²) and the spatial contiguity of basic unit blocks containing educational, cultural, industrial, and social facilities. This statistically grounded approach allows for precise tracking of metropolitan and suburban evolution, independent of administrative boundaries. India, by contrast, combines administrative and statistical criteria. Statutory towns are recognized based on municipal or town committee status, while census towns must satisfy thresholds for population, density, and employment in non-agricultural activities. This mixed approach captures some emerging

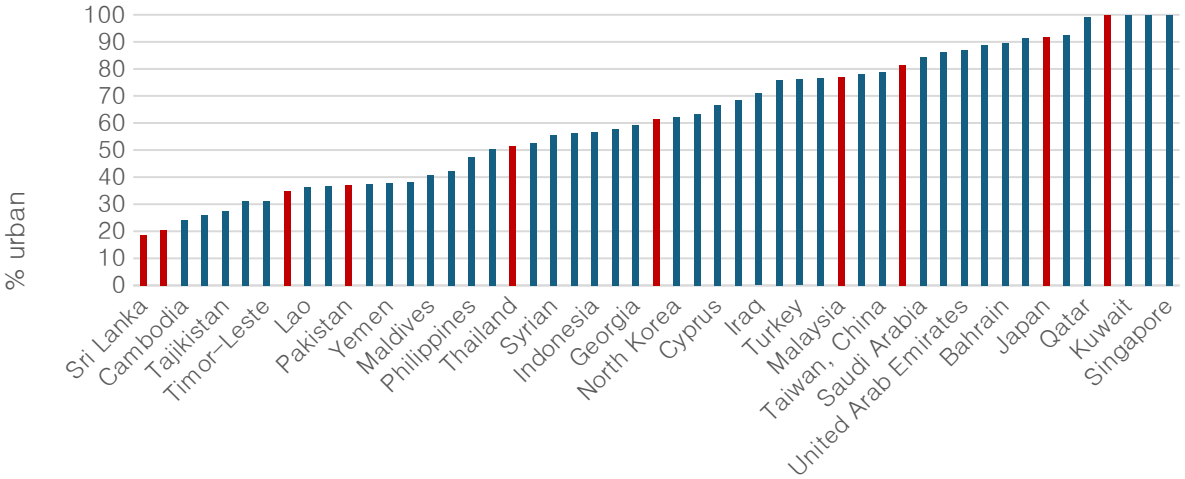
settlements but can underrepresent dense non-administrative clusters that fail to meet all criteria.

China presents a particularly complex case. From 1955 to 1989, urban populations were defined administratively, encompassing all residents of city districts or towns under counties. Expansion of administrative boundaries increasingly overstated urbanization by including rural territories. In 1990, the Census adopted a residence-based criterion, counting those living in urban areas for more than half a year. Subsequent regulations in 2000 and 2008 further refined this approach, using residents' and villagers' committees as the basic units to identify contiguous built-up areas. This allows for finer spatial delineation, yet the definitions remain nationally specific. In Thailand, administrative designations largely determine city status, with districts upgraded to "city districts" based on population or strategic considerations. Frequent administrative reforms since 1975 have created new provinces, districts, and municipalities, meaning that urban classification may reflect political decisions as much as settlement patterns. The Thai statistical office supplements this with density-based criteria to improve consistency.

Malaysia defines urban areas as gazetted settlements and their adjoining built-up zones with at least 10,000 residents and a minimum of 60% engaged in non-agricultural work, while Nepal's National Urban Policy (2007) sets thresholds of 5,000 inhabitants, a density of 10 persons per hectare, and over half the population in non-agricultural employment. Sri Lanka relies primarily on local government structures, where municipal and urban councils define urban areas, and administrative reforms such as the 1987 Provincial Council System have caused some towns to lose urban status. Hong Kong illustrates a highly spatially detailed approach, delineating Urban Core, Urban Fringe, Rural Developed, and Rural Conservation Areas. Although 70% of its territory is designated as protected countryside, over 90% of the population lives in dense urban and suburban zones.

These diverse definitions illustrate that "urban" in Asia is not a singular concept but a spectrum shaped by institutional logic, administrative practice, and historical evolution. Cross-country comparisons are therefore challenging: applying national definitions to identical population grids can yield urbanization rates differing by 20–30 percentage points (OECD–EU–World Bank, 2021). Such heterogeneity complicates international monitoring of frameworks like SDG 11, which relies on consistent urban-rural indicators.

Figure 2 Asian countries/regions selected for the comparative analysis



To address these challenges, harmonized and spatially explicit frameworks have been proposed. The Degree of Urbanization (DoU), developed by the European Commission, OECD, and UN-Habitat,

classifies small spatial units—typically 1×1 km population grid cells—based on population density, size, and contiguity. Under this framework, urban centers are contiguous clusters with at least 50,000 people and a density above 1,500 people per km²; towns and semi-dense areas include clusters of at least 5,000 people with densities between 300 and 1,500 people per km²; and rural areas encompass all remaining regions with densities below 300 people per km².

The DoU method offers several methodological advantages. It applies uniform thresholds across countries, relies on high-resolution population data such as the Global Human Settlement Layer (GHSL) and WorldPop, and supports longitudinal analysis of settlement growth. In this study, DoU is applied to China, India, Japan, Korea, Malaysia, Nepal, Pakistan, Sri Lanka, Thailand, and Hong Kong which reflects countries/regions at different urbanization levels (Figure 2), to generate harmonized measures of urbanization level, distribution, and spatial form. These classifications are then compared with national definitions to evaluate divergences. By employing the DoU framework, this study aims to quantify the effect of definitional differences on reported urbanization levels across Asia, assess how density and spatial connectivity shape settlement growth, and contribute to international efforts toward statistical harmonization. Establishing comparable, evidence-based urban definitions is essential not only for rigorous academic analysis but also for effective urban policy and planning on a rapidly urbanizing continent.

Data and Methods

This study integrates national population census data and spatial boundary files from multiple Asian countries and territories to examine differences in urban–rural classification and to harmonize these under the Degree of Urbanization (DoU) framework. All population data were obtained from the respective national statistical offices or census bureaus, and all spatial data were standardized to a common coordinate system (WGS 84, EPSG:4326) to ensure cross-country comparability.

In Japan, population data were drawn from the Population Census for the years 1995, 2000, 2005, 2010, 2015, and 2020, provided by the Statistics Bureau of Japan. These datasets include both total population and Densely Inhabited District (DID) population for municipalities and wards of major designated cities, totaling 1,831 units based on the 2020 administrative boundary. Population attributes are available in CSV and geopackage (GPKG) formats, while spatial boundaries are provided as shapefiles. Urban populations correspond to DID residents, and rural populations are derived by subtracting the DID population from the total. This dataset allows longitudinal analysis of urban concentration, suburban expansion, and de-densification over a 25-year period.

Thailand's population data come from the National Population and Housing Censuses of 2010 and 2020, compiled by the National Statistical Office. The data are disaggregated by district (amphoe) and subdistrict (tambon), corresponding to Thailand's administrative hierarchy. Although city and town designations in Thailand are primarily administrative, the DoU analysis identifies functionally urban areas by applying gridded population surfaces and density thresholds, with urban clusters defined as contiguous areas of at least 5,000 people with densities of 4,000 persons per km² or more. Spatial boundary files representing provinces and districts were obtained from the Department of Provincial Administration.

For Nepal, population data at the ward level—the country's smallest administrative unit, totaling 6,743 wards—were obtained from the National Population and Housing Census 2021. Ward boundaries were sourced as official shapefiles from the Department of Survey. With an average population of approximately 4,000 per ward, these fine-grained units provide a detailed spatial framework for

examining both administrative and functional aspects of urbanization. The dataset also allows testing of Nepal's official urban definition, which classifies settlements exceeding 5,000 inhabitants, with a density above 10 persons per hectare and at least 50% of the population engaged in non-agricultural activities.

Sri Lanka's population data derive from the 2012 Census of Population and Housing, obtained from the Department of Census and Statistics. The data are available at multiple administrative levels, including Province, District, Divisional Secretariat Division (DSD), and Grama Niladhari Division (GND). Because data at the local government level are unavailable, the DSD serves as the primary analytical unit. Corresponding DSD shapefiles were prepared using information from the Census Department and the Survey Department. Since urban status in Sri Lanka is determined administratively, recalculation of population density at the DSD level enables cross-walking between official classifications and DoU-based categories.

In Hong Kong, population and boundary data were obtained from the Census and Statistics Department for 2011 and 2021. During this period, significant boundary re-delineations occurred: large Tertiary Planning Units (TPUs) were subdivided into smaller Secondary TPUs (STPUs) in rapidly developing areas such as Tseung Kwan O and Tung Chung, while merges occurred in aging or depopulating districts on Hong Kong Island. New TPUs were created in major development zones, including the Kai Tak Development Area and North Lantau, while obsolete TPUs were deleted following large-scale redevelopment. All census data were standardized to the 2021 STPU boundaries to ensure spatial comparability. Hong Kong, with over 90% of its population concentrated in dense settlements and 70% of its land area designated as conservation zones, provides a high-density benchmark within the Asian context.

In China, population and boundary data from the 2020 Census were obtained for about 600,000 villages and neighborhood communities.

To ensure cross-national comparability, all datasets were harmonized through standardized spatial processing. Administrative boundaries were reconciled by converting them to a consistent coordinate system and, where necessary, aggregating or disaggregating units to align with comparable spatial resolutions, such as municipalities in Japan, districts in Thailand, wards in Nepal, DSDs in Sri Lanka, and STPUs in Hong Kong. Administrative population counts were then downscaled to 1×1 km population grids using ancillary data from the Global Human Settlement Layer (GHSL, 2023 release) and WorldPop (2020–2021), creating a uniform population density grid for DoU classification. Population data were temporally aligned to the nearest census years corresponding to available DoU-compatible datasets, with interpolation applied using exponential growth models when necessary. Administrative units that changed over time, such as newly created provinces in Thailand or split TPUs in Hong Kong, were standardized to the most recent boundaries through spatial overlays and area-weighted population redistribution.

The Degree of Urbanization framework was applied following the thresholds defined by the European Commission, OECD, and UN-Habitat. Population grid cells were classified into urban centers, towns and semi-dense areas, or rural areas based on size, density, and contiguity. Urban centers were defined as contiguous clusters of at least 50,000 people with densities above 1,500 persons per km², while towns and semi-dense areas were clusters of at least 5,000 people with densities between 300 and 1,500 persons per km². Remaining areas were classified as rural. Morphological clustering algorithms implemented in GHSL Tools and the QGIS processing toolkit were used to delineate these categories, after which results were aggregated to national administrative units to compute the share of population

within each settlement type. DoU-derived urbanization levels were then compared to official national statistics to identify discrepancies and potential biases introduced by differing definitions.

The harmonized datasets support both cross-sectional and temporal analyses. Cross-sectional comparisons reveal regional patterns of urbanization and deviations from official statistics, while temporal comparisons between the earliest and latest census years highlight trends in urban expansion, densification, and shrinkage. Spatial overlays of DoU results with administrative urban boundaries identify "underbounded" or "overbounded" areas, where functional urban extents exceed or fall short of official designations. This approach provides a robust, replicable foundation for assessing urbanization across Asia, minimizing inconsistencies inherent in national definitions while preserving the spatial and demographic richness of local data.

Limitations and Validation

Despite the advantages of applying a harmonized Degree of Urbanization (DoU) framework across multiple Asian countries, several methodological and data-related limitations remain. These arise from differences in census design, spatial boundary definitions, data resolution, and temporal coverage, all of which can influence cross-national comparability and the interpretation of urbanization trends.

One key limitation concerns the varying census years and temporal frequency across the study countries. Japan conducts its population census every five years between 1995 and 2020, providing a detailed temporal series that captures incremental changes in urbanization. In contrast, Thailand and Sri Lanka have decadal census data, with the most recent datasets from 2010 and 2020 for Thailand and 2012 for Sri Lanka. Nepal's ward-level data are from 2021, while Hong Kong collects data on a five-year cycle from 2011 to 2021. These temporal inconsistencies complicate direct year-to-year comparisons and can obscure short-term urban transitions, particularly in rapidly urbanizing regions such as Thailand and Nepal. Spatial resolution further exacerbates these challenges. Japan's municipal and ward-level data, covering 1,831 units, provide fine-grained detail, whereas Sri Lanka's census data only reach the Divisional Secretariat Division level, aggregating substantial heterogeneity in settlement density and land use. Hong Kong's census boundaries underwent frequent re-delineation between 2011 and 2021 due to new town development and reclamation projects, such as in the Kai Tak and North Lantau areas. Such boundary changes introduce uncertainty when assessing longitudinal population shifts, as spatial units are not strictly comparable over time.

A second limitation stems from the discrepancy between administrative definitions and functional urban extents. In many Asian countries, official urban designations are driven primarily by governance criteria rather than population density or land use. In Thailand, for example, a district may be designated as a "city" for political or administrative reasons, rather than reflecting demographic concentration. Similarly, in Sri Lanka, urban status can be gained or lost following local government restructuring, as occurred after the 1987 Provincial Council System reform. These shifts can lead to misalignment between officially recognized urban areas and the actual built-up, economically active region, complicating comparative analyses that integrate national definitions with DoU-derived measures.

Data quality and classification thresholds present a third set of challenges. Nepal's ward-level data, although spatially detailed, may contain inconsistencies in boundary delineation and population reporting, particularly in remote or mountainous regions. Thailand's census shapefiles vary in resolution across provinces, and certain rural DSDs in Sri Lanka have incomplete digitized boundaries. These discrepancies can affect the precision of population allocation when overlaying gridded density or built-

up layers for DoU classification. Furthermore, the DoU relies on globally standardized density thresholds, such as 1,500 inhabitants per km² for urban centers and 300 inhabitants per km² for towns. While these thresholds facilitate international comparability, they may not fully capture regional settlement specificities, such as compact high-density villages in Japan or linear settlements along transportation corridors in Nepal, potentially leading to overestimation or underestimation of urbanization in specific contexts.

Temporal inconsistencies in built-up area data also contribute to potential uncertainty. Remote-sensing-based datasets, such as GHSL, WorldPop, or GHS-BUILT, do not always align precisely with national census years. For instance, GHSL built-up data are available for 1990, 2000, 2015, and 2020, creating mismatches for countries with mid-decade censuses, such as Japan in 1995 and 2005. Although interpolation can mitigate these gaps, adjustments introduce uncertainty into density estimates, especially in areas experiencing rapid peri-urban growth.

To validate the DoU-based classification, multiple steps were undertaken. First, cross-comparison with national urban designations was performed. In Japan, where Densely Inhabited Districts have long served as a statistical proxy for urban areas, DoU classifications align closely, with over 95% of the DID population falling within DoU urban centers or dense urban clusters. In contrast, countries relying primarily on administrative criteria, such as Thailand and Sri Lanka, show greater divergence. Applying the DoU to Thailand's 2020 census data, approximately 54% of the population resides in urban clusters or centres, slightly higher than the 51% reported under the national definition, highlighting peri-urban areas that functionally exhibit urban characteristics. In Sri Lanka, the DoU approach identifies substantial urban expansion in the Western and Central Provinces that may be underrepresented in official statistics due to delayed administrative reclassification.

Validation also involved spatial overlays and density checks, comparing DoU-classified grids with high-resolution population density datasets, such as the 1 km² WorldPop layer. This ensured internal consistency, with urban areas consistently exhibiting higher population densities and built-up shares. Outliers, including areas classified as rural but showing high built-up intensity, were examined for boundary misalignments or data artifacts. Temporal validation was performed by comparing DoU-derived urban growth trajectories with independent satellite-based measures, such as the GHSL Urban Centre Database and NASA nighttime lights data. For example, Japan's stable DID urban footprint from 1995 to 2020 aligns with satellite observations, while Thailand and Nepal display steeper DoU-based urban growth, consistent with new transport and industrial corridor development. Discrepancies exceeding ±5% in total urban population share were flagged for further review, often due to temporal mismatches or boundary changes.

Finally, sensitivity analyses tested the robustness of DoU classifications by varying population density thresholds by ±10%. These analyses indicated that while minor adjustments slightly affected the proportion of populations classified as urban or rural, the relative ranking of countries by urbanization level remained stable, confirming the reliability of DoU-based comparisons.

Overall, despite data heterogeneity, boundary inconsistencies, and temporal mismatches, validation exercises demonstrate that the Degree of Urbanization framework produces consistent and interpretable results across diverse Asian contexts. Compared with administrative definitions, it offers a functional, spatially continuous representation of urbanization, capturing both formal and emerging urban areas. Nevertheless, cross-country comparisons should be interpreted cautiously, particularly in regions with rapidly changing administrative boundaries or incomplete subnational data. Future

research may benefit from locally calibrated thresholds or dynamic functional urban area delineations to refine comparative analyses further.

Preliminary Results and Discussion

Applying the Degree of Urbanization (DoU) framework to the selected Asian countries reveals both expected and surprising patterns in the spatial extent and intensity of urbanization. The DoU-derived urban population shares largely reflect known regional trends while offering a finer-grained understanding of settlement structures beyond administrative classifications.

In Japan, the urban population is highly concentrated, with over 91% of the population residing in DoU-defined urban centers or dense urban clusters across all census years from 1995 to 2020. The majority of urban residents are located in Tokyo, Osaka, Nagoya, and other major metropolitan cores, while peripheral wards and small towns maintain urban characteristics under the DoU methodology. Comparison with official Densely Inhabited Districts (DID) data indicates a near-perfect alignment, with more than 95% of DID populations falling within DoU-defined urban clusters. This consistency confirms the reliability of the DoU approach in countries with statistically driven urban definitions and demonstrates that Japan's incremental suburban densification has only minimally affected national urbanization shares over the past 25 years.

China exhibits one of the most dynamic patterns of urban growth among the countries studied. The DoU analysis indicates that approximately 63–66% of the population resides in urban centers and dense clusters as of 2020, slightly lower than the official urbanization rate of 66.8% reported by the National Bureau of Statistics. This discrepancy arises primarily from administrative reclassification, where counties and townships include extensive rural hinterlands. Spatial analysis shows that DoU-defined urban clusters are concentrated in eastern coastal provinces such as Guangdong, Jiangsu, Zhejiang, and Shandong, as well as in major inland cities like Chongqing and Chengdu, while northern and western regions remain sparsely urbanized. The DoU method captures emerging peri-urban zones around secondary cities and city extensions, providing a more functional representation of urban areas than administrative data alone.

In India, the DoU method classifies 34–37% of the population as urban in 2020, slightly lower than the official figure of 36.2%. Many peri-metropolitan corridors around Delhi, Mumbai, Bangalore, and Kolkata exhibit high population density and contiguity characteristics of urban centers but lack statutory town designation. These results indicate that administrative thresholds may undercount functional urbanization, particularly in fast-growing sub-national regions, highlighting the value of the DoU framework for capturing polycentric urban patterns.

Thailand demonstrates a notable divergence between administrative designations and functional urban extent. DoU classification estimates that around 54% of the population resides in urban clusters in 2020, slightly higher than the official urbanization rate of 51%. The differences are most pronounced in rapidly developing provinces surrounding Bangkok, Chiang Mai, and Phuket, where dense settlement patterns extend beyond officially designated urban districts. DoU mapping illustrates clear spatial continuity along transport corridors and industrial zones, reflecting functional urban growth not captured by governance-driven criteria.

Nepal and Sri Lanka, while exhibiting relatively low overall urbanization, show high variability in settlement patterns. In Nepal, approximately 27% of the population is classified as urban under DoU, compared with the official 23%, largely due to small, dense settlements in the Kathmandu Valley,

Pokhara, and other regional towns that meet DoU density and contiguity thresholds but lack municipal recognition. In Sri Lanka, the DoU-based urban population is around 21%, slightly above the official 19%, reflecting peri-urban growth around Colombo, Kandy, and Galle. Both countries illustrate that functional urbanization often exceeds administrative classifications, particularly where municipal reclassification is infrequent or smaller settlements remain formally rural.

Hong Kong represents a high-density urban environment where over 90% of the population resides in urban centers. The DoU framework effectively captures the expansion of new town developments, including Tseung Kwan O, Tung Chung, and Kai Tak, and accurately reflects splitting and merging of statistical planning units in response to population growth, aging, and redevelopment. The DoU approach provides a slightly more precise delineation of urban clusters than official STPU-based classifications, particularly in peri-urban zones undergoing functional integration with core urban areas.

Across all countries, comparing DoU-derived urbanization with official statistics reveals systematic patterns. In countries with density-based or statistical definitions such as Japan and Hong Kong, DoU closely matches official urban population figures, with discrepancies generally under five percent. Conversely, in countries relying primarily on administrative definitions such as Thailand, Sri Lanka, and Nepal, the DoU method tends to classify a larger population as urban, particularly in peri-urban and industrial zones. Hybrid systems, including China and India, demonstrate mixed effects: DoU may produce lower urban shares than official figures in regions where administrative boundaries incorporate extensive rural areas, while simultaneously identifying functional urban clusters in secondary towns not recognized administratively. These patterns underscore the significant impact of definitional differences on reported urbanization levels, often exceeding ±5–10 percentage points, which has important implications for cross-national research and policy monitoring.

Beyond aggregate urbanization rates, DoU analysis illuminates settlement morphology. Japan and Hong Kong exhibit compact megacities with highly concentrated urban cores and limited peri-urban sprawl, reflecting mature infrastructure and dense land use. China and India display polycentric metropolitan regions, where multiple urban cores, towns, and industrial corridors form densely interconnected networks that often span several administrative units. Thailand, Nepal, and Sri Lanka feature dispersed semi-dense settlements that emerge along transport corridors and economic clusters, frequently beyond formal municipal recognition. Across all rapidly urbanizing contexts, peri-urban zones—transitional areas between urban cores and rural hinterlands—emerge as important components of functional urban areas, capturing spatial expansion more effectively than static administrative boundaries.

The results carry significant policy and methodological implications. DoU identifies functionally urbanized areas that may lack formal recognition, providing guidance for infrastructure planning, public service delivery, and transport network development. It offers a harmonized framework for international monitoring of sustainable urban development and related indicators, allowing for more reliable cross-country comparisons than reliance on national definitions alone. Moreover, the identification of peri-urban zones highlights the need for integrated rural–urban planning, particularly in countries with high-density small towns acting as regional service hubs. While the DoU method improves comparability, it should be interpreted cautiously in regions with atypical settlement morphology or rapidly changing administrative boundaries. Uniform density thresholds may overestimate or underestimate functional urbanization in localized contexts, yet the approach provides a robust baseline for reconciling administrative and functional perspectives on urbanization.

In summary, the Degree of Urbanization framework reveals that functional urbanization often diverges substantially from administrative definitions, particularly in rapidly urbanizing or peri-urbanizing regions. Countries with statistical, density-based definitions, such as Japan and Hong Kong, show high consistency between DoU and official data. In contrast, hybrid or governance-driven definitions, including China, India, Thailand, Sri Lanka, and Nepal, reveal substantial discrepancies, either inflating or undercounting functional urban areas. DoU also captures spatial morphology and connectivity, facilitating analysis of urban cores, peri-urban corridors, and semi-dense towns. By harmonizing urban classification across diverse contexts, DoU enables reliable comparative analysis, enhances understanding of settlement dynamics, and provides actionable insights for sustainable urban planning in Asia.