Evaluating New-Urban-Area Plans through Jobs–Housing Spatial Performance: The Hongqiao Main Urban Area Unit Plan

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Abstract: Jobs–housing imbalance is one of the most prominent problems in the development of new urban areas. Evaluating plans through jobs–housing spatial performance can improve planning methods and strengthen implementation. Taking the Hongqiao Main Urban Area Unit Plan as a case, this study uses multi-source data to identify factors affecting jobs–housing spatial performance and establishes baseline, target, and extreme scenarios. Comparison of the simulation results shows that the plan gives insufficient attention to key issues such as the jobs–housing ratio; employment and related indicators may exceed planned values; and arrangements for scale adjustment, spatial organization, and dynamic adaptation remain inadequate. The paper proposes spatial and policy optimization strategies and implementation recommendations and summarizes a plan-evaluation framework based on jobs–housing spatial-performance scenarios.

Keywords: Hongqiao Business District; spatial performance; multi-scenario simulation; plan evaluation; jobs–housing balance; new urban area

1 Research Motivation and Literature Review

1.1 Research Motivation

A planning scheme arranges the future spatial development of an area. Because future development is uncertain [1], evaluating the scheme itself is fundamental to scientific planning and effective implementation. Planning must anticipate, assess, and address uncertainty; avoid path dependence; improve methods for analyzing and evaluating spatial layouts; and incorporate the temporal dimension of implementation if it is to function as adaptable action planning.

New towns and urban districts are major carriers of spatial expansion and have pronounced development phases. Conventional static blueprint planning is poorly suited to dynamic development conditions, often producing a disconnect between preparation and implementation and leading either to development without an applicable plan or to non-compliance with an approved plan [2]. The widespread jobs–housing imbalance of new urban areas reflects the contradiction between dynamic socioeconomic activity and static planning schemes. Although ideas such as jobs–housing balance and jobs–residence integration have been introduced, achieving them requires stronger analytical capacity regarding spatial characteristics and urban operation [3]. Plans must anticipate spatial and social problems, evaluate alternatives, and improve operability and authority.

The Hongqiao Main Urban Area has multiple roles—as a business district, urban subcenter, and transport hub—because of its distinctive location and transport conditions. Jobs–housing imbalance is becoming increasingly severe while large-scale development continues. Evaluating the *Shanghai Hongqiao Main Urban Area Unit Plan* (hereafter the "Hongqiao 2035 Plan") [4] can therefore inform future development and optimization in Hongqiao and comparable new urban areas.

1.2 Literature Review

Urban-planning evaluation includes **plan evaluation** and **planning evaluation**. Plan evaluation examines plan content to demonstrate validity, improve the planning process, and raise plan quality—for example through text-based quality assessment [5–7] or decision-theory evaluation of implementation instruments and logic [8]. Planning evaluation examines the process and effects of implementation; such an implementation assessment has already been conducted for the Hongqiao 2035 Plan [9]. Plan evaluation is ex ante rather than ex post and can reduce unnecessary corrective costs during implementation [10].

International research often emphasizes procedural rationality and public participation [11], whereas Chinese studies place more weight on spatial effects and impacts. Static plans, however, cannot adequately govern the complex interaction of spatial elements. Evaluation based only on explicit standards and indicators cannot determine whether implicit socioeconomic activities are compatible with planned layouts. **Performance** is therefore used to measure the efficiency and combined outcomes of spatial organization and urban operation [12], including structural performance [13–15], transport performance [16], and commuting performance [17].

Employment and residence are core urban functions and decisively shape spatial structure and operational efficiency. Jobs–housing balance is generally expected to shorten commuting distance and time [18]. It is influenced by the scale and distribution of residents and jobs, transport service levels, land-use intensity, and transport policy and should be assessed through both quantitative balance and qualitative matching [19–20]. Many new-area plans include jobs–housing balance as an objective but remain focused on numerical balance and neglect commuting behavior and spatial-policy adjustment. Because new-area development is phased [21], jobs and housing are often imbalanced during construction and require both sound planning and adaptive policies.

Hongqiao already faces severe transport and jobs–housing problems. The ideal planning objective is to organize static "job–housing–flow" elements and dynamic movement within limited spatial resources, forming a functionally polycentric structure that supports efficient economic activity [14]. Scenario analysis is a proactive instrument for uncertainty [22] and has been regarded as an especially appropriate spatial-planning approach to complexity [23]. Recent studies have used multi-scenario behavioral simulation to evaluate plans for expo sites and science cities [24–27], measuring spatial outcomes and identifying optimization pathways. Planning itself can be understood as an iterative "simulation–evaluation–optimization" process [28]. Where simulated performance does not support the intended objective, the scheme should be adjusted.

This paper therefore defines **jobs–housing spatial performance** as the combined outcome of urban spatial organization and operation centered on employment, residence, and commuting. It integrates the static distribution of jobs and housing, their dynamic commuting connections, and the stability and compatibility of the overall structure.

1.3 Research Framework

The study uses scenario simulation to evaluate the scientific rationality of the plan and identify strategies for adapting to uncertainty. The method has four steps: (1) analyze the study area and interpret the plan to identify major problems and evaluation priorities; (2) use regression to identify influential variables, set scenario conditions, and simulate performance under multiple scenarios; (3) assess scenario characteristics, problems, and supporting conditions; and (4) identify deficiencies and propose improvements in spatial layout, implementation policy, and development sequencing.

Data include plan texts and drawings, mobile-phone signaling records, land and building data, and road-transport data. Plan data comprise indicators and drawings from the Hongqiao 2035 Plan, including land use and development intensity. Commuting origin–destination data for November 2020 were supplied by China Unicom's Smart Footprint platform and aggregated by residents' committee. Land and building data include points of interest (POIs) and building footprints. Road data were obtained from OpenStreetMap (OSM).

2 The Plan and Jobs–Housing Spatial Characteristics

2.1 Interpretation of the Plan

The Hongqiao Main Urban Area lies in western Shanghai. It was established around the Hongqiao Integrated Transport Hub in 2009, initially as a modern business district, and was later designated as one of four main urban areas in the *Shanghai Master Plan (2017–2035)* [29]. Construction of the core area began after establishment of the development command office in 2012 and has continued for more than a decade (Figure 1).

The Hongqiao 2035 Plan, officially released in 2020, divides the 88 km² area into six subareas: the core, airport, East Hongqiao, West Hongqiao, South Hongqiao, and North Hongqiao. It establishes a three-tier "1+3+N" center system and multiple special-policy zones (Figure 2). The study analyzes spatial structure, centers, land use, special-policy zones, development intensity, and roads using 80 residents' committees as analysis units.

The plan provides for a permanent population of 450,000—a level already reached in 2017 [30]—and 700,000–750,000 jobs. Total floor area is capped at 49.40 million m², including approximately 18.31 million m² of housing and 15.82 million m² of commercial, business, and office space. Many indicators are inherited from upper-level plans such as Shanghai 2035; their compatibility with Hongqiao and their scientific basis therefore require further examination.

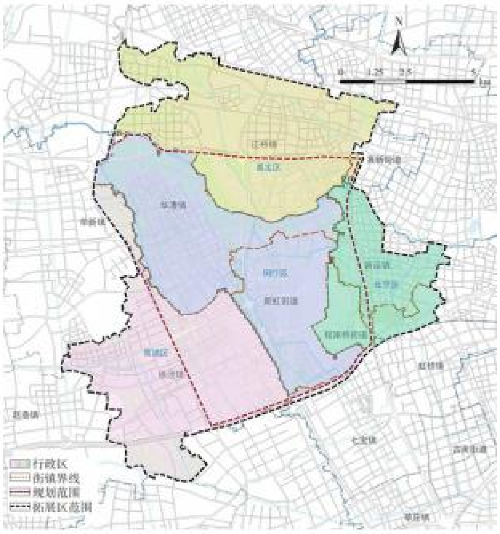

Figure 1. Administrative jurisdiction and planning area of the Hongqiao Main Urban Area [4].

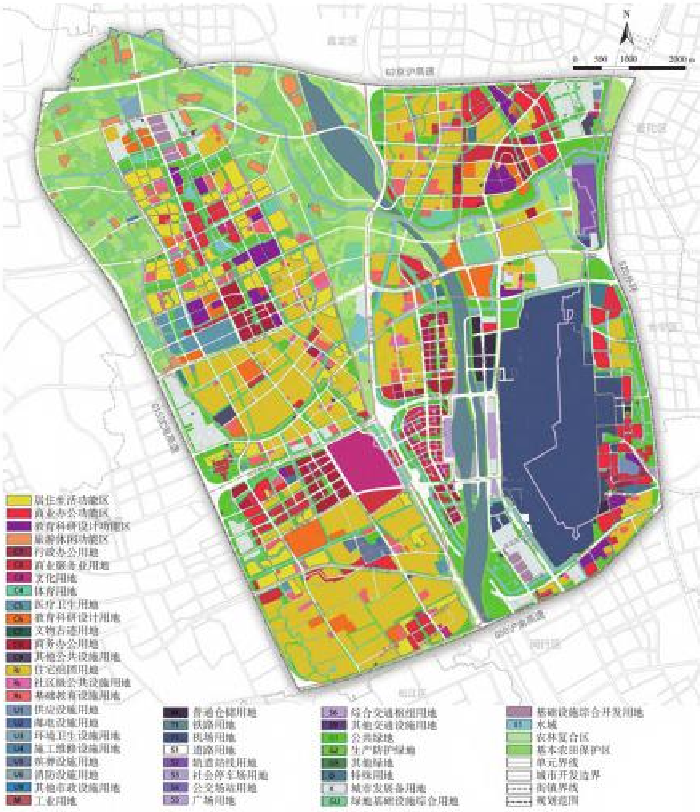

Figure 2. Land-use plan in the Hongqiao 2035 Plan [4].

2.2 Existing Jobs–Housing Characteristics and Problems

Mobile-signaling data were used to model commuting. The area's jobs–housing ratio was 1.29, indicating employment dominance, but values varied widely among units and exceeded 7 in the core. Commuting originated mainly from the west. The commuting tidal ratio was 0.69, showing substantial inbound employment. Both outbound and inbound commuting were large, indicating severe mismatch and long average commuting distances. Only 36% of employed residents worked within the area, and 14.5% worked within 5 km. Jobs were concentrated in the core and the airport economic development zone, while housing was concentrated in West and North Hongqiao.

As Shanghai's principal external transport hub, Hongqiao is already operating near capacity and continues to grow. Hub passengers, commuters, convention and business visitors, and everyday commercial trips overlap [31], creating acute transport pressure. Overall, the area faces quantitative and qualitative mismatch between jobs and housing, weak coordination between transport supply and travel demand, and a spatial layout insufficiently adaptable to future change.

3 Scenario Simulation and Comparison Based on Jobs–Housing Spatial Performance

3.1 Determining Influential Variables

A gravity model was used to forecast trip distribution and construct a commuting OD matrix among units. Commuting gravity values were aggregated by employment destination and mapped in ArcGIS [32]. Ten explanatory indicators were selected across five dimensions—economic activity, land-use intensity, road-network efficiency, public-transport coverage, and jobs–housing commuting—to reflect economic, environmental, and social considerations (Table 1).

Table 1. Indicator system of factors influencing jobs–housing spatial performance

Dimension	Indicator	Code	Data source
Economic activity intensity	Number of POIs	S1	POI data
Economic activity intensity	POI density	S2	POI data
Land-use intensity	Floor-area ratio	S3	Building-footprint data
Road-network efficiency	Road density	S4	OSM
Road-network efficiency	Spatial accessibility	S5	OSM
Public-transport coverage	Share within 300 m of bus stops	S6	Bus routes and stops
Public-transport coverage	Distance to nearest metro station	S7	Bus/metro data

Dimension	Indicator	Code	Data source
Jobs–housing and commuting	Jobs–housing ratio	C1	Mobile signaling
Jobs–housing and commuting	Local-proximity employment ratio	C2	Mobile signaling
Jobs–housing and commuting	Excess commuting index	C3	Mobile signaling

Commuting gravity was used as the dependent variable because it represents both the attraction of employment centers to residents and the degree to which a planned polycentric structure is realized. Multiple linear regression showed that floor-area ratio (S3), jobs–housing ratio (C1), and local-proximity employment ratio (C2) were significant at the 0.05 level. Model fit was strong ($R^2 = 0.854$). Because development intensity is fixed in the Hongqiao 2035 Plan, C1 and C2 became the principal adjustable scenario variables. C1 represents the static numerical relation between jobs and residents; C2 is the share of commuting trips within 5 km and represents dynamic commuting quality.

3.2 Scenario Logic and Assumptions

The plan specifies the total scale and spatial distribution of job and residential elements but not their organizational relationships, which largely determine implementation performance. Different scenarios are therefore used to examine alternative pathways. Because business functions dominate Hongqiao, total employment is treated as a constraint variable. A commuting-gravity model is constructed under different jobs–housing parameters to simulate the residential demand, job distribution, and spatial structure associated with each scenario (Figure 3).

The **baseline scenario** extends current development conditions; the **target scenario** represents the Hongqiao 2035 Plan; and the **extreme scenario** assumes that selected conditions exceed expectations. Parameters are set to improve balance, support polycentric employment, relieve the hub and core, coordinate housing and transport, and redirect new commuting flows. Only internal commuting is simulated; convention, transfer, and other shared external flows are excluded because of modeling difficulty. External commuting is evaluated with indicators such as the tidal ratio.

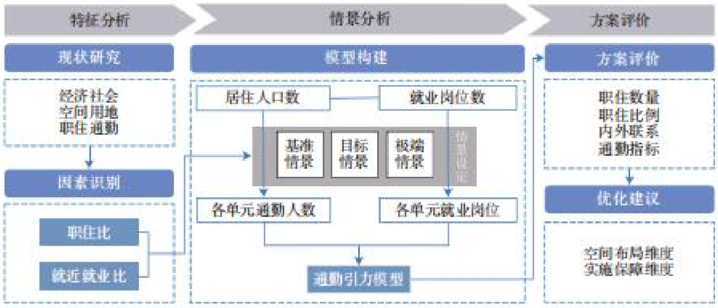

Figure 3. Research flowchart.

3.3 Simulation Process and Results

3.3.1 Scenario 1: Baseline

The baseline follows the current development path with limited adjustment to align with the plan. It is comparatively realistic but has a lower balance level. The local employment share is set at 40%; the residential population is 580,000, of whom 170,000 work locally.

Housing is concentrated west of the Jiamin Elevated Road and in North Hongqiao. The gravity model forms a commuting triangle among the core, South Hongqiao, and North Hongqiao. Employment centers are concentrated in the core, South and West Hongqiao, and the airport zone, partly because the plan allocates the greatest commercial and office floor area to South Hongqiao. High road flows are concentrated east of the Jiamin Elevated Road, with the strongest connection between the core and North Hongqiao (Figure 4).

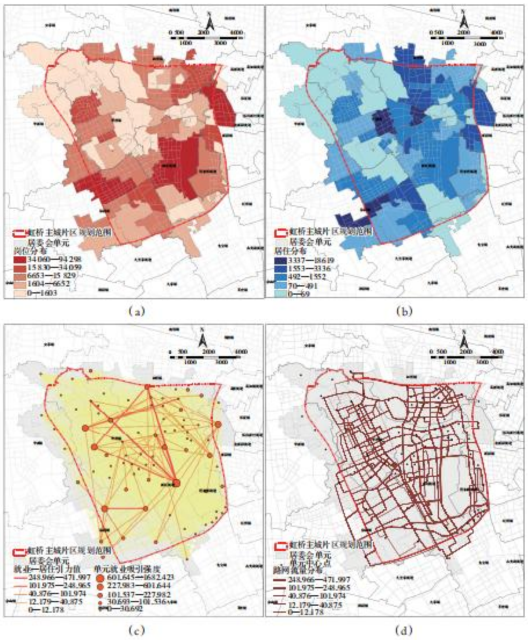

Figure 4. Job distribution (a), residential distribution (b), commuting structure (c), and traffic-flow distribution (d) in the baseline scenario.

3.3.2 Scenario 2: Target

The target scenario uses the planned jobs–housing ratio of 1.7 and assumes that 70% of employed residents work locally. Job and residential distributions follow the 2035 plan. The intended polycentric structure is largely realized: employment attraction increases in East, West, North, and South Hongqiao. Road flows are more evenly distributed. East–west movements, especially between South and North Hongqiao, become dominant; north–south movement is secondary and centers on the core–North Hongqiao relationship (Figure 5).

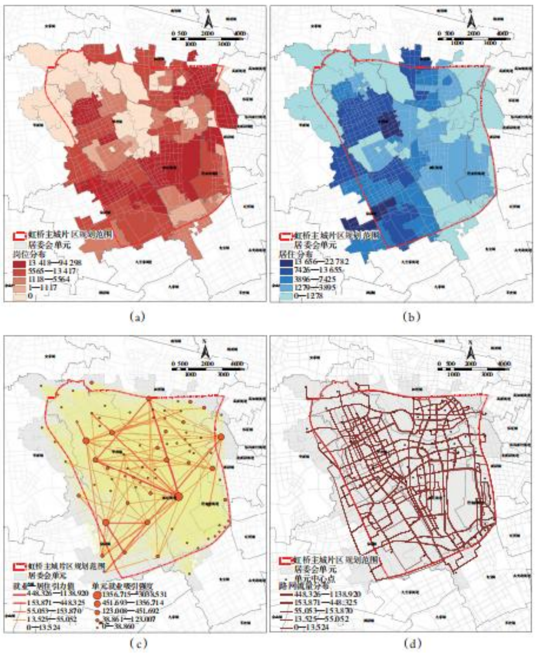

Figure 5. Job distribution (a), residential distribution (b), commuting structure (c), and traffic-flow distribution (d) in the target scenario.

3.3.3 Scenario 3: Extreme

The extreme scenario assumes that employment reaches 900,000 and reserve development land is converted to commercial and office use. North Hongqiao and the airport zone form a contiguous employment concentration, while West Hongqiao also gains substantial jobs. Housing is concentrated in South, West, and North Hongqiao. The core–North–South Hongqiao triangle remains pronounced, and centers in South and West Hongqiao and the core strengthen their connections to surrounding units. South Hongqiao's high employment-attraction area expands most and extends northward. High road flows converge toward the Hongqiao hub; internal flows are high in South and North Hongqiao but lower in West Hongqiao (Figure 6).

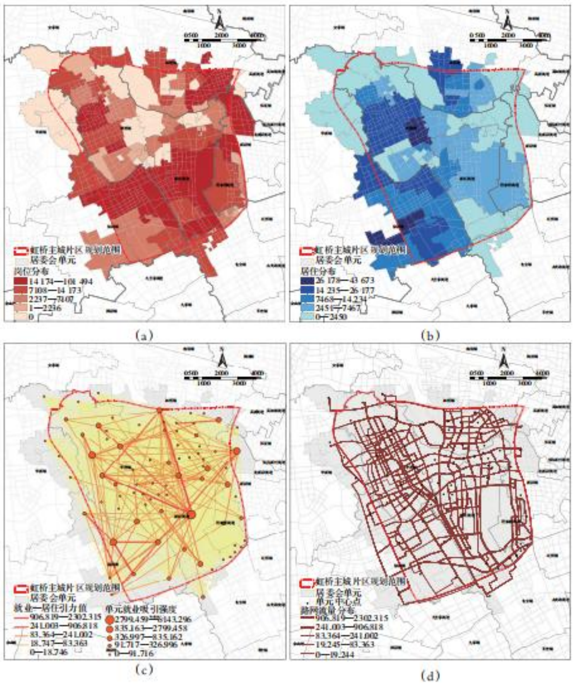

Figure 6. Job distribution (a), residential distribution (b), commuting structure (c), and traffic-flow distribution (d) in the extreme scenario.

3.4 Comparison of Scenario Results

Because scenario assumptions combine previous research with professional judgment, results indicate trends rather than precise forecasts. Evaluation is primarily qualitative and considers spatial distribution and proportion, transport pressure, and required spatial policies (Table 2).

Table 2. Results and indicators of the multi-scenario analysis

Factor	Indicator	Baseline S1	Target S2	Extreme S3
Jobs–housing quantity	Business jobs (10,000)	56	56	68
Jobs–housing quantity	Residential population (10,000)	58	45	75
Jobs–housing quantity	Required residential floor area (10,000 m²)*	2,320	1,831	3,053
Jobs–housing proportion	Jobs–housing ratio	1.3	1.7	1.2
Jobs–housing proportion	Local employment share (%)	40	70	80
Internal/external relationship	Tidal ratio	0.67	0.31	0.50
Internal/external relationship	Local employees (10,000)	17	24	46
Internal/external relationship	Outbound employees (10,000)	26	10	11
Internal/external relationship	Inbound employees (10,000)	39	32	22
Commuting network	Standard deviation	14.67	28.49	53.16
Commuting network	Kurtosis	618.17	922.63	1,080.29
Commuting network	Skewness	22.51	27.60	29.79

*Calculated at 40 m² of housing per capita.

The baseline is closest to current conditions but requires a substantial increase in population and more housing than the plan supplies. The target assumes a high local employment share. Outbound commuting falls, but the imbalance between inbound and outbound movement creates a severe tidal pattern; restricting population scale would amplify the discrepancy, so a larger share of internal residents is needed. The extreme scenario produces a sharp rise in population and housing demand well beyond the planned floor area, although higher local employment reduces both inbound and outbound commuting.

The network results show that continuation of current trends would reinforce existing built-up areas and provide limited support to new development, while housing demand would exceed planned supply. The target best realizes the planned structure and cultivates new centers, and its commuting structure is relatively balanced, but transport pressure increases and implementation is difficult. If local employment is not raised, tidal commuting will be severe, requiring strict implementation control. The extreme scenario places heavy pressure on the core and transport hub, reinforces polarization, and generates excessive housing demand and traffic.

4 Plan Evaluation and Recommendations

The analysis identifies common deficiencies, latent problems with a high probability of occurring, and lower-probability extreme risks. Unclear or unreasonable plan content can be optimized directly; risks arising during implementation require corresponding response measures.

4.1 Spatial Layout: Configure Jobs and Housing Rationally and Cultivate a Balanced Commuting Structure

Hongqiao's permanent population has already exceeded the planned value, and other indicators may also be breached. Jobs–housing indicators are treated as rigid numerical totals, but insufficiently scientific caps make dynamic balance difficult. Simulations show that, even while securing jobs to support core functions, the planned housing floor area cannot meet demand if residential land is capped. If employment exceeds the plan, additional housing demand will further breach overall indicators.

The first priority is therefore to provide an appropriate scale of employment and housing. Limited spatial capacity should be used more effectively; the market supply of small and medium-sized units should increase; and diversified housing policies should combine rental and ownership and accommodate mixed-income groups. Coordination must also occur at a larger regional scale.

Numerical balance alone does not guarantee spatial balance. Commuting direction and organization are equally important. Employment is currently concentrated in the core and airport zone, which already possess strong accessibility and industrial advantages. Baseline and extreme results show that path dependence and polarization would further strengthen centripetal commuting. South Hongqiao and other new areas therefore require stronger external support.

A multilevel employment-center system should increase the share of residents working nearby. The plan gives insufficient attention to development along public-transport corridors and may generate large centripetal flows. Spatial organization and coordination should be improved by cultivating a balanced polycentric employment structure, strengthening the attraction of South and West Hongqiao, and increasing local employment in each unit. At the metropolitan scale, public transport should form the commuting skeleton and align with employment centers; at the local scale, high-quality walking and cycling environments should encourage green travel for short commutes.

4.2 Implementation: Improve Monitoring, Evaluation, and the Action Framework

The plan does not define phased objectives according to the strategic tasks and contradictions of different development periods and therefore cannot respond promptly to changing construction rhythms. Hongqiao is still developing rapidly, and its jobs–housing pattern has not stabilized. Supply–demand mismatch is often most pronounced in this stage, yet mechanisms linking employment density, balance, and development sequence remain unclear. Key factors are not incorporated into monitoring, warning, and regulation, and the supporting conditions needed for the target scenario are insufficiently considered.

Implementation requires a monitoring and evaluation system, a dynamic adjustment mechanism, and coordination across a larger region. Different scenarios should be used to anticipate problems and define trigger conditions. This allows planners to control the pace of development and to optimize the scheme or adjust implementation when monitoring reveals movement toward an adverse scenario.

Conventional development sequencing is often based on infrastructure construction, cultivation of core functions, image-building, and land revenue. From a jobs–housing-performance perspective, sequencing must also consider supply and demand, formation of spatial structure, and bottom-line control, while reserving flexibility for future changes in land function and development intensity. A hierarchical control system should therefore be combined with dynamic monitoring and adaptive adjustment (Figure 7). When trigger indicators signal a potentially adverse pathway, appropriate measures should be selected from a policy toolkit.

Figure 7. Coordination and operation of plans with different time horizons.

5 Conclusions and Discussion

The jobs–housing ratio and local-proximity employment ratio are the two strongest influences on employment-attraction patterns in Hongqiao, representing quantitative and qualitative balance respectively. The Hongqiao 2035 Plan gives them insufficient attention, and employment and related indicators may exceed expectations. Its target scenario is prone to severe tidal commuting; housing supply may not satisfy proximity-based employment; and implementation requires strict control supported by spatial policies.

The study demonstrates that an unreasonable static spatial plan cannot effectively guide the optimization of dynamic urban development. New-area planning must consider jobs–housing relations in detail. The scenario-based spatial-performance method can improve layout and scientific rigor but must be supported by an implementation mechanism covering the entire process. The proposed closed loop consists of characteristic analysis, factor identification, scenario analysis, plan evaluation, and optimization. Scenario analysis itself includes scenario setting, simulation, and comparison. The framework can serve as a decision-support tool for new-town and new-area planning.

Multiple scenarios cannot predict the future precisely, but a combination of quantitative and qualitative analysis can identify development limits, reveal latent problems, and broaden planning approaches, strengthening strategic guidance and bottom-line control. Future work should diversify data sources, construct dynamic databases, extend models to larger spatial scales, and integrate micro-level models to improve explanatory power.

For new urban areas, planning should reduce the tendency to pursue comprehensive but overextended blueprints. It should construct effective rather than unnecessarily complex scenario relationships around major contradictions, fully examine jobs–housing balance, development priorities, and sequencing, and include plan evaluation as a formal stage so that planning genuinely becomes action-oriented.

Notes

① The jobs–housing ratio reflects supply–demand matching and is defined here as the number of jobs divided by the employed residential population within a given area. CERVERO [18] regarded ratios of 0.8–1.2 as quantitatively balanced.

② The commuting tidal ratio is the volume from A to B divided by the volume from B to A and reflects directional peak-hour imbalance. The ideal value is 1.

③ TIAN Jinling et al. [33] classified commuting distances as 0–2 km extremely short, 2–5 km short, 5–10 km medium, 10–15 km long, and more than 15 km extremely long. This paper defines employment within 5 km as local-proximity employment.

④ A literature review comparing Zhangjiang High-Tech Park, Jinqiao Economic and Technological Development Zone, Lujiazui Financial and Trade Zone, Wujiaochang, and Shanghai's five new cities found that the highest local-employment shares generally ranged from 60% to 80%; the target scenario therefore uses 70%.

⑤ In the same reference cases, employment density reaches approximately 10,000 jobs/km². At that density, Hongqiao would contain roughly 900,000 jobs.

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