How to Define the Boundaries of Metropolitan Areas:
Case Study of Wuhan, China

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AIMS OF RESEARCH

To plan ahead for a smart growth of urban clusters and megacities, there has been a trend of developing metropolitan areas for megacities in China, which considers defining the boundaries of metropolitan areas as the basis and premise.
Where do metropolitan areas start and end?

- Is there a continuum of rural and urban land uses to define them?

- If so, what kinds of factors are influencing the boundaries of metropolitan areas?
LITERATURE REVIEW

- The Understanding of Metropolitan Areas

Tokyo Plan 1960, metropolitan area: the central city with the population of more than one million surrounded by towns with over half a million residents. The central city, well connected with towns by highways in a radius of 50 kilometres, would attract more than 10 percent of its population by 1 hour’s travel.
**LITERATURE REVIEW**

- **The Understanding of Metropolitan Areas**
  
  The metropolitan areas cover an area **at a radius of between 60 and 80 kilometres** from the central cities.

<table>
<thead>
<tr>
<th>Metropolitan Area (60-80KM)</th>
<th>Coverage</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paris+7 provinces</td>
<td>12 thousand square kilometres</td>
<td>11 million</td>
</tr>
<tr>
<td>New York Metropolitan Area</td>
<td>32 thousand square kilometres</td>
<td>17.8 million</td>
</tr>
<tr>
<td>Tokyo+3 counties</td>
<td>13.4 thousand square kilometres</td>
<td>36 million</td>
</tr>
<tr>
<td>London+11 counties</td>
<td>11 thousand square kilometres</td>
<td>14 million</td>
</tr>
</tbody>
</table>

**Paris Metropolitan Area (60-80KM)**

- Paris+7 provinces
- **Coverage**: 12 thousand square kilometres
- **Population**: 11 million

**New York Metropolitan Area (60KM)**

- New York+26 counties
- **Coverage**: 32 thousand square kilometres
- **Population**: 17.8 million

**Tokyo Metropolitan Area (60KM)**

- Tokyo+3 counties
- **Coverage**: 13.4 thousand square kilometres
- **Population**: 36 million

**London Metropolitan Area (60KM)**

- London+11 counties
- **Coverage**: 11 thousand square kilometres
- **Population**: 14 million
The Understanding of Metropolitan Areas

The central city and its surrounding towns with different specific functions are sharing close economic connections.

<table>
<thead>
<tr>
<th>Surrounding towns</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crawley</td>
<td>Commercial &amp; Administrative</td>
</tr>
<tr>
<td>Wokingham</td>
<td>Residential</td>
</tr>
<tr>
<td>Reading</td>
<td>University Towns</td>
</tr>
<tr>
<td>St Albans</td>
<td>Film Industry</td>
</tr>
<tr>
<td>Milton Keynes</td>
<td>Residential</td>
</tr>
<tr>
<td>Stevenage</td>
<td>Residential</td>
</tr>
<tr>
<td>Harrow</td>
<td>Residential</td>
</tr>
<tr>
<td>Chelmsford</td>
<td>Manuafactory</td>
</tr>
</tbody>
</table>

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<tr>
<th>Surrounding towns</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domo, Nishikawa</td>
<td>Administrative, Finance, Information, Economics, Culture</td>
</tr>
<tr>
<td>Yokohama, Kawasaki, Atsugi</td>
<td>Commercial, Universities</td>
</tr>
<tr>
<td>Chiba, URAWA</td>
<td>Residential, Political University</td>
</tr>
<tr>
<td>Tupu, Tsukuba</td>
<td>Residential, University</td>
</tr>
</tbody>
</table>
The Understanding of Metropolitan Areas

Due to the economic connections, the metropolitan areas cover an area at a radius of between 60 and 80 kilometres from the central cities, which will take one hour’s ride, as frequent commutes.

(London commuter belt)  (Tokyo commuter belt)
LITERATURE REVIEW

- The Understanding of Metropolitan Areas

There is a continuum of rural and urban land uses to define the boundaries;

Factors influencing the boundaries: adjacent spaces, frequent commutes, close economic connections, complementary functions.

Methodology:
Quantitative + Qualitative
WUHAN CONTEXT

Wuhan municipality: 8569 square kilometres

Wuhan cluster: Wuhan and its surrounding cities including Xiaogan, Hanchuan, Xiantao, Huanggang, Ezhou, Daye, Xianning and etc, covering an area of 58 thousand square kilometres.
WUHAN CONTEXT

Wuhan is at the very stage of urban agglomeration and will enter the stage of dispersed development and the era of post industries around 2030. The growth of an efficient and sustainable megacity will bring about functional complementation across borders and regional corporations at different scales.

The scale of Wuhan municipality and Wuhan clusters is either too small or too large to achieve spatial integration in comparison with the cases of other megacities.

<table>
<thead>
<tr>
<th>Cites</th>
<th>The Areas of municipalities</th>
<th>The Areas of metropolitan areas</th>
<th>The Areas of Urban Clusters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tokyo</td>
<td>2200km²</td>
<td>13.4 thousand km²</td>
<td>36.9 thousand km²</td>
</tr>
<tr>
<td>London</td>
<td>1600km²</td>
<td>11.4 thousand km²</td>
<td>45 thousand km²</td>
</tr>
<tr>
<td>Shanghai</td>
<td>6340km²</td>
<td>17.1 thousand km²</td>
<td>212 thousand km²</td>
</tr>
<tr>
<td>Guangzhou</td>
<td>7434km²</td>
<td>11.3 thousand km²</td>
<td>56 thousand km²</td>
</tr>
<tr>
<td>Wuhan</td>
<td>8569km²</td>
<td>——</td>
<td>58 thousand km²</td>
</tr>
</tbody>
</table>
The **quantitative analysis** will be conducted by GIS tools. Data has been collected not only from relevant government departments but also on internet like the immigration of inhabitants, railway and bus transits as well as the **economic connections** between headquarters and branch companies.
Research Content

- **Quantitative Analysis**: based on commuting distances

Analysis has been made on the GIS platform to define the boundary of the areas within one-hour’s drive by planned networks starting from the residential and business districts in the central city of Wuhan.

The Areas within One Hour’s Drive from the Central city of Wuhan
Quantitative Analysis: based on commuting distances

In addition, commuting by public transport has also been included. With the same method, the boundary of the areas **within 30-minute’s travel by train starting from the train stations** in the central city of Wuhan has also been defined.
Quantitative Analysis: based on commuting distances

On this basis, the areas in the above two boundaries have been combined to be included within the boundary of the Wuhan metropolitan area based on commuting distances, which includes 11 administrative unites surrounding Wuhan.

The Areas within One Hour’s Drive

The Areas within 30-minue Train

The Areas based on analysis on commuting distances
Quantitative Analysis: based on population mobilities

Population mobility can be measured not only by analysing the statistics from governments but also by counting the timetable of buses and trains. The numbers of in-migrants and out-migrants between Wuhan and its surrounding cities have been collected and the cities with the top numbers can be selected.
Research Content

- **Quantitative Analysis:** based on population mobilities

Analysis have been made on the **timetable of intercity buses and trains** between Wuhan municipality and its surrounding cities, which can define **the cities with more train services to Wuhan ranking in the top**.
Research Content

- **Quantitative Analysis:** based on population mobilities

On this basis, the boundary of Wuhan metropolitan areas in the analysis based on population mobilities has been defined, which includes **8 administrative unites** surrounding Wuhan.

The Areas with More In-migrants and Out-migrants

The Areas with Relatively More Intercity Bus Services

The Areas with Relatively More Intercity Train Services

The Boundary of Wuhan Metropolitan Areas based on the Analysis of Population Mobility
Quantitative Analysis: based on economic connections

Economic connections, can be demonstrated by analysing the geographies of headquarters and their branch offices as well as the investment statistics.

First, the cities which locate more branches with their headquarters in Wuhan have been selected. Then, the cities with more investment by Wuhan can also been defined.
**Research Content**

- **Quantitative Analysis**: based on economic connections

The boundary of Wuhan metropolitan area by analysing economic connections can be defined, which includes 5 surrounding administrative units surrounding Wuhan.
Based on the analysis of commuting distances, population mobilities and economic connections, 13 cities surrounding Wuhan have been selected as the potential area. However, cities without meeting all the requirements of commuting distances, close economic connections and population mobilities have been excluded.
Qualitative Analysis: based on ecological resources

Analysis has been made on the surface coverage, water environment, forest resources, animal migration to evaluate the preservation degree of green infrastructure.

The greener the area is, the higher degree of preservation.

Analysis on green infrastructure
Qualitative Analysis: based on ecological resources

Forest parks, wetland parks, lakes and ecological resources with tourism functions have been taken into accounts. Seven administrative units could be included into the Wuhan metropolitan areas.
Research Content

- **Qualitative Analysis:** based on adjacent spaces

  Bordering areas as early forms of urban agglomerations

  Areas with similar functions like industrial parks adjacent to Wuhan, which have achieved mutual cooperation along with competitions and longed for regional integrations.
Research Content

- Qualitative Analysis: based on cultural factors

Throughout history, the cities in the Wuhan Cluster have undergone several administrative changes from the same affiliation to different ones.

There is a shift of the central city geographically from the west to the east, which used to be Wuhan and Ezhou. It is necessary to include Ezhou into the boundary of Wuhan metropolitan areas.
Dialects as important means of communication can reflect regional connections at present. There are mainly at least three kinds of dialects, based on which cultural zones can be defined to readjust the boundary of Wuhan metropolitan area by including 3 more administrative units.
Research Content

- Summary

An area of 21 thousand square kilometres

11 administrative units surrounding Wuhan municipality
Population: 17.68 million
GDP: 1.45 hundred million RMB

The metropolitan area accounts for 36%, 57% and 79% of the whole area, population and GDP of Wuhan Cluster respectfully.
Conclusions and applications

As an intermediate spatial form between megacities and urban clusters, metropolitan areas are not only sharing adjacent spaces but also close social, economic, ecological and cultural connections, which could define their invisible boundaries.

The method of defining boundaries: Quantitative analysis on commuting distances, population mobilities and economic connections and qualitative analysis on ecological resources, adjacent spaces and cultural factors.
Conclusions and applications

It’s not about defining the boundaries but the borderless developments of Wuhan metropolis, which focuses on how to collaborate out of the boundary and grow within the boundary.
Thanks for your attentions!