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Seeking sustainable strategies for Jing-Jin-Ji**

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**2**

**NEW ECONOMY  
AND  
RURAL  
REVITALIZATION**

# VILLAGE REVITALIZATION IN CHINESE MEGAREGIONS IN THE ERA OF DIGITALIZATION – SEEKING SUSTAINABLE STRATEGIES FOR JING-JIN-JI

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**Abstract:** *Villages in Chinese megaregions are struggling to economically compete with their megaregional context. In order to prosper, villages seem to have two choices: to preserve their structure as much as possible and become “beautiful villages in the countryside” that attract tourism; or to radically re-develop and cluster with other villages, attempting to copy the economic success of larger towns. As an alternative to these conventional strategies, it is desirable to explore more endogenous forms of village- revitalization based on their transformation towards a new economy. In a megaregional context, the potentials of village- revitalization have to be assessed in connection to fast-paced, digitalized, and globalized urbanization. This paper presents three approaches for village revitalization that are commonly used in China: e-commerce, agro-tourism, and the attraction of the creative class. For each of them, the influence of digitalization - particularly increasing mobile internet access - is assessed. It can be observed that as much as digitalization can accelerate village revitalization, it also makes the spatial extents of its appearance much less predictable. This increases the necessity to develop sustainable urbanization strategies. Therefore, the revitalization approaches are applied to a case in the north of Langfang, in the center of the Jing-Jin-Ji megaregion. In this sample area, three scenarios for urban development are presented, which could accommodate growth related to village revitalization. The three scenarios are then compared in terms of their contribution to ecosystem services, which is deemed an appropriate indicator for sustainable development. In conclusion, this paper shows that evidence-based regional design can help to cope with the challenges posed by megaregionalization, and that proactive planning approaches can contribute to more sustainable forms of village revitalization within highly urbanized regions.*

**Keywords:** *Village revitalization, digitalization, Chinese megaregions, Jing-Jin-Ji*

## 01 INTRODUCTION

Since 2011, the urbanization rate in China has exceeded 50%. Contemporary Chinese urbanization shows its speed and magnitude, accompanied by a phenomenon of semi-urbanization and significant regional differences in the level of urbanization (Ning 2012). Besides, global level large urban agglomerations consisting of a series of national and regional cities emerged in China, as the national strategy is to participate in global economic network and competition, which has led to a new scale of spatial planning: planning for megaregions. Such megaregions function as major growth poles, such as the Beijing-Tianjin-Hebei (Jing-Jin-Ji) region, the Yangtze River Delta region, and the Pearl River Delta region.

Along with such a rapid transformation process, what has been and still is being changed is the urban-rural relationship. This is not only associated with the urbanization process in China, but also seemingly a global trend, as stated by Patsy Healey (2002, p.331) for the European context, that “the urban region scale seems to offer an appropriate focus for developing an integrated and ‘sustainable’ approach to territorial development.”

Although China’s urban-rural integration has begun to take shape, there are still problems to be solved in future development. One of the issues is that the long existed urban-rural dual system has led to serious imbalance in the allocation of capital, land, talent and other resources between urban and rural areas, and the unidirectional flow of rural resources into cities. This further caused the increasing rural recession. The construction of new socialist countryside since 2005 has significantly improved the appearance of villages and the living conditions of farmers. However, the gap between villages and cities continues to widen, which includes but not limited to spatial quality, infrastructure, and ecological quality, etc. As the consequence, the continuous outflow of rural labor and the phenomenon of “hollowing” villages is increasing, and some villages continue to decline. Villages in megaregions are particularly facing challenges and struggle to survive, as they face more pressure of rapid urbanization. Following the current spatial planning and policies, they either become “beautiful villages” or cluster to become part of the town system. It is of great importance for villages to function well so as to achieve sustainable megaregional development, which calls for alternative revitalization strategies. There is an increasing need to have integrated planning of urban and rural areas, to reach equal quality and development opportunities for both of them. This means that, under the premise of compliance with planning and land use control, allowing farmers to use collective construction land for non-agricultural production. This is to increase the comparative labor productivity of agriculture, and eliminate the dual economy of urban and rural areas. The development of new business forms and models such as leisure agriculture, rural tourism, e-commerce, etc. is crucial (Zhang 2019), to promote the integrated development of primary, secondary and tertiary industries, agricultural transformation and upgrading, and increase businesses opportunities for local residents (Zhang and Zhu 2018).

These alternative village revitalization strategies are actually emerging in Chinese megaregions, such as e-commerce, agro-tourism, and clusters of creative industries in villages in the Jing-Jin-Ji megaregion, which will be introduced in this paper. Research shows that these strategies are strongly affected by the new possibilities given through digitalization and globalization, especially the mobile internet access (Tand and Shi 2015; Li 2019). In 2014, Alibaba Group announced that it will launch the “Thousand Counties and Ten Thousand Villages Plan”, with an investment of 10 billion yuan within three to five years to establish 1,000 county-level operation centers and 100,000 village-level service stations. By moving terminal service

to the countryside, farmers are taught and assisted to do online shopping. Besides, rural e-commerce also advocates selling local agricultural products to the outside world, which is supported by established logistic systems in the countryside. Such new opportunities have encouraged the flow of resources from cities to the countryside. Here is an example: Since 2015, Guantao County in Hebei Province (Jing-Jin-Ji region) has followed the new trend of "Internet +" development and has attached great importance to the development of rural e-commerce. The rapid development of rural e-commerce in Guantao County has attracted more and more migrants to return from big cities to rural areas of Guantao for the development of rural e-commerce.<sup>1</sup> Similar influence of digitalization and globalization can be seen on the development of agro-tourism. As mentioned above, the integration of the first, second, and tertiary industries is the key in village revitalization. In the case of agro-tourism, it includes farming, agro-products, and services (homestays, catering, etc.). The internet-based marketing platform and mobile APPs will facilitate the local community in managing the businesses, including introduction of scenic spots, reservation of accommodation and catering, route recommendations, etc.

At the moment some of the actions related to these alternative village revitalization strategies, such as the clustering of creative class in village areas, are taken in a relatively 'spontaneous' way, initiated by elite groups and local residents (according to interviews done by the authors<sup>2</sup>). The rural amenities, including its cultural landscape, relative proximity to big cities and affordable living and working space, have attracted creative class people to the villages in suburban districts or areas close to big cities, such as the Daxing and Songzhuang districts of Beijing. Thanks to the ICT infrastructure development, the majority (98%) of villages in China nowadays are covered by fiber optic communication systems and 4G mobile network. This provides preconditions for the creative class to work in remote areas. The clustering of the creative class has led to transformation of socio-economic and spatial conditions of villages, and shows potentials of scaling up, which to a certain extent will affect the future development of the megaregion.

Although the above-mentioned phenomena are not new, the knowledge gap lies in the fact that these emerging (digitalized) village revitalization strategies have not been assessed in a megaregional context yet, or in other words, it hasn't been fully explored how such strategies would affect sustainable development of megaregions in various future scenarios of spatial planning.

## 02 STRUCTURE AND METHODOLOGY

This paper seeks strategies for sustainable development in Chinese megaregions, based on contemporary socio-economic phenomena in villages in the era of digitalization. Therefore the research question is: how are revitalization approaches for Chinese villages affected by processes of digitalization, and how can they be implemented into urbanization strategies that contribute to sustainable development in Chinese megaregions?

In order to explore possible answers to the research question, the paper has two main sections. The first of them (Three Revitalization Approaches) presents three strategies that are commonly used for the

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1] [http://www.cnews.net/xw/htysj1/38149\\_20160819093919.html](http://www.cnews.net/xw/htysj1/38149_20160819093919.html), accessed on 25 July 2020

2] ZHAO Zhifeng (professor at Beijing University of Technology) and Architect SI Minjie, (principal architect of VRAP)

revitalization of villages in China. Relevant literature is used to give an overview of their main ideas and the way in which they emerge. The highest relevance for the research question lies in the predictions on how the revitalization approaches are influenced by digitalization, in particular by the growth of mobile internet usage.

The second main section (Regional Scenarios - The Case of Langfang) applies the revitalization approaches to a case in the Langfang prefecture, which is in the center of the Jing-Jin-Ji megaregion. Based on the definition of an ecological network, three urbanization scenarios are developed which could accommodate forms of growth related to the revitalization approaches. The scenarios are compared in terms of their contributions to ecosystem services, which is identified as a suitable concept to assess improvements for both socio-economic and environmental sustainability. The comparison of the scenarios informs statements on how to find sustainable strategies for megaregional development.

This paper is based on research made in a master thesis (Endemann 2020), which looks at peri-urban areas in the Jing-Jin-Ji megaregion and the question how they can develop more sustainably. The authors tried to make it as easy as possible to understand this paper as it is, without further background material. However, at times it might be helpful for the reader to refer to the thesis for more detailed information and more extensive explanations.

Multiple methods are used in order to perform the agenda of this paper. The first section is mostly based on literature review, as well as semi-structured interviews with experts from Beijing, which have been conducted by the authors in the beginning of 2020. For the second section, a research by design approach goes along with a more diverse set of methods. Spatial analysis based on publicly available data (Sentinel 2 satellite images, OSM data, etc.) is performed with a GIS program and other programs for visualization. Furthermore, scenario-making is used as a tool to project potential futures of the region. The scenarios are not supposed to be strictly computational calculations of rationally predictable futures, but rather prototypical and slightly provocative visualizations of pathways that show what could happen if certain planning-paradigms take over. The comparison of the scenarios is again based on spatial analysis, using commonly used indicators for sustainable development, such as landscape fragmentation, as well as some new methods of determining spatial qualities. The indicators all follow the conceptual framework of ecosystem services. It is a cyclic process in which conclusions from research inform design and design outcomes become the start of research (Wall 2004; Amenta and Qu 2020).

### **03** THREE REVITALIZATION APPROACHES

This section presents an overview of approaches for village revitalization that are widely used in China. Based on literature review, three approaches have been chosen: E-commerce, where villagers are setting up online shops to sell manufacturing goods and other products; Agro-tourism, where villagers promote hospitality businesses related to farming activities; Attraction of the creative class, where creatives (artists, architects, designers, etc.) are encouraged to settle in villages. All three approaches are considered to be successful tools for village revitalization. While agro-tourism and the attraction of the creative class are especially happening around Beijing, the expansion of e-commerce can be observed throughout the country. Short descriptions of the main ideas of the approaches and how they develop are presented hereafter. Furthermore, it is hypothesized how the approaches are influenced by ongoing processes of digitalization.

Finally, the commonalities and differences between the approaches are worked out.

### 3.1. E-commerce

The development of e-commerce businesses in rural China is considered to be a successful tool for poverty alleviation (Li 2019). Therefore, this strategy is promoted extensively by both the national government and the Chinese online-business market leader Alibaba, which runs the online shopping website Taobao.

The main idea of rural e-commerce development is to increase the capability of villagers to open online stores (usually on Taobao), where they can sell the products they produce. This includes manufacturing goods, but also fruits and vegetables. Instead of being limited to adjacent towns and villages, an online shop exposes the products of the villagers to millions of people (Cui, Pan, and Cui 2019). This has led to several success stories, where villagers scaled up their businesses from backyard workshops to large enterprises. Furthermore, seeing the success of their fellow villagers tends to inspire others to start their own online shops, creating larger clusters of “Taobao-villagers” who establish collective teaching and service infrastructures. Alibaba is actively supporting such developments by sending employees to villages for technical and strategic support, and by building Taobao service centers in the villages in order to simplify the distribution of goods (Li 2019). Simultaneously, villagers get easier access to online shopping themselves.

E-commerce is - of course - highly dependent on the increasing access to (mobile) internet. The growing number of internet users in China has created new opportunities for villages, even in “the most remote rural areas” (Zi 2019, p.6). The ongoing agenda of Alibaba to support e-commerce in rural areas can be expected to further accelerate this development throughout the country, but it will be more difficult to predict its spatial distribution.

### 3.2. Agro-tourism

Several forms of agriculture emerge as a response of village communities to rapid urbanization in the fringes of Beijing (Yang et al. 2016). One of the most common among them is agro-tourism, where villagers rent out apartments to tourists that look for short term getaways and farming-related activities.

Agro-tourism can happen in different forms and extents. Yang et al. (2016) differentiate between two main types: rather informal subletting of small units, which is easy to start and operate by individual village households who can showcase different kinds of farming and food-processing for visitors to participate in; and more formalized business models for high-value accommodation, which require more effort in terms of investment in infrastructure and staff, but can be highly profitable because of their diverse offer of recreational activities. Occasionally, the individual actions described in the first type can grow and form larger businesses that are more similar to the second type. Both small and large businesses have become a reliable source of income in peri-urban areas of Beijing.

The success of agro-tourism is highly dependent on a multifunctional use of land. The diversification of agricultural production makes this revitalization approach ecologically desirable, while the mix of people and places makes it suitable for improving social ties in the village and beyond. This mix of being “not only economically appealing, but also socially inclusive and environmental friendly” (Yang et al. 2016, p.222)

makes agro-tourism in peri-urban areas a powerful strategy for revitalizing villages in multiple ways.

Like most hospitality businesses, agro-tourism is driven by attracting and pleasing customers. While there is no research known to the authors that studies the ways in which links between potential tourists and villagers are made, it can be assumed that the growing use of mobile internet is beneficial for the creation of such links. Especially for larger businesses, online platforms like Agoda or AirBnB are useful to promote their facilities to a large audience. Smaller businesses might benefit from making informal links with friends and friends of friends through social media apps like WeChat, Weibo, or Tencent QQ. This simplification of customer-attraction can accelerate the development of agro-tourism in a way that is less dependent on the spatial location of a business than it would be in a less digitalized context.

### 3.3. Creative class

Creatives settling in villages is another phenomenon that is particularly appearing in the fringes of Beijing. Since the 1990s, the emergence of art villages is commonly seen as artists that are looking for cheap rental space are settling and creating new creative clusters over time. In some cases, the government is subsidising the creation of such clusters in order to create art districts, which occasionally become new tourist hotspots (Liu, Han, and O'Connor 2013).

Beijing was and is the most important hub for contemporary art in China, which is in line with the observation that art activities “typically cluster in world cities” (Liu, Han, and O'Connor 2013, p.177). Since artists are not the only group that is attracted to big cities, and they have a comparatively low and unsteady income, finding spaces to work in becomes a particular struggle for them (Liu, Han, and O'Connor 2013). Cheap rent prices, a certain degree of informality, and some nostalgia for the Chinese countryside make villages a suitable place for artists to settle. Simultaneously, villagers are open welcome artists as it generates an additional source of income for them. Especially after smaller clusters have formed, villagers serve the new demand by building art complexes and other infrastructure that also attract wealthier artists (Ren and Sun 2012). Since the early 2000s, the Beijing government has discovered artist clusters as a profitable basis for urban development, which coincided with the desire to gain more control over cultural activities in the city. This form of “artistic urbanization” can give an enormous boost to the development of a village, but also tends to displace its old inhabitants (Ren and Sun 2012).

Such processes can be expected to occur similarly with other creatives like architects, designers, or craftspeople (Si 2020). Furthermore, the dynamic of less wealthy economic groups seeking cheap work spaces and forming clusters outside the big cities is likely to occur throughout Chinese urban regions, not only around Beijing. Especially in the earlier stages it is very hard to predict where people might settle, since most contacts are made informally (Si 2020). Once more, social media plays a crucial role in simplifying such contacts and can be expected to significantly increase the frequency of creatives forming new clusters in rural parts of a region.

### 3.4. Revitalization Approaches - Conclusion

All three revitalization approaches are verifiably suitable for increasing the prosperity of a village. This can happen through the villagers themselves gaining new knowledge that allows them to create and expand businesses, or through new groups coming to the village and bringing their skills and capital which the old

villagers can benefit from respectively.

The expansion of digital communication and the increasing access to mobile internet is essential to all three strategies. While e-commerce could simply not exist without platforms like Taobao, also agro-tourism is highly dependent on tourists finding a place on the internet, and the contact between villagers and urban creatives would be much harder without the possibilities given through WeChat and other messaging apps.

As much as digitalization is a crucial accelerator for village revitalization approaches, it also randomizes its spatial extents. Principles like the proximity to agglomerations of people or infrastructural nodes are still relevant for developments, but they seem to be decreasing in relevance as most of the Chinese population is getting access to the internet from virtually anywhere. Even though the relation to larger urban agglomerations remains an important factor for tourists, artists, and economic activities in general, digitalization opens up opportunities for places that lie far beyond the fringes of big cities. This trend underlines the necessity to find urban development strategies that can accommodate village revitalization and economic shifts in a way that aligns economic prosperity, social sustainability, urban growth, and the strive to counteract environmental degradation in Chinese megaregions. The following section tries to envision such strategies.

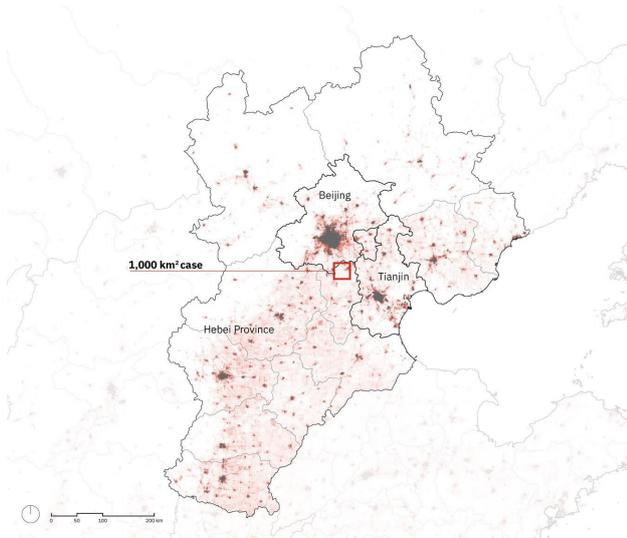
## **04 REGIONAL SCENARIOS – THE CASE OF LANGFANG**

This section produces and assesses different scenarios for urban development that could accommodate forms of growth that are related to the revitalization approaches described in the previous section. It therefore tests how the development of villages could affect the performance of a region and how planning strategies can make it more sustainable.

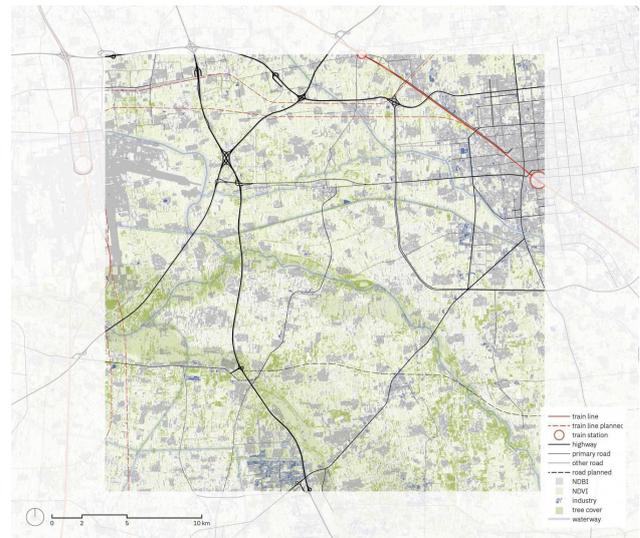
The chosen case is a square of 1,000 km<sup>2</sup> in the north of Langfang. It is in the center of the Jing-Jin-Ji megaregion (see Fig.1), which is one of China's "giant megaregions" (Jiawen, Ge, and Jian 2015, p.1). Jing-Jin-Ji contains the megacities of Beijing and Tianjin, as well as the province of Hebei, with a total population of more than 100 million people. The Chinese government intends to transform this region into a "world class city cluster" (Compilation and Translation Bureau, Central Committee of the Communist Party of China 2016). This intention is materialized through rapid expansions of regional transport infrastructure and other large scale urban developments. Within this megaregional context, the chosen case forms a dense network of villages and towns, located between Langfang City in the east and the newly opened Daxing Airport in the west (see Fig.2).

The area has a significant pressure for urban growth, seen both in developments plans made by local governments (cf. Langfang Masterplan 2016-2035; Daxing District Plan 2017-2035; land use plans of Anci, Guanyong, and Yongqing, 2010-2020) and the projected population growth based on previous years (cf. Statistics of Yongqing 2008-2018; Daxing Statistical Yearbook 2018). Therefore, it is reasonable to work out urbanization scenarios that provide extensive space for such growth and can host new inhabitants and businesses.

This section is structured as follows. Firstly, ecological qualities of the chosen case are analyzed in order to define an ecological structure that the urbanization scenarios should be based on. Secondly, three scenarios



**Figure 1.** Location of the case area within the Jing-Jin-Ji megaregion. Red-to-black: population density (black = 5,000 or more people per km<sup>2</sup>); Source: Authors, based on [http://thematicmapping.org/downloads/world\\_borders.php](http://thematicmapping.org/downloads/world_borders.php) and University of Southampton WorldPop (2015), <https://www.worldpop.org/geodata/summary?id=131>



**Figure 2.** Basemap of the case area; Source: Authors, based on OSM extracts from <https://www.geofabrik.de/data/download.html>; Sentinel 2 satellite images between May and September 2019, retrieved from <https://earthexplorer.usgs.gov>; Google Earth Pro

and their core principles are presented as a possible array of development pathways. Thirdly, the three scenarios are compared in terms of their contribution to ecosystem services in order to reveal their strengths and weaknesses to accommodate sustainable growth in Jing-Jin-Ji.

#### 4.1. Ecological network

The ecological qualities of the area can be measured by a set of indicators that is retrieved from publicly available data. The chosen indicators are:

- **Water and valleys:** existing waterways (difference between canals and natural rivers) - defined through OSM data and NDWI; lower areas with linear morphologies - defined through DEM
- **High tree cover:** areas with dense vegetation (mostly trees) - defined through Infrared image and NDVI
- **Noise exposure** (transport infrastructures): (perceived) noise contours of PKX - based on noise contours of Amsterdam Schiphol Airport; buffer zones around highways - based on OSM data
- **High soil fertility:** areas that are likely to provide the most productive agricultural land - based on the soil's Cation Exchange Capacity (CEC)

Based on these indicators, a prioritized hierarchy of ecological zones is defined (see Fig.3). Different characteristics are related to different priorities. Still, the new network is not a computational definition of strict zones, but rather an interpretation of the characteristics for the purpose of a spatially coherent framework that focuses on high degrees of landscape connectivity and takes the existing urban structures into account.



Figure 3.

Ecological network, based on several indicators for ecological qualities;

Source: Authors, based on OSM extracts from <https://www.geofabrik.de/data/download.html>; Sentinel 2 satellite images between May and September 2019, retrieved from <https://earthexplorer.usgs.gov>

## 4.2. Scenarios

Based on the ecological network, three scenarios are presented here in order to outline different possibilities for urbanization in the north of Langfang. The developments aim to be suitable for the different types of village revitalization presented beforehand. Each of the three scenarios should provide space for each of the three revitalization approaches.

The location and extent of transformations and expansions is inspired by the forms of development that can be expected to happen in villages in relation to their revitalization. The previous section has shown that village revitalization follows different spatial principles:

- Developments happen either on or adjacent to the existing built-up land of a village. This is relevant to all three revitalization approaches, as they are all based on the villages' existing infrastructures and networks.
- Access to transport infrastructure is beneficial for new developments. This is especially relevant to E-commerce, as this form of revitalization is the most dependent on being able to export goods via the road network. It is also relevant to agro-tourism, because villages need to be accessible for tourists.
- The relation between built-up land and the open landscape plays an important role for development. This is especially relevant to agro-tourism, as the promotion of a village as a tourist destination heavily relies on the easy access to open landscapes and "nature" for leisure purposes. Furthermore, creatives might value a close relation to the landscape, as part of the traditional image of a village in the countryside.

These principles form the underlying logic for the scenarios. In each scenario, there are also villages that do not fit into the envisioned developments and are therefore envisioned to shrink - and eventually be transformed into agricultural land or extensively used green land - in a coordinated process over time. More detailed proposals for how such a shrinking process could be designed are made by Endemann (2020).

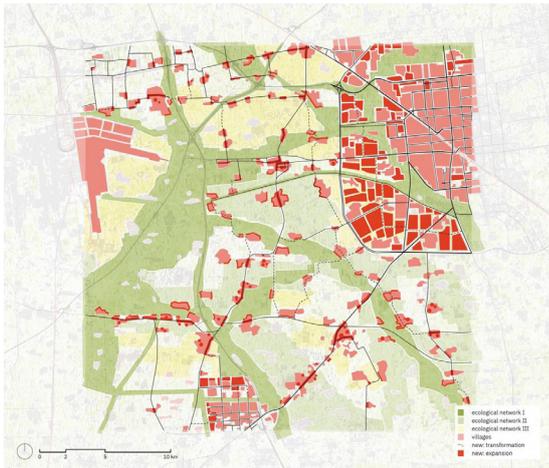


Figure 4. Networks Scenario;

Source: Authors, based on OSM extracts from <https://www.geofabrik.de/data/download.html>; Sentinel 2 satellite images between May and September 2019, retrieved from <https://earthexplorer.usgs.gov>; Google Earth Pro

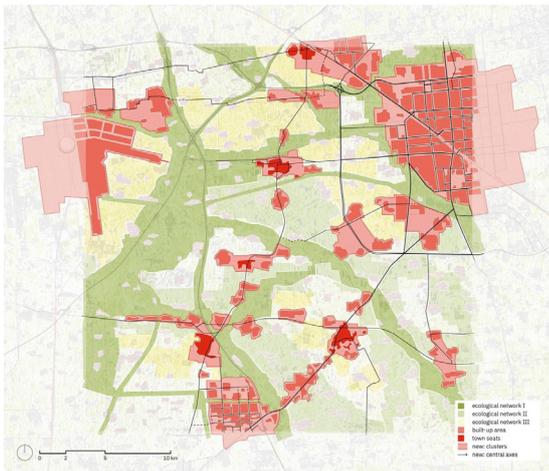


Figure 5. Territories Scenario;

Source: Authors, based on OSM extracts from <https://www.geofabrik.de/data/download.html>; Sentinel 2 satellite images between May and September 2019, retrieved from <https://earthexplorer.usgs.gov>; Google Earth Pro

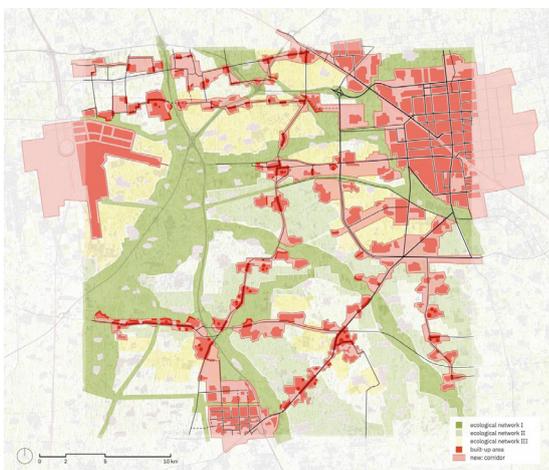


Figure 6. Corridors Scenario;

Source: Authors, based on OSM extracts from <https://www.geofabrik.de/data/download.html>; Sentinel 2 satellite images between May and September 2019, retrieved from <https://earthexplorer.usgs.gov>; Google Earth Pro

The first scenario is called Networks and focuses on the transformation of existing built-up areas, based on the spatial characteristics of the villages. Transformations are made: along central streets which already show signs of organic growth; along shared edges between villages and the primary or secondary ecological network; if villages have a certain degree of industrialization. Villages that do not fit into one of these three categories are envisioned to shrink. As it can be seen in the scenario map, a majority of the villages fits into at least one of the transformation-categories (see Fig.4). Still, the developments that can be generated would not be sufficient for the required growth in the area. Therefore, large expansions would be needed elsewhere, for example around the core of Langfang City, as it is shown here. This scenario is probably the most similar to what would happen in an open competition between villages, towns, cities, and their respective market actors.

The second scenario is called Territories and takes the existing administrative structure of the region as the basis. This mainly leads to township seats receiving generous expansion areas, and villages in their spatial proximity being allocated smaller transformations. Villages that have insufficient spatial and infrastructural connections to the townseats and larger cities should be prepared to shrink. This development logic creates a series of clusters around township seats, and excludes a large number of villages from revitalization (see Fig.5). This scenario is probably the most similar to the developments envisioned by local governments (county/ prefecture-level).

The third scenario is called Corridors and focuses on the expansion of villages along newly designated axes. It follows the simple principle that villages are allowed to expand if they have access to the primary road network, and that they should be prepared to shrink if they do not have such access. This principle leads to several corridors throughout the area, thickened around the core of Langfang City

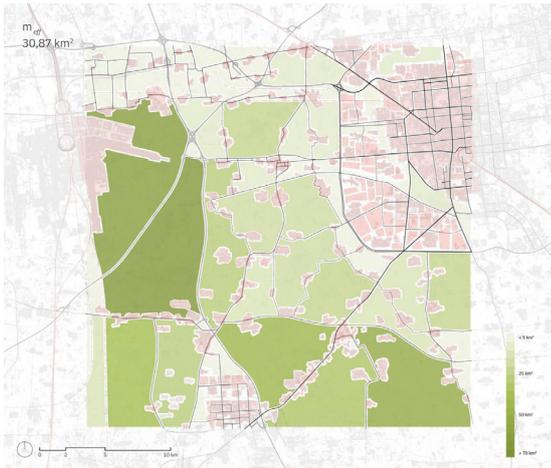


Figure 7. Networks Scenario – Fragmentation of unbuilt areas;

Source: Authors, based on OSM extracts from <https://www.geofabrik.de/data/download.html>; Sentinel 2 satellite images between May and September 2019, retrieved from <https://earthexplorer.usgs.gov>; Google Earth Pro



Figure 8. Territories Scenario – Fragmentation of unbuilt areas;

Source: Authors, based on OSM extracts from <https://www.geofabrik.de/data/download.html>; Sentinel 2 satellite images between May and September 2019, retrieved from <https://earthexplorer.usgs.gov>; Google Earth Pro



Figure 9. Corridors Scenario – Fragmentation of unbuilt areas;

Source: Authors, based on OSM extracts from <https://www.geofabrik.de/data/download.html>; Sentinel 2 satellite images between May and September 2019, retrieved from <https://earthexplorer.usgs.gov>; Google Earth Pro

(see Fig.6). The corridor scenario is probably the most unconventional of the three, as it significantly restructures the existing spatial pattern.

Together with the definition of areas for transformation and expansion, the scenario maps also include a potential transformation of the existing transport infrastructure. For example, the numerous spread-out developments envisioned in the network scenario require a large amount of new roads to be built.

### 4.3. Comparison

After the basic principles and spatial patterns of the three scenarios have been presented they can be compared in terms of their environmental and socio-economic performance. The conceptual framework of ecosystem services is chosen as a basis to make this comparison because it combines the acknowledgement of the intrinsic value of nature with an emphasis on the functional benefits of the environment for human well-being (Lele et al. 2013). Therefore, it is a suitable concept to find strategies that contribute both to higher ecological qualities and more socially sustainable communities.

The concept of ecosystem services is widely used throughout environmental sciences and typically entails four categories, first defined by the Millennium Ecosystem Assessment (2005): supporting, provisioning, regulating, and cultural services. Here, these categories will be explored through three spatial analyses: fragmentation of unbuilt areas (caters multiple services), landscape experience (cultural service), and agricultural productivity (provisioning service).

The fragmentation of unbuilt areas is commonly considered to directly affect biodiversity (Wandl 2017). Here, fragmentation was calculated based on the method developed by Jaeger et al. (2002), and its adaption for dispersed urban regions by Wandl (2017). For the three scenarios, the fragmentation

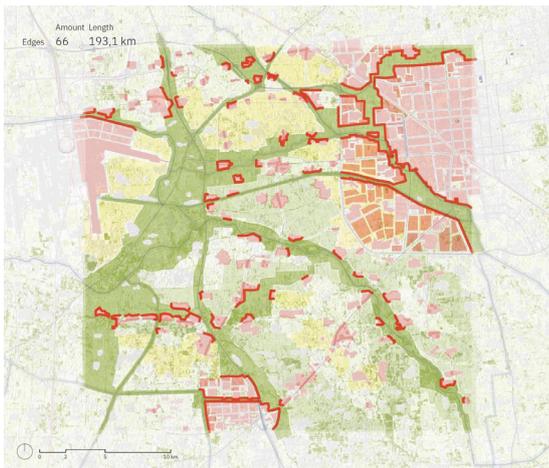


Figure 10. Networks Scenario – Shared edges between built-up and primary ecological zones

Source: Authors, based on OSM extracts from <https://www.geofabrik.de/data/download.html>; Sentinel 2 satellite images between May and September 2019, retrieved from <https://earthexplorer.usgs.gov>; Google Earth Pro

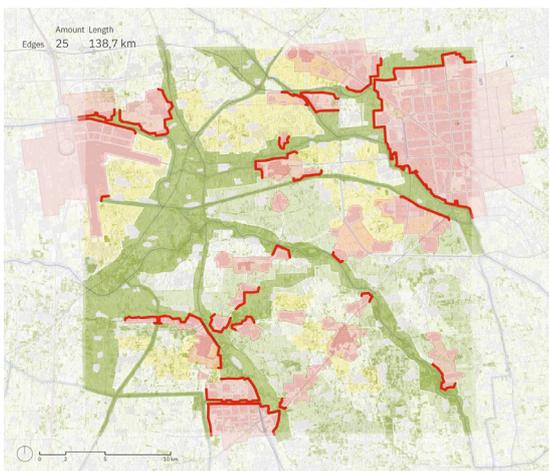


Figure 11. Territories Scenario – Shared edges between built-up and primary ecological zones

Source: Authors, based on OSM extracts from <https://www.geofabrik.de/data/download.html>; Sentinel 2 satellite images between May and September 2019, retrieved from <https://earthexplorer.usgs.gov>; Google Earth Pro

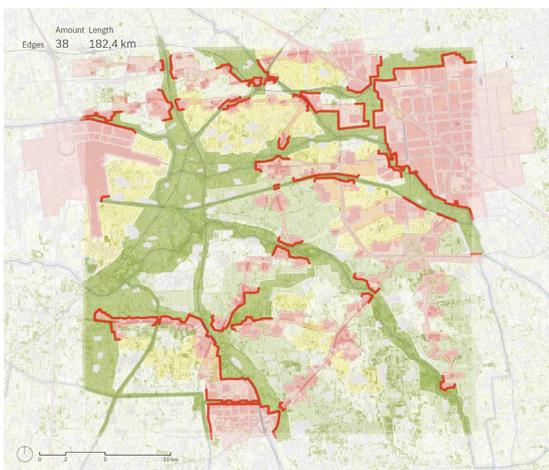


Figure 12. Corridors Scenario – Shared edges between built-up and primary ecological zones

Source: Authors, based on OSM extracts from <https://www.geofabrik.de/data/download.html>; Sentinel 2 satellite images between May and September 2019, retrieved from <https://earthexplorer.usgs.gov>; Google Earth Pro

geometry is defined through transport infrastructure (primary roads, highways, and railways) and built-up areas, all with buffer zones of 50 m. The analysis shows unfragmented unbuilt areas with a size of up to 70 km<sup>2</sup> (see Fig.7-9). In all scenarios, areas in the west tend to be larger than in the east of the sample area. The effective mesh size ( $m_{eff}$ ), which “is an appropriate fragmentation measure because of its mathematical characteristics and its intuitive interpretation” (Jaeger 2000), shows that the corridor scenario is the least fragmented one. The territory scenario is slightly more, and the network scenario much more fragmented. These results match the visual impression that the corridor scenario shows the largest unbuilt-areas. The main reason for this is probably the scenario’s low need for road infrastructure and the linear concentration of built-up areas.

The second analysis is concerned with landscape experience, spatialized through the proximity of people to recreational areas. A simple measurement used here is the length of shared edges between built-up areas and the primary ecological network (see Fig.10-12). Such edges are expected to enhance the accessibility of recreational areas. The network scenario shows the highest length of urban/ecological edges, closely followed by the corridor scenario. The strong clustering of built-up areas in the territory scenario lead to a much lower length of shared edges.

The third and last analysis for ecosystem services is concerned with the quantity and quality of agricultural land as a key indicator for provisioning ecosystem services. This is measured through three categories: areas with high soil fertility, medium soil fertility (defined earlier as secondary and tertiary ecological zones respectively), and villages that lie within these areas and are envisioned to shrink and to be transformed into agricultural land in the long term (“Village Transformations”). The primary ecological zones defined previously is excluded from the calculation, because they are envisioned



Figure 13. Networks Scenario – Agricultural productivity

Source: Authors, based on OSM extracts from <https://www.geofabrik.de/data/download.html>; Sentinel 2 satellite images between May and September 2019, retrieved from <https://earthexplorer.usgs.gov>; Google Earth Pro



Figure 14. Territories Scenario – Agricultural productivity

Source: Authors, based on OSM extracts from <https://www.geofabrik.de/data/download.html>; Sentinel 2 satellite images between May and September 2019, retrieved from <https://earthexplorer.usgs.gov>; Google Earth Pro



Figure 15. Corridors Scenario – Agricultural productivity

Source: Authors, based on OSM extracts from <https://www.geofabrik.de/data/download.html>; Sentinel 2 satellite images between May and September 2019, retrieved from <https://earthexplorer.usgs.gov>; Google Earth Pro

to become extensive unbuilt areas without agricultural use. The network scenario clearly has the lowest overall area of agricultural land, which can be assumed to be related to the low amount of village transformations and the high degree of new developments envisioned around Langfang City. The corridor scenario has a slightly higher overall area of agricultural land and a significantly higher amount of highly fertile land than the territory scenario, which makes it the scenario with the most potential for food production. (see Fig.13-15)

#### 4.4. Regional scenarios - conclusion

The synopsis of the analysis shows that the corridor scenario has the best performance for ecosystem services, as it ranks first for fragmentation and productivity, and second for experience. The network and the territory scenario perform significantly lower. This underlines the usefulness to explore unconventional development strategies.

Announcing the corridor scenario as the “winner” of the comparison is an important conclusion, but does not mean that the other two scenarios should be tossed away. Apart from the fact that they also perform well in certain categories, the importance of including more conventional strategies becomes apparent when considering moments of crisis: the corridor scenario requires a major strategic shift of spatial planning practices, and might be connected to significant costs and legal adjustments, which require the willingness to take some risks. Such risks are unlikely to be taken when there are little financial resources or times of high uncertainty. The Covid-19 pandemic is a prime example for this, since it is expected to produce major disruptions of the (global) economy, and shift the focus of attention for public investments. Under such conditions, the importance of planning for uncertainty becomes obvious. Therefore, the adaptability of different options should be tested in order to be able to combine and switch between them if necessary.

The three scenarios do not conclusively render the possible pathways for urbanization in the north of Langfang. Other scenarios, or combinations of the ones at hand, might lead to better performances. Furthermore, it could be revelatory to use more indicators to analyze the scenarios at hand in order to get a better understanding of where their strengths and weaknesses are. Nonetheless, the comparison in terms of ecosystem services gives a quick, simple, and broad overview of how the different strategies could influence sustainable development in the area.

## 05 DISCUSSION AND CONCLUSION

### 5.1. Discussion

The paper provided an overview on contemporary forms of village revitalization in Chinese megaregions, and how digitalization contributed to these emerging strategies; Besides, it demonstrated ways of projecting the spatial effects of village revitalization and how it affects the environmental performance of an area, based on scenarios of future spatial development. Results of the research have been highlighted briefly by the end of each section, and will be further discussed in this part of the paper.

The literature study and interview conducted by the authors indicate that the three emerging revitalization approaches introduced in this paper (E-commerce, Agro-tourism, and the clustering of creative class) all have the potential of increasing economic prosperity of villages in Chinese megaregions. The proximity to big cities and other local conditions (such as cultural landscape, environmental quality) determines approaches that are likely to be implemented. Furthermore, the development of ICT infrastructure enabled the expansion of digital communication and the increasing access to mobile internet in most villages in China, which is essential to facilitate all three above-mentioned village revitalization strategies, with various online platforms and networks. For example, Taobao as one of the major platforms of e-commerce has made great effort in enabling entrepreneurship in villages in China in collaboration with local government, without which the rapid expansion of 'Taobao villages' wouldn't be possible; in the case of agro-tourism, the business is highly dependent on tourists finding the place on internet, therefore internet-based marketing platforms and mobile APPs are essential facilitating the local community in managing the businesses; as for the clustering of creative class, the fiber optic communication systems and 4G mobile network in village areas provided preconditions for people to work in remote areas, while the contact between villagers and urban creatives is also facilitated by mobile messaging APPs like WeChat.

Although much has been said about how digitalization supported these emerging village revitalization approaches in economic terms, it also leads to spontaneous spatial expansions. One example is that digitalization and the use of mobile internet platforms open up opportunities for places that lie far beyond the fringes of big cities. Although the proximity to big cities remains an important factor for tourists, artists, and economic activities in general, the local resources of some remote areas (history, culture, environment, etc.) tend to attract certain development. Such initiatives of development driven by economic forces would have spatial and environmental impacts on local as well as regional scales. Within this context, it is necessary to have proactive and integrated spatial development strategies that can accommodate village revitalization and economic shifts in such a way that economic prosperity can be aligned with social sustainability, and environmental quality in the processes of local and regional spatial development.

With this purpose, the paper examined three scenarios of spatial development, which can accommodate the emerging village revitalization approaches, using the study case of North Langfang and multiple indicators for measurement. The results show that the corridor scenario, an unconventional development strategy, has the best performance for ecosystem services. However, this does not mean that the other two more 'conventional' scenarios (network and territory) are not relevant, considering the importance of planning for uncertainty, especially in times of crisis. Of course, other scenarios than the three showed here might also happen and lead to better performances. The intention of the paper is not to complete the list of possibilities, but to provide a methodology of research by design: 1) to visualize the spatial implications of different development models, 2) using multiple indicators to analyze the scenarios for a better understanding of their strengths and weaknesses. Here, the comparison on ecosystem services provided an overview of how the different strategies could influence sustainable development in the area.

## 5.2. Conclusion

The main take-away of this paper indicates that, supported by the development of ICT infrastructure, digitalization and the use of mobile internet, the emerging alternative forms of village revitalization (E-commerce, Agro-tourism, and the clustering of creative class) can increase the socio-economic sustainability of villages and give communities a new perspective. However, this kind of development can have negative effects for the environmental sustainability of the region, if no proactive measures are taken to guide the spatial development. Therefore, it is important to plan proactively in order to channel potentials, and find forms of village revitalization that both give villagers new economic opportunities and contribute to a greener megaregion. This calls for spatial planning strategies that can accommodate these local village revitalization approaches in long-term spatial development in the megaregional scale.

The scenarios and their comparison made in this paper showed that different pathways for regional development can have very distinct effects on ecosystem services. Therefore, it is highly relevant to seek development strategies that react to both local trends as well as requirements for improving an area's performance in terms of sustainability. Methodologically speaking, evidence based regional design can be used as a tool for examining the potentials and consequences of spatial development, with scenario building as an example. It can contribute to understanding and coping with complexity and uncertainty associated with regional development, and creating new ways of planning that are more oriented towards enabling and accommodating local initiatives of new economies in the era of digitalization.

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