Spatio-temporal changes and the driving forces of One Village One Product (OVOP) industries in Beijing suburbs

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Abstract. One village one product (OVOP) oriented in Japan is an economic and social sustainability strategy for rural development. The OVOP industries in the areas surrounding a metropolis are susceptible to changes due to the urbanization process. In order to reveal the changing trend of OVOP and its driving forces around metropolitan areas, and promote the OVOP-related decision-making process, we analysed the spatio-temporal changes of OVOP villages in the Beijing suburbs using statistical data for the period of 2007–2017. Mixed methods of literature review, statistical data collection, time series change and policy impact analysis were employed to analyse the spatio-temporal changes of OVOP villages, also the driving forces were screened from the aspects of urban sprawl, industrial policy change and institutional variation, the qualitatively analysed to illustrate their influences on OVOP changes. The results revealed that from 2007 to 2017, OVOP industries in the Beijing suburbs improved agri-product quality to meet the changing urban needs, promoted local labour employment, and improved farmer organization and encouraged rural entrepreneurship, even under a quantitative decrease and spatial shrinkage, which was mainly driven by urban sprawl, afforestation, industrial policy intervention, and the comparatively low benefits of agriculture production. Therefore, more efforts should be directed toward promoting OVOP development in urban contexts, including protecting the spaces for OVOP industry development from urban sprawl and ecological construction, stabilizing favourable institutional arrangements on rural industrial structure, improving the rural community capacity for self-development, and encouraging the flow of more urban resources into the rural OVOP industries.

1. Introduction
One village one product (OVOP), as a rural development strategy, began in 1979 in Japan in the prefecture of Oita. The OVOP movement aims to cultivate competitive and high-value-added products and to produce benefits by connection with the broad market. It has attracted wide international appeal in developing countries [1-2] and has been effectively practiced in Thailand, Laos, Kenya, Nepal, Tanzania, Malawi, Senegal, and other countries and regions. OVOP was proven to be a favorable tool in the fight against poverty and in boosting rural economies through enhancing regional vitality by exploring rural advantages and developing specialized industries.

OVOP was a community-centered and demand-driven economic development approach [3], and emphasis was placed on three basic principles: local yet global, self-reliance and creativity, and human resource development [4]. Thus, sustainable community actions, including human resource management,
public participation, and marketing strategies [5], were key forces in OVOP development [6]. Lack of political commitment, leadership, and mutual cooperation among different actors seem to cause major hindrances at the community level for OVOP programs [7]. However, at the individual level, the participants, income level, member’s age, capital ownership, and social network influence the household decision-making process related to the OVOP program [8].

Two different methods to promote OVOP included the top-down approach and bottom-top approach [9], with Japan and Thailand as examples, respectively. With both methods, OVOP policies exerted important impacts. Documented research has showed the policies needed in OVOP movements, including investigating and identifying products with a high-value-added potential, establishing linkage between villages and markets, diversifying markets and transactions, developing human resources, empowering local culture and communities [10], developing the OVOP-based small- and medium-sized enterprises (SMEs) [11]. The OVOP policy arrangements could affect the OVOP outcomes at the household, community, or regional levels.

The outcomes of OVOP movement have varied according to regional differentiations. The villages near large cities have more access to financial or technological resources and markets than those in deep rural areas [8], more programs were distributed in the areas near large cities [12], and more successful OVOP villages emerge around highly developed urban areas [13]. Thus, the outcome of OVOP under different contexts must be evaluated. Diversified approaches and indicators have been employed to evaluate the OVOP outcomes, from the aspects of organization construction, the promotion cycle, the socio-economic achievements [14], or the dynamic changes of OVOP quantity, spatial distribution and industry type, etc [13, 15].

Many studies investigated how to fabricate favorable institutional environments to promote the OVOP movement [16], however, less attention has been paid to the effect of institutional changes, which could produce more uncertainty in OVOP development. Institutional variation includes changes in land use, rural development, and economic incentive policies, etc., also impact OVOP implementation and farmers’ engagement, providing the major forces of OVOP change. However, the effects of institutional change on OVOP remain unclear. The limited research has only considered the spatial and quantity analysis of OVOP over a long period of policy changes.

The OVOP movement was introduced in China in 1983, and firstly adopted by regional governments to produce goods and services that conformed to the local characteristics [16]. The practice and experience attracted the attention of high-level governments. Since the 1990s, OVOP has been promoted at the national level in China. In 2007, the Ministry of Agriculture (MOA) launched a monitoring plan for OVOP and formulated an indicator system for OVOP village identification. Since 2011, the villages that meet the standards set by MOA have been awarded National Demonstrative OVOP Villages, which will help these villages to employ new technologies, attract investments, and gain access to market opportunities, followed by increasing the agricultural efficiency [17, 18]. In China, OVOP has achieved rapid growth, considerably improved the rural livelihood in a span of 20 to 30 years.

To fill the gap on the effects of institutional change on OVOP in the literature, we drew upon the experiences of Beijing, the capital and one of the most developed international mega-cities in China, to study the long-term series OVOP change during rapid urbanization and large-scale afforestation process in recent decades. We chose the following questions: How did OVOP change the suburbs of a megacity? What were the major forces driving these changes, and how did they work? Lastly, what kind of policies should be adopted to help with OVOP development in the future in the urban agriculture context? We analyzed the changes from the aspects of quantity, geographical distribution, industry type, employment, industrialization, products, and brand effect, and the driving forces of urban expansion, afforestation, the competitiveness of the rural industry, and institutional changes of rural industry.

The remainder of this paper was structured as follows. In Section 2, we illustrated the geographical characteristics of Beijing and the OVOP development in the suburbs. Next, the OVOP indicators and driving forces were identified and elucidated under the urban agriculture context. Then, the changes in OVOP from 2007 to 2017 and its driving forces were presented and analyzed in Section 4. The OVOP
changes and policy implications are discussed in Section 5, and Section 6 provides our conclusion and outlines the possible avenues for future research.

2. Study area
Beijing is located in the Northwest of the North China Plain, with an area of 16,411 km². Beijing is of higher altitude in the northwest and lower in the southeast, the elevation ranges from 6 to 2294 m (Figure 1). Mountainous areas above 100 m account for 62% of the total area, while the remainder belongs to the plains and low mountainous areas. Beijing has a monsoon-influenced humid continental climate, with annual temperatures of about 11–13 °C and annual precipitation of 528 mm [19]. The favorable climate and various landforms, diversified vegetation, and soil types provide suitable environmental conditions for agricultural development.

Beijing has a long history of agricultural cultivation and a variety of local agri-products and handicrafts in the suburbs, which set the basis for OVOP development. As suburban villages have easier access to urban markets, investment capital, transportation networks, technological transferring, and other infrastructure [20], they have become early application sites of the OVOP movement [17]. More recently, with the emphasis on urban agriculture [21, 22], OVOP was integrated into the Beijing agricultural system as a village-level entry point for rural development. A number of OVOP villages emerged in the suburbs and have continued to develop and expand since the mid-1990s. The 2010s witnessed an accelerating increase in OVOP villages. With the deepening of our understanding of urban agriculture multifunctionality [23] and agritourism, other types of industries have been incorporated into the OVOP system. By 2017, the quantity of OVOP villages rose to 108, 60 of which were awarded as National OVOP Demonstrative Villages. All these villages attract more support from governments and
other organizations [24]. They have played an exemplary role in promoting specialized industry development, and laid a good foundation for Beijing’s urban agriculture development.

3. Materials and methods

3.1. Methodology
This research employed a mixed method of literature review, secondary data collection, time series analysis and policy impact analysis. First of all, we searched the relevant literature, including research papers, books and reports on the OVOP change and the institutional arrangement to understand the main forces affecting the change of OVOP and its mechanisms. Furthermore, the secondary data on Beijing OVOP villages were collected from administrative bureaus of agriculture. Time series analysis was mainly used to study the trend of long-term changes in the number, industry type, labor force employment and agricultural product quality of an OVOP village. Then, the policy impact analysis was mainly used to track the relevant policies affecting the OVOP development in Beijing suburbs between 2007 and 2017, in particular the changes in institutional arrangements such as adjustment of urban function, afforestation and rural industrial development. Combined with the obtained relevant reports issued by the government, the impact of the implementation of these policies on OVOP is qualitatively analyzed.

3.2. Data source
The research data were derived from the OVOP Statistical System, which was run by the Ministry of Agriculture (MOA), established in 2007 and annually updated since then to include all eligible villages across the country. According to the criteria, OVOP villages must have a specialized industry that is rooted in the local resources, covers more than 50% of the households, contributes over 30% of the village total revenue, and the villager’s per capita income must be 10% more than that of their towns.

The villages that meet the standards report their information, including the village geographic location, demographics, employment, type and volume of the specialized industry, branding, certification, and sales of the product. The attribute information of each village was input by village coders according to the statistical data and screened by high-level administrations before being submitted to the MOA system. The data were audited several times for credibility for decision making.

In addition, Google Earth's image data of a case study village were used to reflect the land use and cover change before and after an afforestation project, reflecting the space shrinkage of the OVOP industry caused by ecological engineering.

3.3. Indicators calibration
There were 41 indicators in the OVOP Statistical System from the aspects of village information, villager’s income and sources, industry features, product, brand, and sales channels. The OVOP villages’ information of Beijing suburbs from 2007 to 2017 was extracted from the system. Several indicators were chosen for the OVOP change analysis, including the village quantity, distribution (administrative regions or geographic zones), industry types, employment, organization and entrepreneurship, branding effect, and certification of the product. The data were screened using several procedures, including self-check by the village and re-checking by county-level bureaus. For on-site verification 10%–20% of the villages were annually sampled, and all the data were proved to be true and valid. The validity and rationality of the data were further checked by comparison with the interannual changes.

3.4. Driving forces identification
The development of OVOP was impacted by a large number of forces, including endogenous forces and exogenous forces. The relationship between OVOP changes and its driving forces was complicated as the interaction and mechanisms are quite uncertain, and random forces play important roles in determining village development [25]. Thus, accurately assessing the extent of the influence of these forces on village development was difficult, as the numerous forces were playing some extent,
interchangeably. Thus, quantitative driving forces were not analyzed in the research. However, several forces were chosen to help identify the main cause of urban agricultural OVOP changes in Beijing suburbs.

Beijing OVOP villages are mainly engaged in agriculture productive industries; crop, vegetable, and fruit planting occupy a large proportion of agriculture. However, the expansion of urban construction areas and ecological construction areas decreased the OVOP spaces to increase economic and ecological benefits. The relatively low revenue of OVOP exiled the engaged farmers to non-farm businesses for higher-paid employment. The changes in industry policies related to the Beijing rural areas in recent years produced changes in the industry types in OVOP villages, leading to a change in the number of OVOP villages. Therefore, urbanization, afforestation, farmers leaving for higher-paid non-farm businesses, and the industry policies were screened as the major forces influencing OVOP change of Beijing suburbs, and these were qualitatively analyzed in this study.

4. Results and analysis

4.1. Spatial-temporal changes in OVOP

4.1.1. Quantity change. The quantity of OVOP villages in the Beijing suburbs fluctuated from 2007 to 2017; the peak value of 174 villages occurred in 2014 and the lowest value of 88 occurred in 2016. Then, the quantity increased to 108 in 2017, covering 2.76% of all rural villages of Beijing suburbs (3940). In general, the quantitative change decreased from 2009 to 2017 (Figure 2). However, in 2012, the Beijing Municipal Government started up the Plain Afforestation Project, which was followed by a new policy aimed at cropping structure adjustments and water-saving agriculture developments in 2014; from 2012 onwards, the OVOP quantity decreased and essentially remained stable, fluctuating around 100 villages.

![Figure 2. Quantity change of one village one product (OVOP) villages in the Beijing suburbs.](image)

4.1.2. Spatial distribution of OVOP villages. The OVOP villages were mainly distributed in the rural areas of the Beijing suburbs. The quantity was generally stable after 2012; however, the subregions of the Beijing suburbs experienced different changes. In 2017, MY and FS had 18 OVOP villages each, whereas DX and MTG had 12 OVOP villages each, followed by YQ (11), SY (9), and PG (9), with smaller numbers in other districts. During 2007–2017, the number of OVOP villages in each district fluctuated widely (Figure 3). In the inner part of the peri-urban districts, the number of OVOP villages was relatively low and were gradually disappearing, such as the FT district (one village in 2009, which
disappeared), the CY district (one village in 2007 and 2008, then it disappeared), the HD district (one village in 2007, 2008, and 2017). In other districts, the number varied considerably. The TZ district, for example, increased from 14 in 2007 to 38 in 2010, then decreased to less than 10, and stabilized at a relatively low level (four in 2017). There was a sharp increase of PG in 2013, the reason behind this was an outbreak of vegetables and fruit villages after a long period of cultivation, which was followed by fast decreased in the following years because of agricultural structure adjustment for water saving and environment improvement purpose.

Figure 3. The change in the number of OVOP villages in different districts in Beijing.

Thereafter, from the perspective of large terrain zones, the spatial variation was clear. From 2007 to 2017, the OVOP quantity in mountainous areas was relatively stable, while the plain areas showed a decreasing trend (Figure 4). The number of OVOP villages in the plain area increased from 37 to 115, while the number in the mountainous area increased from 27 to 78. Before 2010, more OVOP villages were located in plain areas than in the mountainous area, which reversed after 2012, as the plain area is adjacent to the city area and susceptible to decreases by urban expansion and ecological construction.

Figure 4. The change in the number of OVOP villages in different terrain zones.
4.1.3. Changes in industry types. The industrial types of OVOP villages in the Beijing suburbs were relatively concentrated. In 2017, 96.3% of villages were engaged in agricultural productive industries, only four villages were engaged in agritourism as a mainstay of the rural economy.

The types of OVOP industry can be divided into seven groups according to the products. The share variations of each group from 2007 to 2017 are shown in Figure 5. The group of vegetables, melons, and edible fungi, and the group of fruits were the two most important industrial groups, which covered a relative stable share of 60%–70% of Beijing OVOP villages as of 2008. The group share of livestock and aquatic products gradually decreased, while that of forestry products slightly increased and agritourism remained basically stable. Shares of other crops, including traditional herbs, flowers, and seedlings, slowly increased based on the cropping adjustment for multifunctional purposes. However, non-farm industry OVOP villages have not been included in the statistics since 2011.

![Figure 5. Composition of OVOP villages by product.](image)

4.1.4. OVOP village employment. OVOP industries were important for local labour force employment. From 2007 to 2017, the average number of people employed through the mainstay industry in a village was approximately 300–500, with an average of 398, annually (Figure 6). Most of them were farmers who lacked the skills and capacities for urban employment, particularly for the mid–high-aged population over 50 years old and women needing more time to care for their families. The development of OVOP industry increased villagers’ incomes as a stable income source. With the recognition of agricultural multifunctionality, OVOP-related agricultural product processing, rural tourism, online
commerce, and the logistics of agricultural products increased the job opportunities and provided benefits to the local villagers.

![Figure 6. The labour force quantity of the mainstay industry per OVOP village.](image)

4.1.5. **OVOP entrepreneurship.** Taking advantage of proximity to the city, a large number of innovative resources were provided to the countryside and stimulated the entrepreneurial activities around the OVOP mainstay industries. Large agri-enterprises (also called “dragon head enterprises” in China), importation or local enterprises, and breeding and cooperative establishments were the main measures used to promote entrepreneurship and foster the connection between the local industry and broader markets. Until 2017, after a stable increase, more than 90% (Figure 7) of the OVOP villages had established cooperatives, which had advanced their production and marketing; 35% of OVOP villages had ushered in and tightly connected with large agri-enterprises to promote mainstay industry development; and 25% of the OVOP villages established agricultural enterprises to promote standardized production, agricultural services, and product sales. The increasing OVOP entrepreneurship brought in advanced management methods, social capital, and talent resources to the countryside, and furthered OVOP industry development.
Figure 7. The shares of villages with different entrepreneur methods.

4.1.6. **OVOP product certification.** The quality and safety level of OVOP products has continuously improved. Three kinds of certifications were encouraged in Beijing suburbs: the certification of pollution-free agricultural products for entry-level safety quality, the certification of green foods, and the certification of organic products for higher-level product quality. Figure 8 depicts the proportion changes of villages holding certifications. The share of OVOP villages holding certifications reached 71.3% (pollution-free food certification), 23.1% (green food certification), and 28.7% (organic product certification) in 2017 from 41.9%, 7.8%, and 10.9%, respectively, in 2007, which means a substantial increase in the quality and revenue of OVOP agricultural products.

Figure 8. The variation in certification of OVOP villages.
4.1.7. **OVOP branding effect.** Branding construction and expansion were used to encourage OVOP success by improving the market performance of agricultural products. OVOP villages were encouraged to apply for trademarks as the first step into markets. The geographical identification could facilitate the formation of a unique product identity in the market; higher performance products could be awarded the honour of being a celebrated brand. The share of OVOP villages with trademarks increased to 78.7% in 2017, and nearly 20% of villages had been approved for geographical indicator products, while 43.5% of the villages were awarded with being a celebrated brand at the municipal or higher level in 2017 (Figure 9), which showed an expanding brand effect. Compared with the baseline, the OVOP branding effect improved in the 10-year period with the increases in urban demands, which greatly benefitted industry development.

![Branding effect on OVOP improvement.](image)

**Figure 9.** Branding effect on OVOP improvement.

4.2. **Driving force analysis**

4.2.1. **Urban expansion.** In recent years, urban expansion has applied considerable pressure on the use of agricultural land use, overtaking a large amount of high-quality farmland in China. From 2005 to 2020, the constructed area expanded at a mean rate of 20.32 km²/year in Beijing [26]. Due to the government’s increasing emphasis on farmland protection and land use control, the trend slowed down in more recent years.

The vast area between the 5th ring road and the 6th ring road of Beijing was the main plain area for agricultural production, also was the frontier for urban expansion (Figure 10A). The OVOP villages in the region decreased from 17 in 2007 to 2 in 2016, and increased to 3 in 2017 (Figure 10B).
4.2.2. Afforestation project. To fight against the increasingly severe smog and other environmental problems, the Beijing municipal government initialized the Plain Afforestation Project to construct 700 km² of trees in the plains area surrounding the city to promote urban air purification and soil protection from 2012 to 2015 [27], which resulted in a large amount of farmland being replaced by forest land. This project was extended until 2017, adding 80 km² of afforestation area [28]. The proportion of farmland reduced from 25.58% to 17.79%, while forest land increased from 23.46% to 33.47% [19]. This large-scale afforestation occupied the space used for OVOP industries, resulting in the disappearance or decline of the original OVOP industries. Over time, new forest-related OVOP industries formed. The nature of the employment of the OVOP industry also changed [29]. In 2018, another afforestation program was initiated to further increase the forest coverage from 2018 to 2022 [30], which will further shrink the development space available for OVOP industries.

We selected Mahezhuang, an OVOP village in the Tongzhou (TZ) District, as an example. Since 2009, 172/245 households with 57.3 ha farmland were related to vegetable production, which contributed 69.3% of the village’s total income. Since 2014, the village has been affected by plain afforestation, and a total of 45.6 ha farmland was converted to forestland for greening and recreational purposes (Figure 11).

![Figure 10. OVOP village changes between the 5th and the 6th ring roads of Beijing.](image)

![Figure 11. Land use change for Mahezhuang village from Google Earth (Google LLC) images.](image)
4.2.3. **Human resources loss.** Increasing household income was the main purpose for villagers to choose OVOP production. Villagers’ income was mainly dependent on farm revenue with less wage income and lower diversity compared to urban employment. However, the per capita net income of OVOP farmers was lower than that farmers in Beijing since 2008, and the gap continuously expanded until 2017 (Figure 12). The low comparative profit of agriculture production lowered farmers’ willingness to maintain OVOP production. Many villagers, especially the youth and the middle-aged, entrusted the OVOP business to corporations, cooperatives, or other villagers, or even left it idle and ran non-agricultural employment to obtain a more competitive income. Most of them resorted to urban employment from OVOP businesses due to higher income opportunities. The loss of human resources, particularly the skilled OVOP farmers, resulted in the decline of productive efficiency and investment capacity. It was difficult for the left-behind elderly people to use new technologies to maintain and expand their production, which easily led to the degradation of the OVOP industry.

![Figure 12. The farmers’ income gap between OVOP villages and that of Beijing.](image)

4.2.4. **Shifts in regional and industrial policies.** The formulation and implementation of policies had different effects on the development of one village and one product, which could be drivers of or barriers to its future development [31]. Regional or industrial development policies could influence industrial distribution and its developing volume from different aspects. In September 2014, the Beijing municipal government implemented a new policy to encourage cropping structure adjustments and water-saving agriculture; thereafter, the grain area decreased from 1173 to 733 km$^2$. Some of the high water-consuming crops, wheat for example, were sharply reduced and replaced with new varieties of water-saving and drought-resistant crops, such as corn, millet, or other crops. Agricultural product processing was discouraged for water consumption purposes, which hindered the OVOP industry chain extension and value adding process.

Into protect the ecological environment, Beijing designated 5202 km$^2$ of non-livestock breeding areas in 2016, and 379 farms were shut down until 2017 [32]. Thereafter, the related OVOP villages in these areas had to change their mainstay industry to comply with the new industry policies. Stimulating policies were also implemented to foster OVOP development, a half million RMB award was offered to the village achieving National Demonstrative OVOP Village status, and 1–2 million RMB were offered per village to promote OVOP industry development, particularly improving the infrastructure and public services, human resources training, information and communication, branding, and online
marketing. The Beijing OVOP industry is crucial to the rural economy and farmers’ livelihoods. Therefore, policy makers needed to make careful OVOP-related decisions, and the OVOP villages had to manage their self-resilience and adaptive capacity to policy change.

5. Discussion

Over 10 years of practical implementation in the Beijing suburbs, the OVOP movement witnessed dramatic changes, not only in the quantity and distribution of villages, but also in the institutional background of the movement.

The quantity and quality of OVOP goods was important for OVOP development [33], especially in the early stage, where quantity was valued over quality [11]. Dynamically analysing OVOP villages was helpful for understanding the developing OVOP trends. However, the quantitative change should not be simply treated as the increase or decrease in OVOP villages. The reasons for OVOP quantitative changes could be analyzed from three aspects considering the comparison between the village performance and the criteria for OVOP. Firstly, the fluctuation in mainstay industry production caused by specific events, climates, or price fluctuations could make the productive indicators meet or fail the OVOP criteria, including or excluding the village of the OVOP system, respectively, causing annual quantity changes. Secondly, the fast urbanization or ecological construction changed the OVOP space, resulting in weak or disappearing mainstay village industries. These villages were removed from the OVOP system, leading to the OVOP quantity decrease. Thirdly, some villages actively or passively adjusted their mainstay industry. The old industries disappeared, while alternative industries were still being cultivating and not yet meeting the OVOP criteria, which caused a decline in the number of OVOP villages.

Table 1 shows the OVOP changes of the Changping District (CP), where grey pixels indicate that the OVOP industry was under cultivation (below criteria), green pixels indicate OVOP recognition (above criteria), blue pixels indicate OVOP fluctuation (below criteria), and orange pixels indicate OVOP weakness or disappearance or alternative industry formation (below criteria). With regard to the concrete reasons for change, further detailed analyses are still needed in future research.

The OVOP movement was influenced by various forces and policies, which played a critical role not only in the cultivation of OVOP villages [34, 35] but also in OVOP changes. Formulating better environments to promote the OVOP, enhancing the spatial connectivity to participate in the regional or global value chain, encouraging the coordination between external and internal stakeholders or social capacity improvements should be emphasized [36], and the fluctuations resulting from policy changes. A stable policy climate could promote the development of OVOP industries [16]; however, the policy change could reverse the trend of developing OVOP villages, especially for the villages located on the urban fringe, which are susceptible to change due to the urbanization process and ecological construction. However, certain rural industries, especially for products involving handicrafts with geographical or cultural specialty, should also be well protected, and space reservations should be guaranteed for further development.

In urban agricultural contexts like Beijing, regional disparities between the urban and rural areas were common for urban areas with high paying and attractive jobs and more financial resources [37], which would encourage the flow of human resources from neighboring rural areas into urban areas. The flow human resources should be compensated for by directing the urban resources into the rural areas, including corporations, social capital, and urban talents related to agriculture, which deserve more consideration from policymakers.

In the Beijing case, entrepreneurship was improved by introducing urban food corporations and establishing local agricultural enterprises that involved a larger number of small stakeholders, which is similar to the practice in Indonesia [38]. However, more efforts are required to improve the atmosphere of entrepreneurship; in particular, more innovation resources should be introduced and more entrepreneurship should be encouraged. Rural OVOP entrepreneurship should include more than only the productive industries for the multifunctional agriculture that has been commonly recognized and accepted in peri-urban areas [39]. Thus, more attention should be paid to the multifunctional use of local
resources, OVOP-related agritourism, e-commerce, and value-added product processing, and creative product manufacturing should be further encouraged.

Table 1. The OVOP change of the Changping (CP) District, Beijing.

| Village Name | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|--------------|------|------|------|------|------|------|------|------|------|------|------|
| Shiziying    |      |      |      |      |      |      |      |      |      |      |      |
| Nanzhuangying|      |      |      |      |      |      |      |      |      |      |      |
| Zhenshun     |      |      |      |      |      |      |      |      |      |      |      |
| Huyangtudian |      |      |      |      |      |      |      |      |      |      |      |
| Mapaoquan    |      |      |      |      |      |      |      |      |      |      |      |
| Qijianfang   |      |      |      |      |      |      |      |      |      |      |      |
| Wangzhuang   |      |      |      |      |      |      |      |      |      |      |      |
| Xinglongkou  |      |      |      |      |      |      |      |      |      |      |      |
| Sanhezhuang  |      |      |      |      |      |      |      |      |      |      |      |
| Yingfang     |      |      |      |      |      |      |      |      |      |      |      |
| Songlanbao   |      |      |      |      |      |      |      |      |      |      |      |
| Guozhuang    |      |      |      |      |      |      |      |      |      |      |      |
| Huangquansi  |      |      |      |      |      |      |      |      |      |      |      |
| Kangling     |      |      |      |      |      |      |      |      |      |      |      |
| Changling    |      |      |      |      |      |      |      |      |      |      |      |
| Suanzaoling  |      |      |      |      |      |      |      |      |      |      |      |
| Dongying     |      |      |      |      |      |      |      |      |      |      |      |
| Maizhuang    |      |      |      |      |      |      |      |      |      |      |      |
| Xiangtun     |      |      |      |      |      |      |      |      |      |      |      |
| Xinzhuang    |      |      |      |      |      |      |      |      |      |      |      |
| Houbaihuajian|      |      |      |      |      |      |      |      |      |      |      |
| Mayufang     |      |      |      |      |      |      |      |      |      |      |      |

Notes: Grey pixels indicate that the OVOP industry was under cultivation (below criteria), green pixels indicate OVOP recognition (above criteria), blue pixels indicate OVOP fluctuation (below criteria), and orange pixels indicate OVOP weakness or disappearance or alternative industry formation (below criteria).

Regarding on the complexity of the peri-urban agriculture of Beijing, the management of local administrations bottlenecked OVOP multifunctional development [40], especially the capability of village cadres and cooperative leaders, whom were crucial actors in successful OVOP development [24]. The village cadres functioned well at the start-up stage of OVOP industries; however, most of them tended to choose the easy-to-implement farming industry, which remained at relatively low levels due to a lack of management skills. The development of cooperative organizations helps the villagers organize to promote standardized production and high-tech transfer, and enabled jointly obtaining social capital and support from governments and to negotiate with other marketing subjects. The case of Beijing proves the importance of rural organizations for extending the industrial chain, enhancing product branding and marketing, and improving OVOP entrepreneurship. Thus, the capacity of local administrations and the abilities of leadership and organization should be further developed.

Finally, besides the anthropogenic forces, natural forces affected the OVOP development from different aspects, e.g., extreme weather events pose risks to crop or fruit growth and change the annual performance of the OVOP industry. Natural forces mainly lead to temporary impacts on the OVOP production, which, in turn, result in quantitative fluctuations without causing a continuous decline in the quantity. However, the negative effects of natural forces should not be ignored and the administrative
bureaus should extend agriculture insurance coverage to support OVOP farmers’ livelihoods and maintain the stability of the OVOP industry.

6. Conclusions
In this study, we examined the spatial and temporal changes of OVOP villages in Beijing suburb areas in the context of urban agriculture. The long-term changes showed the important role of OVOP in cultivating industries, promoting employment and rural economic development. The OVOP strategy deserves attention as a sustainable socio-economic development strategy for future rural development.

The OVOP movement in Beijing suburbs still experienced changes that require further consideration. The number of OVOP villages declined and their distribution changed markedly, accompanied by the increase in employment capacity, the improvement of agricultural product quality, and the growth of agricultural organizations. The spatial-temporal changes in OVOP were, to a large extent, a shock to the rural industry and livelihood in suburban areas. The space reduction caused by urbanization and afforestation decreased the potential area for OVOP development and the unfavorable institutional arrangement for certain industries (livestock breeding, etc.) accelerated their withdrawal, while substitute industries required a long period to cultivate. The policy climate should be further stabilized to optimize top-down administrative management, which could improve the development of OVOP industries with the enhancement of local community capacity and leadership.

Management should be improved to promote Beijing OVOP development. Firstly, the space for OVOP industry development should be protected from unreasonable land acquisitions. Urban planning should be strictly implemented to restrict urban sprawl and conserve the OVOP spaces from future loss to compose diversified urban-rural landscape. Secondly, the OVOP management should be enhanced by improving governmental support, community capability, and leadership of OVOP villages. Thirdly, attention should be paid to optimizing the OVOP evaluation system, which should be more comprehensive and include more value-adding industries, including handicraft and agritourism industry.

Lastly, communication between urban and rural areas should be furtherly encouraged. The introduction of urban capital, academic institutions, and corporations will help to form an integrative OVOP stakeholder system, improving the environment for innovation and entrepreneurship. Future research is needed to focus on how to maintain OVOP stability in the process of urbanization in the surrounding areas of large cities and to continuously enhance the community capabilities to make better use of the location advantages and move toward a broader market.

The main weakness in this study is the lack of quantitative research on the relationship between OVOP change and the influencing forces, which was mainly restricted by anthropogenic forces, which is difficult to quantitatively evaluate simultaneously with other natural forces. However, the analysis of influencing forces is extremely important for understanding the OVOP development mechanisms and for rational institutional intervention. It is necessary and urgent to carry out quantitative analysis on OVOP changes and specific driving forces in future research.

Nevertheless, this study is still of great reference value to other countries and regions, particularly metropolitan areas, regarding implementation of rural sustainability development strategies. The challenges faced by Beijing's suburban agriculture with regard to rural industrial development are also common to many other large cities, particularly those in developing countries and regions. Further studies should emphasize on optimizing the institutional environment, improving the management of industrial development, and promoting the interaction between urban and rural forces to facilitate the development of rural OVOP industry.

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