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Scale farming operations in China

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REVIEW ARTICLE

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Abstract

Agriculture in China is often characterized as small-scale farming because of the limited farm sizes. However, in recent years the country has witnessed widespread increased-scale farming operations. In this paper, we aim to systematically illustrate the recent scale development of farming operations in China based on cases taken from Zhejiang province. Two main types of the scale farming operations in China are identified. These are based on: (1) concentrated farmland and (2) agricultural services. Finally, the trends of scale farming operations in China are discussed.

Keywords: China, scale farming operation, farmland transfer, agricultural service
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1. Introduction

Agriculture in China is often characterized as small-scale farming because of the country's limited farm sizes. In 2012, the average area of cultivated farmland in Chinese rural households was 0.47 hectares (China Statistics Yearbook, 2013). This is in sharp contrast with other countries, such as Japan, for example, where the average was 1.4 hectares, South Korea (1.2 hectares), the US (195.2 hectares), and in Western European countries (18 to 69 hectares) (Mei, 2002). There are also significant differences among the 31 Chinese provinces in terms of average area of cultivated farmland in Chinese rural households (Figure 1); for example, in 2012 this equated to 2.50 hectares in Heilongjiang province (northeast region), and only 0.04 hectares in Shanghai municipality (east region). Generally, the average household farmland size in the northwest and northeast regions is larger than in other regions, and is smaller in coastal areas[1].

In recent years, however, there has been a widespread increase in the scale of farming operations. With the continual development of the Chinese economy, rural labor has been absorbed by non-agricultural sectors, which are mainly located in the coastal provinces (Yang *et al.,* 2013). The agricultural workforce dropped dramatically from about 95% of the entire Chinese workforce in 1978 to about 70% in 1995; since 1995, it dropped more gradually, to about 65% in 2010[2] (Xie and Jiang, 2016; Yang *et al.,* 2013). The impact of the labor outflow from the agricultural sector in China is twofold. First, food security has been threatened.[3] Small rural households have tended to adjust from farming grain to non-grain products that are less labor intensive. Furthermore, some small rural households have even abandoned farming, leaving their farmland idle (Xie and Jiang, 2016). Second, the labor outflow has led to a decline in food safety. In the face of labor constraints (Cai and Wang, 2008; Zhang *et al.,* 2011), small rural households have become more likely to increase their use of chemical products (Lambert, 1990; Wen, 2010), such as chemical fertilizers instead of manure (Hu and Yang, 2015), or herbicides instead of manual weeding. This issue has been highlighted by several authors (e.g. Zhou and, Jin 2009),[4] and is one of the central causes of food safety problems in

[1] The geographic disparities are mainly due to two reasons. The first is the endowment difference. Northwest and northeast regions are less populated but with more abundant cultivated farmland; while the average household farmland in coastal regions is smaller because of a larger population but with limited amount of farmland. The second reason is the economic factors. Since the reform and opening up, the faster pace of economic development in coastal regions is followed by rapid urbanization, which resulted in the loss of vast areas of cultivated farmland to construction.
[2] According to Yang *et al.* (2013), the sharp drop of the rural agricultural workforce over the past three decades is mainly due to two reasons: (1) the rapid increase in rural nonfarm employment, and (2) the massive rural-to-urban migration that occurred during the past two decades.
[3] Because China has the largest population in the world, food security has long been one of the primary concerns of the Chinese government, particularly since Brown (1994) raised the question of who is able to feed China.
[4] Zhou and Jin (2009) indicated that unspecialized (small-scale) farmers lack basic knowledge of pesticides, and are more likely than specialized (large-scale) farmers to spray highly toxic pesticides on fresh produce.

Figure 1. Average area of cultivated farmland of Chinese rural households in 2012 (adapted from China Statistics Yearbook, 2013).

China. In addition, the overuse or abuse of chemical products degrades farmland and the agro-environment.[5] From the end of the 1980s, the Chinese government began to encourage moderate scale farming operations. Different types of scale farming entities, including specialized large-scale farmers, family farmers, specialized cooperatives, agricultural enterprises, and so on have been fostered, such that scale farming operations have developed rapidly in recent years. As depicted in Figure 2, the ratio of transferred contract farmland to total increased sharply from 2005 to 2013, from 5 to 30.36%, that is, over six times in eight years.

This paper aims to systematically discuss the rapid development of scale farming operations in China based on case studies. The cases considered in this paper will mainly be taken from Zhejiang province, which is one of the most developed provinces of coastal China. Zhejiang province is made up of 11 cities: Hangzhou, Ningbo, Wenzhou, Jiaxing, Huzhou, Shaoxing, Jinhua, Quzhou, Taizhou, Lishui, and Zhoushan. With the rapid development of rural industries, a large amount of the agricultural labor force in Zhejiang province has transferred to non-agricultural sectors. Although the average cultivated land area in Zhejiang province is only 0.10 hectares, its farmland transfer rate is among the highest in China (Figure 3). According to the Zhejiang Provincial Department of Agriculture, an average of 48% of rural household farmland was transferred at the end of 2013; this is about 30% higher than the national level.[6] As a result, Zhejiang province can be seen as a pioneer of scale farming operations in China.

The remainder of this paper is organized into four sections. Following this introduction is a background analysis of scale farming operations in China. Multiple types of scale farming operations are then systematically illustrated, followed by a conclusion.

[5] Although the agricultural economy in China has grown markedly since the reform and opening up, this growth has come at the expense of the environment. For example, the agriculture sector produced a large amount of agricultural non-point source pollution (Chen, 2002). According to the 2014 China Environmental State Bulletin published by the Ministry of Environmental Protection, agricultural chemical oxygen demand emissions totaled 11,024,000 tons in 2013, which accounted for 48.0% of the national total discharge of waste water. Furthermore, agricultural ammonia and nitrogen emissions equated to 755,000 tons, which accounted for 31.7% of total emissions in 2013.

[6] According to the China Agricultural Statistical Material (2014), the rural household farmland transfer rate was 18.36% at the end of 2013.

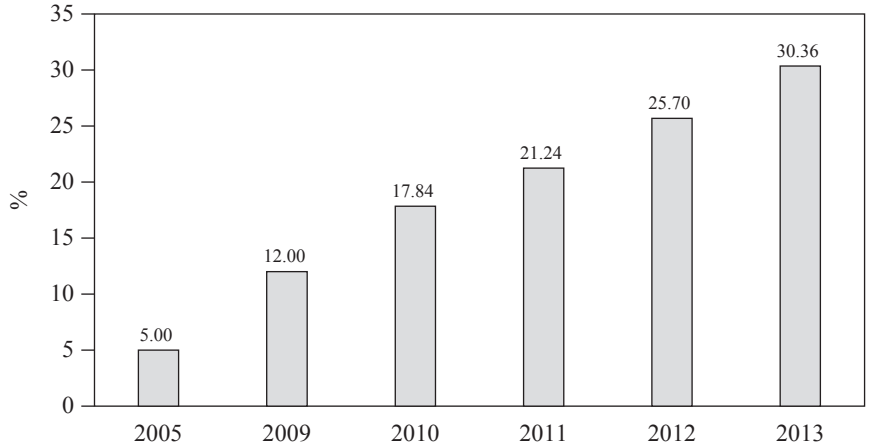

Figure 2. Ratio of transferred contract farmland (Adapted from China Agricultural Development Report, 2010, 2006; Ministry of Agriculture of China, 2011, 2012, 2013, 2014).

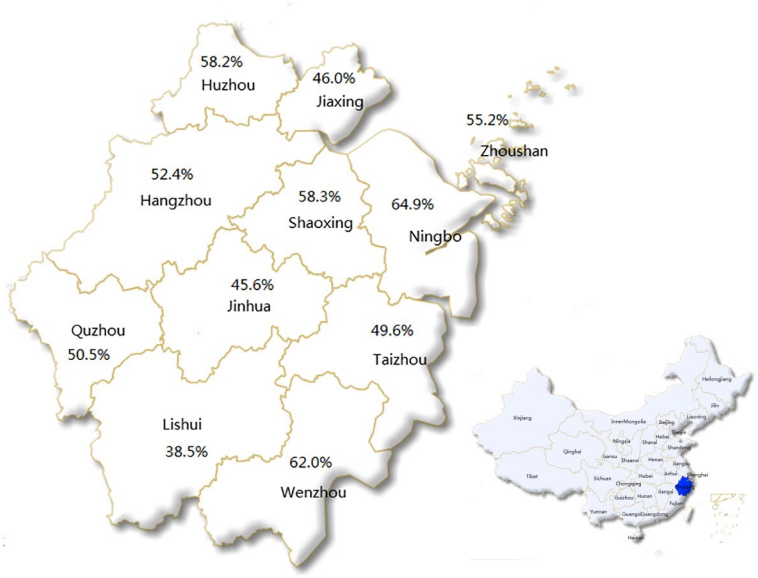

Figure 3. Farmland transfer rate in Zhejiang province in 2013 (adapted from Zhejiang Provincial Department of Agriculture, 2014).

2. Background of scale farming operations in China

In general, the development process of China's scale farming operations can be divided into three stages.

■ *Stage 1, 1978-1987*

Based on the establishment of the household responsibility system,[7] large-scale agricultural operations began. The Third Plenary Session of the 11th Central Committee of the Communist Party of China (CPC) in 1978 initiated reform and opening up in China, and the household responsibility system was initiated and implemented. Although the household responsibility system resulted in a remarkable rise in agricultural productivity (Lin, 1992), farmland was segmented and assigned to individual rural households according to size.[8] With the economic development brought about by the reform and opening up policy, farmland held by less productive rural households in certain economically developed areas began to be transferred to more capable farmers. In addition, farmland that could not be assigned to rural households in the form of contracting was concentrated by the village for scale farming operations, and thus formed a prototype for this type of farming. For example, in Zhejiang province, by the end of 1983, more than 97% of villages in the province had implemented the household responsibility system, and 3% of the farmland that could not be assigned to rural households in the form of contracting, or that had been left unattended by rural households, was collectively retained and contracted to more capable and willing farmers.

■ *Stage 2, 1988-1997*

Due to the rapid development of the rural economy, and against the background of a need to address food security problems, large-scale farming operations entered into an accelerated stage of development. Following a proposition by the CPC Central Committee in Document No. 5 in 1987 to promote moderate-scale farming

[7] Prior to implementation of the household responsibility system, farmland was owned and managed collectively. It was divided into plots to match the soil type, irrigation, and drainage conditions, and for the convenience of management (Tan *et al.,* 2006). For a brief description of the household responsibility system, see Lin (1992).

[8] The negative impact of the household responsibility system on scale farming in China may not lie simply in the segmentation of farmland on an area basis. Rather, farmland fragmentation, which resulted from the fact that farmland was shared according to soil fertility, may also have been a factor, as rural household farmland was often scattered across a number of plots with different fertility levels (Niroula and Thapa, 2005).

operations in different forms,[9] the transfer of contracted farmland developed rapidly. After Deng Xiaoping's South Inspection Speech in 1992, rural industrialization based on township village-enterprises also saw rapid development. A large amount of rural labor was transferred from rural areas to secondary and tertiary industries, thus enabling the transfer of contracted farmland. Meanwhile, the responsibility system of the provincial governor for grain production[10] was implemented nationally, and the provincial government focused on grain fields and actively promoted farmland transfers. For example, in Zhejiang province, the government promulgated the Decision on the Development of Moderate-Scale Operation of Grain Fields in 1994, which actively supported grain production household with farmland of more than 2 hectares. In addition, the key counties for scale farming operations were increased from 15 to 25. During 1988-1997, the transfer of farmland gradually expanded from southern and eastern Zhejiang to the north of Zhejiang, which had relatively more per-capita farmland compared to south and east. This also triggered subsidized subcontracting in Wenzhou, Taizhou city, and other areas, and the recruitment of nonlocal farmers for rice production in cities such as Ningbo city. Thus, rice production became the main reason for farmland transfers and the development of scale farming operations.

■ *Stage 3, 1998-present*

Based on the increased profits from agriculture due to the recognized economic benefits and policy incentives, scale farming operations entered a stage of steady development. In October 1998, it was proposed in the Third Plenary Session of the 15th Central Committee of the Chinese Communist Party that 'for few places with well conditions, the farmland moderate scale operation in various forms can be developed on the basis of improving agricultural intensification and voluntariness of the rural households.' By the end of 2008, it was proposed in the Third Plenary Session of the 17th Central Committee of the Chinese Communist Party that farmland transfer should be further promoted, and that various types of scale farming operations should be developed. Thereafter, many local governments actively set up farmland transfer service agencies to regulate farmland transfer activities. During this period, the farmland transfer policy became more systematic, and new types of scale farming operations appeared. Due to the increased economic benefits from the agricultural sector, as well as policy incentives, the farmland transfer rate rapidly increased each year. As depicted in Figure 2, the ratio of transferred contract farmland increased from 12.0% in 2009 to 30.6% in 2013. Against the background of the adjusted agricultural structure proposed by the Chinese government, scale farming operations gradually extended from rice production to cash-crop production.

3. Multiple types of scale farming operations in China

Scale farming operations based on concentrated farmland

The scale farming operations based on concentrated farmland is the most important form of scale farming operations in China. This was achieved mainly through the transfer of farmland management rights,[11] or in the form of farmland share-cooperatives. The transfer form and direction are detailed in Table 1. According to Table 1, farmland management rights are mainly transferred through subcontracting[12] or leasing;[13] these activities account for 79.72% of the total farmland transferred. The majority of transferred farmland went to farmers (including specialized large-scale farmers and family farmers), while 31.53% went to cooperatives, and companies. Farmland assigned to the cooperatives increased from 13.40% in 2010 to 21.91% in 2013.

[9] Document No. 5 proposed, for the first time, that in Beijing, Tianjin, and Shanghai suburbs, and in southern Jiangsu and the Pearl River Delta, one or two counties in each could be chosen for the set-up of moderate-scale family or cooperative farms. In addition, other forms of professional contracting could be organized in order to conduct intensive farming.

[10] The responsibility system of the provincial governor for grain production was introduced in China in 1994-1995. The policy was designed to strengthen food security by making provincial governors and governments responsible for balancing grain supply and demand, and stabilizing provincial food markets and prices (Huang *et al.*, 1999).

[11] Under the household responsibility system in China, the 'property right' of farmland is collectively held by administrative villages in rural areas, while rural households within these villages have a 'contract right' to farmland. After receiving farmland, rural households may decide to transfer their farmland 'management right' to another party. See Li and Vandermeer (1998) for a detailed description.

[12] Subcontracting here refers to rural households transferring their contract farmland to other households within the village for agricultural production.

[13] Lease in our context means that the rural households rent some or all of their contract farmland to others outside the village for agricultural production.

Table 1. Form and direction of transferred farmland (%) (Ministry of Agriculture of China, 2011, 2012, 2013, 2014).

Year	2010	2011	2012	2013
Form				
Subcontract	51.10	49.32	46.87	46.57
Lease	27.10	28.86	31.67	33.15
Share-cooperative	5.50	5.89	6.94	6.72
Others	16.30	15.92	14.52	13.56
Direction				
To farmers	67.60	64.69	60.29	58.37
To cooperatives	13.40	15.85	20.36	21.91
To companies	8.40	9.18	9.44	9.62
To others	10.60	10.28	9.91	10.10

Farmland concentration is achieved via the transfer of farmland management rights and the establishment of farmland shareholder cooperatives. These are explained in more detail below.

Transfer of farmland management rights

This method enables scale farming entities to concentrate farmland after receiving farmland management rights from rural households, and allows them to carry out large-scale production operations. According to our field survey, there are currently two main ways to achieve the transfer of management rights.

The first is to transfer the farmland of an entire village. This is applied in economically developed areas where the village head has a strong persuasive skill. For instance, 118 villages accounted for more than 80% of the farmland transfer rate in Shaoxing City, Zhejiang Province; 28 of these transferred all (100%) of the village's land in 2014. In the context of the relatively rapid development of local industry, and increased rural labor transfer, Yaobang Village, in Xindai Town, Pinghu City, Zhejiang Province formulated a document entitled 'Implementing rules for land transfer in the whole Yaobang village'. After this was approved based on a vote by the Village Member Representative Congress, household contracts for farmland management rights transfer were signed by 488 rural households – that is, every household in the village. Thus, 100% of the village's farmland, with the total area of 172 hectares, was transferred to scale farming entities; this allowed the objective of implementing scale farming operations to be achieved.

The second form of transfer is called an entrusted transfer. This is used in areas with a developed farmland transfer market. For example, a standard process for farmland transfer was developed in 2005 in Ningbo City, Zhejiang Province. According to this standard process, a farmland transfer engagement letter must first be issued by the rural households, in which they indicate their willingness to entrust their farmland to the village. In Xinmian Village in Beilun District, Ningbo city, where the farmland per capita was less than 0.07 hectares, the village began to acquire farmland entrusted to it by its rural households in 2008. After the transfer was complete,[14] this farmland was then contracted to specialized large-scale farmers. Also in Qiaotou Town in Cixi County, in Ningbo city, the construction of farmland infrastructure was also jointly invested in collectively by the local government and villages. About 800 hectares of farmland, which originally comprised low terrain and weak infrastructure, were transferred by being contracted to more than 30 specialized large-scale farmers.

[14] The village implemented collective investment in the construction of farmland infrastructure such as roads, canals, ditches, and so on, along with the rebuilding of standardized greenhouses and the undertaking of routine maintenance of agricultural facilities, so as to fully meet the production demands of the specialized large-scale farmers.

Farmland shareholder cooperatives

A farmland shareholder cooperative[15] is formed based on members' investment in terms of management rights of farmland. Shares of a member are evaluated on the basis of both the size and quality of the farmland. Pooled farmland of the membership is operated collectively to gain scale economy. A representative case is Xinhe Share Cooperative Farm in Xianju County, Taizhou City, Zhejiang Province. This farm was formerly Qidu Cultivation and Breeding Professional Cooperative in Xianju County, which was established in 2013 with a registered capital of 1.2 million Yuan. The farm had 132 initial shareholders and an operating area of 100 hectares, and was the first cooperative farm in Zhejiang province. The farm was built into a cooperative farm by the 132 shareholders on the basis of 0.4 hectares of farmland per share (with a total of 53 hectares of farmland), accounting for 50% of the registered capital; merger of the original cooperatives assets (rice processing plant, rice cake, rice and noodle processing plant and warehouse) accounting for 30% of the registered capital, 10% of technology share and 10% of business share.

Another example of this type is that of the Renfa cooperative, located in the north of Heilongjiang province[16], which represents typical large-scale grain production based on farmland shareholder cooperatives. Initially, in order to attract rural households to join, the cooperative promised that each share (comprising one hectare) would be guaranteed at 5,250 Yuan, compared to the market price of about 3,900 Yuan per hectare for leasing the management rights to the farmland. Moreover, the cooperative promoted the farmland as an investment for rural households, which could yield year-end dividends and benefit from subsidy funds provided by the government are also distributed to the shareholders. In this way, the rural households could benefit from three types of revenues from purchasing the farmland management shares. After the farmland became concentrated in this manner, the cooperative pushed the mechanization of farming operations via modern, large-scale agricultural machinery for the production of grain and other crops.

Scale farming operations based on agricultural services

Scale farming operations based on agricultural services rely on scale farming entities developing the agricultural service system so as to realize scale farming operations in one or several parts of the agricultural production process. Usually, the role of scale farming entities is twofold.

First, scale farming entities provide professional services during the technology-intensive production stage to ensure that farmland productivity is not reduced due to a decrease in the agricultural production skills of rural households following transfer of the labor force.[17] For example, in the farming of rice, the wide variety of rice pests means that disease and pest control should be conducted multiple times throughout each season. Meanwhile, recent years have witnessed an increase in fulminant pests and diseases in rice. The conventional self-defense way by small-scale households entails problems with inefficient prevention and control, high prevention and treatment costs, and poor control effects. In 2007, the Green Agriculture Professional Cooperative was established in Nanhu District, Jiaxing City, Zhejiang Province, initially with the aim of controlling the most prevalent pests in the agricultural production chain. This gradually evolved to include agricultural services such as tractor-ploughing, mechanical transplanting, mechanical harvesting, the purchase and sale of agricultural products, etc. The Green Agriculture Professional Cooperative's pest prevention and treatment services for the surrounding rural households led to the rapid development of the service scale. The area of farmland in the District increased from 432 hectares in 2007 to 4,194 hectares in

[15] Farmland shareholder cooperatives are a special model of farmer cooperatives in China. Farmers obtain the membership by transferring their management rights of farmland to the cooperative. Pooled farmland of the membership is operated collectively and benefits are distributed among members, which by definition is a farmer cooperative (that is, member owned, member controlled, and member benefited) and is different from an investor-owned firm.

[16] Heilongjiang province has the highest latitude and the easternmost longitude of China. Its abundant arable land resources provide favorable conditions for the development of agricultural large-scale operations.

[17] In China, younger, more educated labor forces are entering into the off-farm labor market (De Brauw *et al.,* 2002), leaving the elderly, women, and children at home to take care of the farm work and causing a decrease in the agricultural production skills of rural households.

2013, which accounted for 39.90% of the rice planting area. In addition, the Cooperative provides technical training, and technology consulting services related to agricultural production for rural households.

Second, scale farming entities provide mechanization services for the labor-intensive production stage to ensure land productivity is not reduced due to limitations to physical strength of rural households following transfer of the labor force. Jinsui Whole-process Mechanization Grain Production Cooperative, located in Luqiao District, Taizhou City, Zhejiang Province, was the first farmer cooperative established via industrial and commercial capital investment in Zhejiang province. Since its foundation in 2005, it has effectively mitigated several critical issues in the agriculture sector, including the low comparative benefits of manual grain production methods and low land utilization rate, via mechanization of grain-production. This mechanization covers grain production from farming, seedling growing, planting (seeding), irrigation, plant protection, harvesting, drying, processing, etc. While retaining the contract rights of the farmland, the Cooperative provides rural households with three kinds of mechanization service modes. First, they may rent out their contract farmland to the Cooperative for a quarter or a whole year, whereby the lease payments are settled in the form of grain provision. Second, with respect to independent farming by the rural households, the Cooperative provides the whole-process mechanization services outlined above, for which the rural households pay a service fee; under this arrangement, all the harvested grain is owned by the relevant households. Third, households may buy mechanization services from the Cooperative for any of the grain-production processes. As of 2014, the Cooperative's operating area has developed to more than 40 hectares, the service area of annual mechanical transplanting is more than 600 hectares, and the mechanical harvesting area is over 1,600 hectares. Besides local scale farming entities, there are many national-level professional service organizations in China. For example, according to Yang *et al.* (2013), there are tens of thousands of private mechanization service providers in Peixian in Jiangsu Province[18] that offer inter-regional harvesting services. Representatives of these entities travel across the provinces of China throughout the year to sell harvesting services (as harvesting is the most labor-intensive task in grain production).

Of course, the promotion of scale farming operation entities is extremely important to the development of scale farming operations based on agricultural services. Currently, there are two main approaches to promote this in China. This first is via government support. The government has a leading role in promoting scale operations in China, and local governments may encourage the construction of facilities or purchasing of equipment by providing financial support and various incentives, subsidies, etc. to increase scale farming capabilities of existing agricultural entities. Scale farming entities are then able to serve the surrounding rural households using existing equipment, and thus conduct large-scale farming operations. The second approach is enacted at the grassroots level. By jointly constructing facilities or purchasing equipment, entities in villages or industries that are in close geographical proximity may generate scale economies, which can be continuously improved. One example of this is the nine-village collective economic organization in Xindai Town of Pinghu City, Zhejiang Province. Through joint construction, Cooperative of Xinlian grain and oil, pig farming has been established, professional service teams formed, and scale farming operations conducted in different regions; thus, scale farming entities have been created.

4. Conclusions

During the last two decades, scale farming operations have been encouraged by the Chinese government against the backdrop of labor decline in the agricultural sector, and rapid development thereof. This paper systematically considered the recent development of scale farming operations in China. Using cases from Zhejiang province, two main types of scale farming operations were identified. These are based on: (1) concentrated farmland and (2) agricultural services. Regarding trends, the development of scale farming operations based on land concentration may slow due to the difficulties encountered in improving farmland transfers; however, scale farming operations based on agricultural services will continue to expand. Nevertheless, the regional disparities in China's scale farming operations will not fundamentally change in the near future.

[18] Jiangsu province is situated on the eastern coast of China, and borders Zhejiang province to the south.

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