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State-driven marketization: a preliminary review of China's seed governance and marketization history

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State-driven marketization: a preliminary review of China's seed governance and marketization history

XU Siyuan

1 Introduction

China became the second biggest seed market in the world in 2005, the trade value of which was RMB 35 billion (Ma, 2010). The number soared to RMB 50 billion in five years, increasing by 57%. The value of the domestic seed market was estimated at 9 billion USD in 2011 (ISF, 2012). The expansion of China's seed market has received great attention over the years. It is important therefore to review how seed marketization came so far in China, and with what impacts it has had on the seed sector, seed enterprises and Chinese agricultural producers, and what factors have driven the changes.

Seed marketization of today's form, featured by free competition driven by profit maximization, did not exist in China's planned economy ranging from the 1950s to 1970s. Seed appeared as a semi-commodity only in rare cases of seed help and seed exchange, which were conducted in the commune system and regulated by the state.

In the Mao era, the state's seed governance primarily strived to meet the seed demand of agricultural production and facilitate the grassroots to realize seed self-reliance. Early seed marketization in China began in 1978 (Huang, 2002) at the same time as the Reform and Opening up took and it is composed of two historical stages. Whereas the market reform was already underway, seed provision was still centralized by the state, with the state-owned companies being the only market actors. The second historical stage started when the first Seed Law was rolled out in 2000. It marked the opening up of China's seed market both domestically and globally (Tong, 2002; Huang, 2002).

In the new millennium, seed marketization in China went through three phases. The first phase is characterized by the rapid growth of seed merchants and small seed enterprises. Those who had served in multilevel seed authorities, and the agricultural system at large, were the first to benefit from seed marketization. Others also entered the seed market as the threshold was low and the demand for improved seeds was high. The second phase witnessed the unprecedented soaring of seed prices. It was at this phase that the Chinese seed industry met the transnational agribusiness sector and began adopting their marketing strategies. More seed enterprises were established and the flooding of seeds on the market eventually resulted in overproduction. The third phase started as a countervailing measure against the transnational agribusinesses corporations (TACs) in the Chinese seed market. But the further development of the national seed project has far-reaching significances. In the wake of the new 2016 Seed Law, the contradictory yet biased engagement of the state marks the fast changing landscape of the seed industry. Table 1 briefly lists the time and features of each phase in China's seed governance and seed marketization.

Table 2 Historical stages of China's seed governance and seed marketization

	Time period	Features
Seed governance era	1949-early 1950s	individual household seed provision
	1950s-1970s	grassroots self-reliance
	1978-2000	early marketization; state controlled seed companies
Seed marketization era	2000-2005	multiple seed enterprises; sales agents dominated seed circulation
	2006-2010	TACs flooding and seed prices soar
	2010-2017	strong state presence; the globalization agenda

The first section of the paper provides a brief review of seed provision in the Mao era (1950s-1970s) and of the early period of seed marketization (1978-2001). Seed production in the latter was still in the state's centralized control, yet deepening seed marketization was already inevitable. The second phase of seed marketization began with the privatization of the state-owned seed companies. With private companies flooding into the seed sector, the seed industry was increasingly capitalized and driven by profit maximization. How the state facilitates marketization and basically sets the tone for the development of the seed industry will be one focus of the second section. The other will be the effect of competition from the transnational agribusiness corporations (TACs) on China's seed market. The third section focuses on the impacts of the state's intervention and seed marketization by examining how the balance between the state and seed enterprises and the balance between the seed enterprises and peasants have tilted in the past seventeen years. The conclusion brings seed marketization back in the broader background of the reform era and discusses how neoliberalism plays out in China's seed marketization.

2 Seed provision in the planned economy and early marketization (1949-2001)

Self-reliance and grassroots participation in seed supply (1950s-1970s)

China was primarily an agricultural country in 1949. After decades of wars, natural disasters and enduring exploitation of the ruling classes, the grain production stagnated at 113 million tons when the new China was first founded (208.91 kg per capita) (China's National Bureau of Statistics, 2017). Agricultural production remained poor as there were not even enough seeds for the next growing season. When the Communist Party of China (CPR) seized power, it was faced with great challenges to increase agricultural productivity to feed the large population.

The farmland was equally distributed among farming households in the land reform launched in the newly liberated areas, and seed provision also remained in individual rural households in the early 1950s. Every farming household was expected to save seeds ("every family farms, every household saves", jia jia zhongtian, huhu liuzhong) for its own use. The First National Conference on Agriculture (quanguo nongye gongzuohui) in 1950 stressed that the fine varieties were crucial for agricultural production (Tong, 2002). In the following year, the Ministry of Agriculture announced the Five-Year Plan on Popularization of Improved Varieties (Draft) (wunian liangzhong puji jihua caoan). The movement of mass participation in seed selection and seed saving was thus begun and it made a noticeable contribution to agricultural production.

Seed selection covered grain crops, cotton and oil crops. By 1952, selected seeds were planted on 810,000 h ㎡ of farmland (Huang, 2002). Many places, including one of the major agricultural regions, Shang Dong Province, replaced the conventional seeds for the first time (Gu, et al., 1988). More than 2000 improved varieties were selected by the end of 1954 (Tong, 2002).

By the late 1950s, rural China had completed its organization into a three-tiered collective farming system, including production teams, brigades and communes from the bottom to the top. Seed provision was also collectively guaranteed. In April 1958, the Ministry of Agriculture and the Ministry of Grains jointly organized the First National Seed Conference (quanguo zhongzi gongzuo huiyi) and produced a policy that emphasized seed self-reliance at all grassroots levels. Production teams were expected to carry out their own seed selection and breeding, and to save and use their own seeds. These grassroots self-reliant practices would be supplemented by some adjustments (the policy was called "four self-reliance and one supplement", si zi yi fu).

In each production team, there was an agricultural technician who was responsible for seed selection and sometimes seed breeding. They were usually young people who received more education than common peasants. The state provided additional training in agricultural technology and basic seed

breeding knowledge. They shouldered the responsibility of agricultural extension, but also worked along with the production team members (the peasants). The seeds were not produced separately from grain by the production teams. The technicians and team members would observe the crops during the growing season and select the land pieces that produced the best crops for seed selection. For different crop seeds, the selection process varied, but it required the production team to work collectively. Wheat needed to be skillfully winnowed, leaving the best grains at the windward side. The corn seeds were selected from the middle of the best cobs which were hand-picked by the technician or team members. Every spring, last year's soybeans were distributed to each member household to be individually selected (most of the time by women members).

Each production team was responsible for its own seed production and supply (Huang, 2002; Tong, 2002). However, when the production team was short of seeds due to a bad harvest or simply in need of better varieties, its demand could be met through two main sources. One was through exchanges with other production teams. The other was to purchase from the seed bases established at the brigade or commune level. The seed prices were relative to grain prices and were regulated by the state. According to a production team leader in Heilongjiang Province, seed prices were only slightly higher than grain prices. The improved varieties propagated at the seed bases were more expensive, but the prices were controlled at 8%-10% above grain prices.

A large number of grassroots seed breeders appeared in this period (Huang, 2002; Schmalzer, 2016). Many educated young peasants were recommended by their brigades to receive the state-initiated training programs. They stayed in the programs for one to three years, depending on their education backgrounds, and were assigned various tasks afterwards. Some returned to their home production teams to guarantee seed supply; some were promoted as seed breeders at the commune or brigade seed bases; others were given administrative positions in the state's seed system. The grassroots breeders were integral to seed research during the 1950s to 1970s. Independently, they bred varieties that best suited the local conditions. The peasant breeding expert, Gong Wensheng, who was recognized with an award by the Ministry of Agriculture in June 1960, bred a new wheat variety Neixiang No. 5, which yielded 20% to 30% more than conventional varieties. (Nanyang dangshi wang, 2010). As a supplementary part of the formal research institutes, grassroots breeders made great contributions to the success of hybrid rice in the massive seed breeding mobilization (Schmalzer, 2016).

For a brief period before the collective farming system was established, each farming household was individually responsible for its own seed supply. Seed provision was collectively guaranteed afterwards and was based on the self-reliance of each production team. The production teams achieved this through the collaboration of team members and agricultural technicians who were trained by the state-initiated programs. The seed supply at the production team level was also supplemented by seed help and seed exchange. These were the rare cases where the seed appeared as a commodity. But the purchase prices were directly related to grain prices and fixed by the state at a low level.

Centralized seed marketization: The first step to an opening seed market (1978-2000)

In June 1978, the State Council approved the report on current seed affairs from the Ministry of Agriculture and Forestry (nonglin bu). The report re-named seed stations at provincial, municipal, and county levels as seed companies. These seed companies assumed the governance authority of the seed stations in seed breeding, production and quality inspection. In the meantime, they also took on a new role of seed management, becoming the only qualified market actors for seed marketing. The new arrangement was to realize regionalization of seed distribution, specialization of seed production, standardization of seed quality, mechanization of seed processing and centralization of seed supply at the county level, often referred to as four–izations and one supply, or "si hua yi gong".

The seed companies' dual roles of seed governance and seed management are often criticized as being both the player and referee, indicating the lack of supervision in seed quality (Li and Huo, 2001; Gu, 2010). However, two interviewees who worked in seed companies explained how seed was supplied

and the quality control approaches specific to the supply system. In the three-tiered seed company system, the provincial seed companies supervised purification and rejuvenation, usually at the seed bases. Seed production was the municipal seed companies' responsibility and they distributed seeds for the county companies to sell. Some county seed companies also made contracts with the rural collectives for seed production (Tong, 2002). Quality inspection was conducted by the governance department of the seed companies. As one interviewee stated:

> In the period of "four–izations and one supply", only the seed companies were allowed to sell seeds. There was not a seed market to govern to begin with. There were few problems with the seed quality. Nobody would sell fake seeds because there was no need to. Seeds were cheap, on the one hand; on the other, the overproduced seeds could be sold as grains and the state would subsidize the prices. They would not be sold as seeds for the next season.
>
> Every year, we would inspect seed production sites for the entire summer. Some production teams would not dare to report on the low purity seeds. But if the seed plots were noticeably impure, the leaders from the Bureau of Agriculture would scold the manager of the seed company on site, and the problem would be addressed immediately, as people's faces were very thin back then.

Two points could be drawn from the above statements. Firstly, the low profits of seeds discouraged the sale of poor seeds or fake seeds. Also, the state subsidies reduced the risks of overproduction and prevented dated seeds from being sold. Secondly, the seed company managers did not just sell seeds, but held pride in their work. This work ethic was nurtured in the Mao era and was not exceptional to those who had lived through the 1950s to 1970s. Many interviewees nostalgically recalled the old days when people did their best work to serve the interests of the people. Material incentives were rare, and also unnecessary.

In the late 1970s, along with the organizational transition of the seed companies, rural China also underwent a series of transformations. The commune-brigade-production arrangement was replaced by the Household Reasonability System. Seed companies could no longer rely on production teams to organize seed production (Yang and Wang, 2010). Instead, they had to deal with individual rural households. Peasants changed from being an integral part of a collective seed provision system to being mere suppliers for the seed companies. The price differences between seeds and grains led some peasants to mix grains in seeds when selling them to the companies.

Seed provision in the previous stage was subsidized by the state. However, under the new policy, government financial allocation was no longer available. Seed companies were expected to be responsible for their own gains and losses (Tong, 2002). Seeds could be bought with grains in the beginning, but cash purchase became the mainstream with the deepening of seed commodification. Along with this, seed companies became the cashbox of the agricultural system (Wang, 1993), and profit-making created inner competition among the seed companies (Tong, 2002; Yang and Wang, 2010; Zhang and Wu, 2010). The president of a major seed company in Hunan Province, who used to work in the provincial seed company, recalled:

> The provincial seed company bore the losses over seed purification at the seed bases. Later on, it took over seed production from the municipal seed companies, and again it could not make any money from it. Among the three-tiered seed companies, only the county level could profit from selling seeds, so the provincial seed company started to compete with its inferior.
>
> We set up demonstration stations for new varieties in all the 110 counties, but they in fact only sold seeds. For peasants living far away from the capital city, seeds were mailed to them through the post offices. From 2000, we started sending flyers at the county/

> township buses to inform peasants that they could buy seeds or pick up their deliveries at our seed stores. The county seed companies were furious at their superior's doing this. One day, 13 vehicles from 8 counties were parked in front the gate of the provincial seed company to protest against the competition.

The profits in seed marketing did not only cause inner competition among the seed companies, but also attracted other actors to enter the seed market. Although the seed market was still nominally monopolized by county seed companies before 2000 when the Seed Law rolled out, unlicensed seed stores started flourishing in the 1990s (Yang, 1989), so did forged and fake seeds (Tong, 2002).

3 Three phases of seed marketization: market as opportunity & market as imperative

On the eve of China becoming a WTO member country, the first Seed Law was enacted in 2000. It marked the opening up of China's seed market to domestic and overseas seed enterprises. Seed marketization in China went on at such a high speed that it reached to a point that it took developed countries decades to achieve (Tong, 2002). However, it also means the issues related to seed commodification intensified in a short period of seven years. In this section, the paper will review the three stages of China's seed marketization, during which, the market evolves from an opportunity to an imperative.

Privatization and the rapid growth of seed enterprises (2000-2005)

Between 1978 and 2000, the seed companies combined the role of governance and management of seed production and seed sales. However, once seed marketization set in motion, profit making became the goal that outweighed all the others. The state also initiated divorcing seed companies from seed governance stations and enabled them to run independently as enterprises since the 1980s (Tong, 2002; Yang, 1989). But due to difficulties in the division of responsibilities, in budgets and in personnel arrangements, the separation was not complete until the 2000s.

The state allowed easy market access for various forms of capital (Huang, et al., 2010). The 2000 Seed Law only requires RMB five million of registered capital to start a seed enterprise. There is also a requirement for fixed assets, but in practice many enterprises did not comply with this regulation. Some enterprises borrowed money for registered capital and transferred the money elsewhere after registration. Upon the opening of the seed market in China, many private seed enterprises were set up by individuals, agricultural universities and research institutes (Yang, et al., 2006). By the end of 2000, there were more than 2300 registered seed enterprises in China (Jiang, et al., 2015). Within 6 years, the number had increased to over 9000 (Yang, et al., 2006).

The 2000 Seed Law sets an even lower bar for seed sales (Li and Li, 2004). Although it stipulates that operating permits must be obtained prior to business license application for seed sales, in the same chapter, the operating permit is considered unnecessary if packaged seeds will not be sub-packaged, or the seed sale agents hold written contracts with those that have obtained operating permits. Under this stipulation, anyone with an ID card can sell seeds without informing the local seed governance authority. Seed sale agents increased from 32,500 in 2000 (Tong, 2003) to 120,000 in 2006 (Yang, et al., 2006).

In the 1990s, an imbalance between demand and supply already existed with the seed companies increasingly being driven by profit making. The fluctuation of seed prices happened every a few years (Li, et al., 2006), with 1990 and 1995 being a sellers' market, while the seed supply in both 1996 and 1997 exceeding market demands (Zhang and Ding, 1997). However, the seed prices were still regulated by the state and remained directly related to grain prices and seed quality (purity and germination ratio), and thus the profit margin was rather narrow (10%) (Sheng, 1992). When the

county seed companies were still the only market actors permitted by the state, seed supply was secured first and seed overproduction remained under control.

Since the 2000 Seed Law came out, the newly opened seed market presented as great opportunities to make profits. On the one hand, the seed enterprises were now at liberty to set seed prices, even though they still needed to seek approval from the Price Bureau (Tong, 2002). On the other, the seed demand was still high, but the qualifications required to sell seeds were few. Those who had worked in the seed companies were the first to become seed sales agents. Soon after them, those who had almost no knowledge of seeds also started their businesses (Chen, et al., 2016). The seed demand remained high at this stage, so the success of seed enterprises was determined by their sales volume, which makes the control of sales channels crucial.

The separation of seed companies from seed governance gave rise to a number of seed enterprises that first sought the opportunity to profit in the market economy. At the same time, it created an important group of seed sales agents, who were mostly the previous government workers. They worked in the seed companies/seed stations or the agricultural system, which enabled them to be close to the authorities and also to make use of the established government marketing channels. As the marketing manager of a major seed enterprise in Guangxi commented:

> The market demand was really huge in the first few years. No matter how many seeds you could produce, they could always be sold. Seed marketing was not needed. All the seed enterprises reached their sales peak in 2005. The requisite conditions for a successful enterprise were varieties and networks. For the latter, since all the sales agents were originally from the government system back then, so as long as they agreed to sell seeds for you, everything was settled.

The seed prices rose during this stage partly due to increasing production costs (fertilizers, pesticides, labor costs, etc.), but more importantly, due to the profits in the circulation (Zhang, 2006). Seeds were distributed through sales agents at the provincial and county level and finally sold to peasants from the township seed stores. In 2006, the prices for ordinary varieties increased by 250% from the farm gate prices to the retail prices; for special varieties, the increase reached 566.7% (ibid.). Seed circulation took up respectively 45% and 53% of the profits in the entire industry chain for ordinary varieties and exclusive varieties respectively (Zhang, 2006).

Learning from the masters: integration with the global market (2006-2010)

In the late 1980s, foreign vegetable seeds already appeared on China's seed market, followed by cotton seeds in mid 1990s (Yang, 2014). Since the 2000 Seed Law was rolled out, and especially after China joined the WTO in 2001, foreign seed companies started flooding into China's seed market (including grain crop seeds). These companies have been major figures in the vegetable and flower seeds industry, but their prominence in grain crop seeds quickly increased (Cheng, 2011; Yang, 2014). In 2001, the first seed joint adventure was established by Monsanto and the state-own company, CHINA SEED. After that, many foreign seed companies sought partnership, particularly with major Chinese seed companies, in order to rapidly expand their business (Cheng, 2011; Yang, 2014). Table 2 shows the joint ventures in the hybrid corn seed industry, featuring the collaboration between key transnational agribusiness corporations with their Chinese business partners. By 2010, there were more than 70 foreign seed companies in China (Ma, 2010; Zhao and Lin, 2009).

Table 2 Joint Ventures in Hybrid Corn Seeds

Year	Transnational Seed Giants	Chinese Partners	Joint Ventures	Seed Products	Market Areas
2001	Monsanto Company	China National Seed Group Co., Ltd. (CHINA SEED)	CNSGC-DEKALB Seed Company Ltd. (CNDK) since 2001. China Seed International Co., Ltd. since 2013.	DK 007, DK 008, M751, M753, DK 519, DK 516, etc.	North, Northeast, Northwest, Southwest China and Huang-Huai-Hai Region (the Yellow River region)
2002	DuPont Pioneer	Shandong Denghai Seeds Co., Ltd.	Shangdong Denghai Pioneer Seeds Co., Ltd.	Xianyu 335, Xianyu 508, Xianyu696, Xianyu688, etc.	Huang-Huai-Hai Region
2002	Limagrain	Shanxi Tengda Seed Co., Ltd	Shanxi Limagrain Special Crops R&D Co., Ltd.	Field crop seeds (wheat & corn), notably LIC016, and vegetable seeds.	Northeast China and Inner Mongolia
2006	DuPont Pioneer	Gansu Dunhuang Seed Co., Ltd.	Dunhuang Seed Pioneer Hi-Bred Co., Ltd.	Xianyu 335, Xianyu 508, Xianyu696, 32D22, etc.	Northeast and Northwest China
2008	Syngenta	Sanbei Seed Co., Ltd.	Sanbei Seed Co., Ltd.	Syngenta 408, Syngenta 203, Syngenta 205, Syngenta101, Sanbei 2, Sanbei 89, etc	Northeast, Northwest, Southwest China and Huang-Huai-Hai Region
2014	KWS SAAT AG	Beidahuang Kenfeng Seed Co., Ltd.	Kenfeng-KWS Seed Co., Ltd.	Kenwo No.1, Kenwo No. 2, Kenwo No. 1, Demeiya No. 3, Demeiya No. 2	Northeast China

The introduction of foreign seeds changed the landscape of China's seed market. Take hybrid corn seeds for instance. In 2002, DuPont Pioneer jointly founded Shangdong Denghai Pioneer Seeds Co., Ltd. (Denghai Pioneer) with Shandong Denghai Seeds Co., Ltd. Two years later, its signature product Xianyu 335 appeared the Huang-Huai-Hai region market (a major grain production area) and within two years, its sales increased phenomenally. On the same year, DuPont Pioneer founded Dunhuang Seed Pioneer Hi-Bred Co., Ltd. with Gansu Dunhuang Seed Co., Ltd. to further expand its seed sales in Northeast and Northwest China. In merely three years, Xianyu 335 took 40% of the Northeast China's hybrid corn seed market (Chen, 2012).

One government official at the Heilongjiang provincial Seed Bureau and several seed sales agents explained the changes brought by Xianyu 335. Firstly, it altered the peasant mode of production. Xianyu 335's high germination rate saved peasants' thinning time and reduced the amount of seeds used on average farmland plots. Secondly, it increased hybrid corn seed prices on the market. When Xianyu 335 first came to Northeast China's seed market, its price was fixed at RMB 40/kg while the average seed price was around RMB 15/kg. Shortly after this, other varieties that resembled Xianyu

335's traits, especially those that could be single particle planted, also raised their selling prices. Consequently, more seed enterprises and sales agents emerged on the market to take advantage of the increased profit margin.

The hybrid rice seed enterprises adopted the same pricing strategy. The seed prices were set highly above the production costs, so that the seed enterprises could recover their costs in the initial years after the products were released. When the sales volume decreased, the profit margin could be reduced to cover the marketing costs. Soon after the two leading seed enterprises raised their prices, the rest followed. One hybrid rice seed marketing manager called 2007-2011 "the windfall profit period". In the previous period, the profit of 30 million kg of seeds was RMB 30 million, while now 10 million kg could generate RMB 150 million of profit.

The huge profits encouraged seed enterprises to increase production and also attracted capital from other industries to enter the seed market for quick gains (Yu, 2014). Fake-licensed seeds and unauthorized seed production generated and intensified blind production (Tong, 2015; Yu, 2017). From 2010 to 2016, "overproduction and oversupply" commonly appeared in the annual reports of listed seed companies (Sohu, 2017). In the previous stage, production was never 50% above the market demand when overcapacity happened, but in this period, it was beyond 100% (Yu, 2014).

Industry concentration and state-supported globalization (2010-)

Since 2010, the seed industry has been dealing with the problems of overproduction and overcapacity. The competition in the hybrid rice seeds and the hybrid corn seeds industries become more severe as the market have been shrinking. More farmland is being turned into cash crop production from grain crop production. The rice production areas are also transforming from double cropping to single cropping. Therefore, seed marketing became more important than ever to reduce pressure of the overproduction.

Except for the conventional site meetings where the seed enterprises invite sales agents and producers to examine the harvests of their products on site, more high-input and high-profit marketing strategies were adopted in this period. One CHINA SEED marketing manager describes how their competitors promote hybrid rice seeds in Guangxi:

> Since 2016, Longping High Tech (the biggest hybrid rice seed company in China) started adopting human wave attacks in the Guangxi seed market to promote its seeds. Guangxi's sowing season is later than other regions. Therefore, Longping would transfer its salesmen in other regions to Guangxi in June and July to do promotion. These salesmen are like migratory birds, coming to do promotion for some time and leaving for their own regions afterwards. There are 300 of them this year (2016).
>
> Gold Agriculture (one of the top-ten star seed enterprises) has 20 to 30 staff in Guangxi all year round. Learning from Monsanto, it does technology development (TD) to find out the best marketing areas for its products. Since 2013/2014, it also sends 30 to 40 people to do county/township level product promotion during the entire production season. The teams have expanded to 100 people now.

Both the human wave attacks and TD require long term investment in personnel and other resources, which means they are financially feasible only for big seed enterprises. Other promotion measures such as giving gifts (televisions, cars, etc.) and special offers to attract producers and to encourage advance orders also only apply to seed enterprises with significant marketing budgets. As the president of one of the biggest seed enterprises in Hunan Province commented, "When the market is promising, it is good for everybody. But the crisis gives the stronger an upper hand to outcompete others." The overproduction crisis pushed small-middle sized seed enterprises out of the seed industry. According to this president's estimation, half of the remaining seed enterprises exist in name only.

At the same time, the seed distribution system has also been simplified (Luo, 2015). The numerous sales agents in the three-tiered distribution system were important when the seed market was first opened. Seed enterprises with similar products depended on them to reach the peasants (Luo, 2015). Over the years, the promotion of branded seed varieties relied less and less on sales agents. The intensification of market competition during the overproduction crisis also encourages seed enterprises to reduce the profit share in the distribution system.

In 2011, the State Council issued a new policy paper on the further development of the seed industry, which is commonly referred to as the New Seed Deal (zhongye xinzheng). It raises the registration threshold of seed enterprises in registered assets, fixed assets, research and development (R & D) capacity and technology level. By doing so, it encourages large corporations to enter the seed industry through mergers, shareholding or other means. Chinese seed enterprises are also expected to form larger seed corporations through mergers and reorganization. The New Seed Deal will increase industry concentration and eliminate seed enterprises that are unable to fulfill the new registration requirements. Therefore, the overproduction issue will not be worsened by further production.

The pressure to overcome the overproduction crisis in the seed industry also parallels with the state's globalization agenda (Lyu and Zheng, 2014; Zhang and Zhang, 2016). Among the grain crop seeds, China's hybrid rice seed is the most competitive product on the global market (Han, et al., 2015). Since the1980s, China's seed export had been used to dispose of domestic seeds that exceeded market demand (Li, et al. 2011). With the seed production mounting and overproduction normalizing, the seed industry started to lobby for loosening policy restrictions on seed export (yicai, 2016). In the New Seed Deal, the state expresses its further encouragement and support of the globalization of China's seed industry. Seed going out is also included in the One Belt One Road Initiative, as a part of the international agricultural cooperation component.

4 The balances tilt: the state, seed enterprises, and peasants

The previous historical review of the transformation in China's seed governance and seed marketization reflects the changing power relations among the state, seed enterprises and peasants. For the convenience of discussion, in this section, the paper only focuses on the two main eras of the transformation, the Mao era (1950s-1970s) and the reform era (1978-). The latter consists of the early marketization phase (1978-2000) and the open market phase (2000-).

In the Mao era, seed provision was maintained at the grassroots level and seed self-reliance was the main feature. The three-tiered commune-brigade-production team system was the organizational foundation for the participation of the grassroots. Organized peasants were both the seed producers and an integral part of seed breeding. The agricultural technicians, coming from the grassroots, were brought up in the state-initiated training program and became the backbone of the grassroots seed provision system. Seed marketization remained at a minimum level under the regulation of the state to complement the sudden and unexpected seed shortage. Seed help and seed exchange were paid in grain, and therefore, profit in seed marketization was very low.

Early seed marketization was part of the transformation of Chinese society from the planned economy to the market economy. Seed marketization was initiated and also supervised by the state, as seed companies being the only actors on the seed market. As much as self-reliance is the idea behind seed provision in the previous phase, seed marketization changed the landscape of seed governance and seed marketization in China. The prevalence of seed sales and the advancement of seed marketization since the Reform and Opening up is driven by both internal and external factors.

Domestically, two changes in this period jointly contributed to the institutional transition of the seed companies and called for an open seed market. Firstly, when the state permitted seed to be purchased

by cash instead of grain, the profits in seed sales became visible and seed companies were seen more as profit-making institutions, less as the seed provisioning body. Voices from inside of the seed companies called for the separation of seed management from seed governance. Secondly, the state dismantled the collective farming system, which not only dissolved the production foundation of the state-owned seed companies, but also changed peasants from part of the state seed provision system to the contractors of seed companies. After the 2000 Seed Law, the rapidly growing seed enterprises seized the opportunity to profit from the opening seed market. However, with the intensification of seed commodification, soon they were under the imperatives of competition, accumulation, and profit-maximization, the distinctive "laws of motion" of capitalism (Wood, 1998).

In 1978, the former Party Chairman Hua Guofeng visited Yugoslavia. Learning from its market reform experience, the three-tiered seed company system was set up soon after Hua came back. Since the 1950s, the International Monetary Fund (IMF) and the World Bank (WB) initiated the Structural Adjustment Programs (SAPs), a loan attached project that required receiving countries to implement market-oriented reforms. From 1996 to 2002, the WB provided a loan of USD 57.1 million to China for a seed sector commercialization project towards the commercialization of state-owned companies, the use of improved technology in agriculture and reform of the seed sector, including the promotion of breeders' rights and international cooperation (WB, 2003). Consistent with the loan requirements, in 1995, the Fifth Plenary Session of the Fourteenth Central Committee launched the Seed Project (zhongzi gongcheng). It intends to realize four fundamental transitions in the seed sector, including the intensification of seed production, the socialization and internationalization of market competition, the establishment of large-scale specialized seed enterprises or enterprise groups, and the integration of seed research, production, extension and marketing.

The Seed Project provides a blueprint for seed governance and seed marketization in China throughout the Ninth Five-Year Plan and extended to 2010 (The National Seed Project Workshop, 1996). In the following years, the state-owned seed companies divested themselves of their seed certification and quality control functions and formed into self-accounting autonomous legal entities. China became a member of the International Union for the Protection of New Varieties of Plants (UPOV) in 1999 for the protection of intellectual property rights. In 2000, the Seed Law was rolled out to make the seed sector open for competition.

In the open market phase, profit maximization and international competition further shaped China's seed sector. The easy market access provided by the 2000 Seed Law permitted many enterprises to flood into the seed market. These seed enterprises profited from the market opportunity with homogeneous seed varieties for a few years. However, the competition from foreign seed companies accelerated the transition of China's seed sector. Around 2010, a series of investigations and research (Zhao and Lin, 2009; Ma, 2010; Shao, et al., 2010; Pan and Zhang, 2011; Lin, 2013) drew the attention to foreign companies' presence on China's seed market. Much research (Tong, 2011; Jing and Li, 2011; Wu, et al., 2016) stresses the gaps between China's seed enterprises and transnational agribusiness corporations in enterprise scale, R&D investment and international competitiveness. The transnational companies, such as Monsanto, Syngenta and Du Pont, are often referred to as learning examples for the domestic companies. The government is also suggested to provide a supportive policy environment, such as promoting the division of labor between basic research and applied research, supporting mergers and acquisitions in the seed sector, and encouraging globalization of Chinese seed companies.

Several leading seed enterprises had already started their preparations for the international competition. For instance, in 2013, Longping High Tech planned to purchase the minority stakeholders' interests of three of its subsidiaries in order to centralize the resources to form a giant enterprise group. The state not only provided a supportive policy environment, it also directly contributed to mergers and acquisitions in the seed sector. In 2016, the China International Trust & Investment Corporation (CITIC) purchased 18.79% equity interest in Longping High Tech and became the controlling shareholder of Longping. CITIC's capital injection furthered Longping's

advantage in becoming an international seed giant (CITIC, 2017). In 2016 alone, Longping acquired a vegetable seed enterprise and a rice seed enterprise in Southwest China. It also established a rice seed enterprise in Northeast China.

When the seed marketization proceeds, agricultural producers grow more dependent on the seed industry. The seed commodification rate increased from 30% in the 1990s to 60% in 2013 (The Soft Science Committee Office of the Ministry of Agriculture, 2013). Among the grain crop seeds, hybrid rice and hybrid corn are entirely commercialized, while wheat is 66% (ibid.). The agricultural producers are first faced with the increased seed prices due to the profits concentrated in the seed sector. The hybrid rice seeds, hybrid cotton seeds and cucurbit and vegetable seeds are most profitable, the gross profit rates of which are over 60% (Lu and Sun, 2005). Conventional grain crop seeds, on the other hand, only generate average gross profit rate of 10% to 30% (ibid.). Besides the rising seed costs, agricultural producers are also challenged by the fluctuating seed market caused by market monopoly and the marketing strategies of large companies. Take Demeiya, a hybrid corn seed variety, for instance. It once took 90% market share in the main corn producing area of Heilongjiang Province (CCTV, 2015). In Spring 2015, Demeiya could not be found on the market and some producers were prepared to pay double of its last year's price.

The costs and benefits of seed marketization are unevenly distributed in the transformation of China's seed governance and seed marketization among various subjects, in particular, the commercialized seed sector participants and the agricultural producers. The seed sector did not exist in the Mao era. The state's seed governance and organizational structure in rural China provided a foundation for peasants' control on seeds. However, in the reform era, agricultural producers are increasingly faced with mounting seed prices and market un-stability. In the meantime, their dependency on commercialized seeds grows.

The state has been criticized for exercising too much control in the seed market and for creating barriers for seed enterprises to pursue their best interests (Tong, 2002). The residues of the planned economy are also condemned as responsible for the chaos in the seed market (Tong, et al., 2002). However, when the seed market was first open for competition, the state provided unprecedentedly easy access to the seed sector. The seed companies continuously enjoy increasing profits and more control over the seed market.

Seed commodification was initiated by the state, the dynamics of which are still shaped by it to a certain degree. However, the state's roles are contradictory. It represents the opposite interests of peasants and agro-capitals. It is both the regulatory body of the seed market, and a powerful advocate for deregulation and a free market. In the past two decades, influences of agro-capitals, both domestic and transnational, have more influence on the state. As a result, the state's balance is advantaging the agro-capitals, even if the advantage is also unevenly enjoyed.

4 Conclusion

In both the planned economy and market economy, the state is clearly the most prominent figure in the transformation of China's seed governance and seed marketization. However, in the seed governance era (1950s-1970s), the state deliberately avoided seed commodification, a policy choice that derived from the communist ideology and Marxist theory. With the ideological and theoretical commitment, the state nurtured and facilitated the inseparable relations between peasant's and seeds and as well as peasant's knowledge and practices of seed selection, seed saving, and essentially, their long-standing control of the important means of production. China's market reform overlapped with the neo-liberal shift in the world economy in the 1980s (Friedmann, 2009). In agriculture, neo-liberalization is manifested in the prevalence of the industrialization of agricultural production and the free trade of agricultural produce (ibid.). The former leads to the commodification of agricultural inputs. As Goodman, et al. (1987) argue, "The industrial transformation of agriculture has occurred historically

through a series of partial, discontinuous appropriation of the rural labor and *biological production processes (emphasis added by the author)* (machines, fertilizers, hybrid seeds, fine chemicals, biotechnologies), and the parallel development of industrial substitutes for rural products".

China's seed marketization was part of the liberalization program that international institutions (the WB, the IMF and the WTO, etc.), the developed countries and the transnational agribusiness corporations so enthusiastically encouraged or explicitly imposed on the pre-communist countries or any other countries that did not yet join the market economy of the neo-liberal world. The neo-liberal project requires the national states to launch market reforms in order to allow transnational agribusiness corporations to seek profits in different markets. Aydin (2010) argues that the neo-liberal transformation of Turkish agriculture started due to the pressures from the World Bank, the EU and the WTO. In alignment with the rules and regulations of these international institutions, the Turkish government had to abandon its nationalist project and restructure its agriculture to enable the free competition of the transnational corporations in Turkey. The internationalization of Turkish agriculture resulted in the rising influences of the transnational corporations and inevitably brought Turkish small- and medium-sized rural households at their mercy. In the marketization era (1978-), similar to the Turkish government, the Chinese government also de-regulated and streamlined the seed industry and the seed market for the benefit of both domestic and global agro-capitals. Agricultural producers, on the other hand, suffered from the increased seed prices, market fluctuation and loss of control over their seeds.

There are questions remaining to be explored and answered. Firstly, the Chinese government has restructured the seed market to harmonize the policy environment for the global neo-liberal project. However, with China's own seed globalization agenda, it seems to demonstrate a stronger role than other developing country governments in the neo-liberal world. The question will be what distinguishes China's seed marketization in the neo-liberal world and how China's participation will change the global market and its relations with the developed and other developing countries. Secondly, although the state provides favorable conditions for the development of domestic seed enterprises but the benefits are unevenly distributed. The question of how domestic seed enterprises influence the state and what impacts they have on seed marketization arises. Thirdly, the dynamics of China's seed marketization should be studied as part of the ongoing domestic and global agrarian transformation. For example, how does seed marketization and the transformation of modes of agricultural production influence each other? Finally, on reflection, the seed governance experience in the Mao era provides inspiring alternatives for the protection of peasants' collective rights over seeds. Therefore, what can the social movements for peasants' rights in seeds and food sovereignty in general learn from seed provision in China's communist history?

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