

# The Drivers of China's Agricultural Production Efficiency over 40 Years

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**Abstract:** This paper systematically examines the main drivers' of agricultural production later fuelled China's economy over 40 years back since the period of the reform year 1978. China's current boom development founded from radical structural economic reform of the country from 1978 to 1991. Though there was a less inflated deviation in production during the period from 1978 to 2017, yet for the sake of evaluation we preferred to focus on the available literature. Empirical evidence undoubtedly concurred that structural reform had a great impact on overall the country's economy; especially agricultural sector later served as a bridge for the industrial developmental transition. Agriculture had registered less production inefficiency at the time of reform; this is because of the presence of rural land reform, price adjustment, market-oriented production, and perfectly functioning of institutions. The dozens of papers indulged that the contemporary great China shaped through the mercy of reform cumulative effects, particularly in agriculture, which took an elephant-share for current holistic development. To keep sustaining this sector production efficiency, the Chinese government should pay more attention on the a good stories of biotechnology and genetically modified organism (GMO).

**Keywords:** Agricultural Production, China, Drivers, Efficiency, Reform

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## 1. Introduction

China has registered a boom, remarkable, holistic, and radical catch up development history just four decades. Presently, China has a "leapfrog" economic growth. According to [19] the main drivers of the current China's fast growth are capital accumulative, boosted total production efficiency and open door policy for the investor which is initiated by radical reform held from 1978 to 1984 in particular, [37] the three-stage reform held from 1979 to 1991 brought a sound impact on China's economy. As the explored literature revealed that rapid agricultural technology expansion and high usage of modern agricultural inputs (fertilizer, chemicals, high

yield variety, pesticides, etc) had a significant effect for the increment of agricultural production and productivity. Agricultural production was stimulated due to historically unprecedented economic reform done in: (1) household responsibility system (HRS)<sup>1</sup>; (2) price index adjustment and; (3) institutional arrangement<sup>2</sup> in general and in local land use

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1 Market imperfection was maintained by the economic reform through household farming system, yet cadres at small villages were responsible for reallocation and distribution of a small plot of land, property and assets in China [3].

2 See the highlighted discussion given on the household responsibility system was first introduced during 1979, when the Chinese Communist party was made a radical reform [31, 32, 33, 42, 51]. This thought has gotten acceptance specially by farmers counted as a change agent. As evaluations agricultural productivity through the institutional structure household responsibility system (HRS)[31]. In

rights change latter cause surplus of productive land due to expansion of urbanization and out-migration of labour. The HRS has been distributing the entire social system with the kinship ties [49].

The body of this paper is in four sections. The first section is about the antiquity of Chinese agriculture before and after the reform period. The theoretical and Empirical efficiency measurements and theories in the second section. The third section provides information on what are the main drivers of China's agricultural production efficiency? If it was less inefficient. Can China's agricultural production efficiently be sustained? And how? In the last section presented.

### **1.1. Antiquity of Chinese Agriculture Before and After the Reform Period 1978**

Since the early 1950s' to 1958 Chinese agriculture was shown improvement in production. It is also a proxy history that China's economy become powerful following agricultural production rose up. Despite of this, from 1959 to 1961 about 30 million people have exposed famine in Chinese history. Unlike the Great Leap period, after the reform period, post-Mao and the mid communist party, following China become a member of WTO, implemented radical reform had shown remarkable agricultural production increment and the transition period become a new history again in the nation [7]. Chinese agricultural production has increased and became popular élites following the economic reform implementation held in 1979. For instance, [28] analyzed the grain production had shown increment from 304.8 million tons to 407.3 million tons from the period 1979 to at 1984. As the national statistical yearbook report supported agricultural production had a sound change output grew at 7.7% per annum over the period 1952-1978 (Statistical Bureau, 2000). Chinese agricultural production efficiency brought through the government's commitment to the reform seemed decollectivization<sup>3</sup> [31, 32] through institutional reforms.

In the past burgeoning literature evidenced that agricultural production in China was more or less efficient due to the

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this regard, economists use different methods to value production efficiency and inefficiency. For instance, technical efficiency or productive efficiency estimated the amount of output produced from the given level of input used in the production process see, e.g. discussions [3]. we have explored a paper by [42] explained that the property of land supposed to be natural where as leases are issued by administrative villages. Peter further contested that property of land is natural is cosmic rather it is under control by state government and ministry of agriculture since the formulation of different laws in 1980s and 1999..

3 T Though in the period from the 1950's to 1959 collectivization campaign was done successfully, however, later collectivization brought adverse impact on the overall economy at the time of historically memorable catastrophes. Later the novel thought of political ideology emerged the so called decollectivization. This thought brought a miracle change in from thinking to practice in Chinese life by carrying responsibility lost during collectivization. The ideology of decollectivization first initiated after the great leap period in China (1958-1962) mainly due to: (i) three successive years of bad weather, (ii) bad policies and poor management, and (3) incentive problems throughout collectivization campaign (See discussions, [12; 31; 38] decollectivization is one period or time jump increased out put however, Chinese total agricultural production showed continuous improvement and sustained growth (see discussions, [31, 32]. The present china started to be built through the household responsibility system rather than collectivization.

following major reasons: (1) tenure, land and rights and farmers incentives package implementation [3; 34], (2) cropland expansion (Yan et al., 2009), (3) out-flow-of labor from agriculture following the economic transition later resulted in many non-farm enterprise creation, (4) efficiently use of water resource uses in the face of climate change and fast world population for food-related production [49]. Based on population projection for food-related production will increase 3.7 billion by 2050, hence, these need additional future food production. A similar study conducted by Sotnikov [44] contested that agricultural production in typically planned economy opted for Russia, market, and trade liberalization had a significant implication for efficiency.

A recent study by Lin [30] point out that increasing use of inputs in the production process had an affinity with structure reform implemented in the period 1981-1984. Despite this, the availability and use of resources could not be a guarantee for less efficient in the utilization of water reservoirs in Semi-dry Northern China [25], which is Contrary to the previous study.

In spite of the tremendous sound impact of agricultural production efficiency, later reform in 1984, the fuelled agricultural production growth was slowdown due to the following reason: (1) the household responsibility system reforms completed in 1984/1984; (2) the drop in the availability of chemical fertilizer<sup>4</sup> and; (3) the swift out-migration of the labour force from cropping sector. This is due to rises in state procurement prices, however, are found to have no significant effects on productivity. This may be because of the fact that the state procurement prices, even measured with the above quota delivery premiums, are lower than market prices [31].

The original intention of the Chinese government, however, was to maintain historically-depressed procurement prices for major crops, tailored management and improving budgetary expenditure in agriculture investment since 1978. Fortunately, by 1985 China turned to be a net grain exporter which one of three important crops, cotton and oil crops and agricultural growth first time after a quarter of a century [30].

Unlike to the study made by Sotnikov [44] in Russia, the then Soviet Union though the Chinese government follows planned economy, the market seemed liberal and fast total agricultural production efficiency. One reform led to another until china by 1987 had moved a considerable distance from the Soviet-style command system, it had introduced in the 1950s [30; 31]. Since 1978 many of rural policy reforms changed radically from government's blueprint<sup>5</sup> to grounded economic reforms [41]. Remarkably, the 1950s Soviet-led fashion government structure following a dramatic reform in 1978, the market seemed liberal and fast total agricultural

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4 [21]. As many developing countries, increased use of inputs and chemical fertilizers' had brought significant difference in the production of food and fiber crops in china. Figuratively, cotton and grain crops had sound influence for export market (see, [31])

5 It is obvious hearing many promise and cognizant ambitious policies from the ruling party any where however, for peoples republic of china (PRC) it is possible. They change the plan document into practice (see the discussion made by [40], the government much succeeded in achieving the targeted goals.

production efficiency registered in China's economic history.

### 1.2. Theoretical Framework of Production Efficiency

Recently the measurement of efficiency has gotten considerable attention in agricultural and applied economics, particularly in the developing world. The measurement of Economic efficiency has been intimately linked to the use of frontier functions. To date, economic efficiency is measured based on the seminal paper on [16], and [1] frontier neutral assumption analysis.

Economic efficiency estimation has been done through the manipulation of technical efficiency and allocative efficiency. Using the assumption of Farrell, greatly influenced by [11] who measure technical efficiency the amount of input/output after the break downing the overall efficiency into technical and allocative parts. This is in-situ with definition made by Koopmans [26] simplify measure of economic efficiency.

This is to highlight the foundation of the frontier of production theory and how production efficiency was measured from the inception of the concept. The nature of measurement tool selection can be also a deterministic approach (both mathematical programming and econometrics) or stochastic frontier (econometric analysis) depending on the parametric and non-parametric techniques preference based on certain valid circumstance and criterion. The efficiency of agricultural production can be seen the cumulative of the technical, allocative and economic efficiency of total factor production irrespective of subjective measurement techniques and analysis preference.

Among dozens of papers, we have examined theoretical frameworks inherited to the thought of Farrell's [16] production efficiency measurement into on aggregate input-output increasing as whole agricultural production in one way. Besides, there is also another way to bring efficiency be reducing costs measured were reduced inputs to produce a constant output level. Therefore, the Chinese fast agricultural production efficiency brought dominantly aligned with input-output increasing, especially in the use of agricultural input utilization to boost production and productivity as reviewed literature revealed.

## 2. Empirical Evidences

Though many of the developing countries, experienced crippling with rapid population growth, political unrest, climate change, and the influence of western thought through donor agency such as the IMF and World bank group, however, china as Asian tigers build a robust economy. Beyond all the stories, the firm foundation of the contemporary Chinese catch economic development is the efficiency of total agricultural production undoubtedly. The myth of China's achieved fast and sustained economic growth was breaking the constraints of land resources and begun to bring improvement in yields [55]. The most important economic factors such as land, labour, capital, and fertilizers, are considered to be the main inputs for

agriculture production, and it is true for china [4]. Broadly speaking, for Chinese positive results brought when farmers have more schooling in both economic efficiency measurements i.e. technical and allocative [22; 52; 56]. In similar fashion, [54] Illustrated TFP (Total Factor Productivity) in Chinese agriculture increased by 47% from 1979 through 1996, and most technical innovations happened after 1987. There are mainly two innovations: the use of hybrid seeds and the changes in the cropping system. Consistent with this argument, China has been the largest pesticide user in the world since 1990 (Huang *et al.*, 2000c).

Apart from technological innovations, the technical and allocative efficiencies also change. A study by Pray *et al.*, (2002) proved the fact that from the years 1999-2001 in Northern china cotton growing region of the Yellow river, pesticide application by small holders was shown reduction whereas cotton production has increased. Using the data from Zhejiang Province between 1986 and 2000, [5] found that the increase in agricultural productivity mainly happened before 1990, and the technological efficiency, increased very fast during that period and the allocative effects can be insignificant; while after that both the technology and allocative efficiency are stagnant. As Lin [31] points out that the technological innovation and diffusion, such as F1 hybrid rice in China, is induced by market demand.

We have observed that inequality of production efficiency in South Asia increased after the Green Revolution [6]. As the previous study found that the technical efficiency, allocative efficiency, and economic efficiency for conventional rice production in Jiangsu Province from 1985 to 1986 were 0.94, 0.88 and 0.83, respectively, while those for hybrid rice were 0.85, 0.72 and 0.61 [53]. The technical efficiency, allocative efficiency, and economic efficiency for conventional rice were all higher than those for hybrid rice.

Moreover, using the data from over 900 farmers in Jiangsu province in 1993, [14] found that technical efficiency, allocative efficiency, and economic efficiency were 0.81, 0.71 and 0.57, respectively. However, compared with the historical data, he also finds that both technical and allocative efficiencies increased from 1980 to 1993.

Similar results found in Zhejiang province, the technical efficiencies before 1992 are lower than 0.4 and hereafter higher than 0.7 [5]. A notion also uses the provincial data to compute the technical efficiency from 1965 to 1985 and finds that the technical efficiency increased from 0.646 in 1965 to 0.843 in 1985 [13]. Similarly, the survey data computation indicated that for more than 7000 farmers in 1990 from Sichuan Province and Jiangsu Province, and find that the technical efficiencies are 55% and 77% of Sichuan and Jiangsu Provinces, respectively. This finding is consistent with our contention that agricultural production efficiency has registered a sound result in different administrative areas of the nation and in different periods since the launched period of the reform.

While we concluding, we have (1) the technical efficiency for hybrid crops is usually lower than that for conventional crops due to the increasing complexity of managing

production; (2) The technical efficiency and allocative efficiency in Chinese agriculture continuously increase before 1990, and hereafter are stagnant; (3) Regional disparity of the technical efficiency of agricultural production in China is very large; and the technical efficiency in Western China is usually lower than that in Eastern China; (4) human capital is very important for explaining the differences in technical and allocative efficiencies in China.

### 3. The Main Drivers for China's Agricultural Production Efficiency Improvement

This paper strongly reviewed and consulted many kinds of literature to get a remedy for the question of the myth of Chinese overall agricultural production efficiency. As mentioned in [10], the components of the reform were included: (1) agriculture; (2) state-owned enterprises; (3) the open door policy; (4) price system; (5) development of non-state sectors; (6) the banking and finance sector; (7) economic and social infrastructure, and; (8) the social welfare system. Among we evaluated empirical studies, we gave special emphasis for agricultural growth and found that as most of the papers concur that high-speed economic growth and improvement in agricultural production efficiency, in particular, has brought due to the following three core reforms as pointed out [28; 29; 31]: (1) price reform; (2) institutional reform; (3) planning and marketing reform and; (4) rural land reform.

#### 3.1. Price Reform

When we examined previous studies on price system, we do not find better price package which assures holistic benefits before the period of reform. However, after 1978 China's economic reform, the most important policy change intended by the government at the beginning of the reforms was the adjustment of procurement prices for major crops and the government subsidized agricultural inputs (e.g. Fertilizers). Before the reform, two distinct prices, (1) quota prices and; (2) above-quota prices, existed in the state commercial system. Quota prices applied to crops sold in fulfillment of procurement obligations; above quota prices for crops sold in excess of the obligation. Announced at the end of 1978 and started to be effective in 1979, quote prices increased 20.9 percent for grain, 23.9 percent of oil crops, 17 percent of cotton, 21.9 percent of sugar crops and 24.3 percent of pigs. The average increase in the quota prices was 17.1 percent (State Statistical Bureau, Trade and Price Statistical division, [47], cited in [30]).

Moreover, to Lin [31] and Wiens [52], price reform was very important for Chinese agricultural production growth. Prior to 1978, the price index was based on the implicit deflator estimated by Chow (1990) as indicated in [19], the price of building materials was fixed hereafter and then inflated between the period 1978 to 1990. Price adjustment reform had a sound contribution to present, China's

agricultural production stage.

#### 3.2. Institutional Reform

The changes in the farming institution of the collective system to the household-based system, now called the household responsibility system (HRS), was not intended by the government at the beginning of the reforms like the pricing system [30; 42; 3]. A study by Fan and Pardy [15] finds that the institutional changes from 1978 through 1984 contributed 38.6% of agricultural growth; and furthermore institutional changes from 1985. Through 1993 contributed 42.10% of the agricultural growth in China. The institutional changes from 1985 through 1993 have a larger impact than those from 1978 through 1984.

However. A later study by [14], finds that the institutional reforms contribute 60.08% of agricultural production growth during the period from 1978 through 1984, and -0.84 during the period from 1985 through 2000. It seems that there are some contradictions about the contributions of the institutional changes in Chinese agricultural growth. Even though the institutional reform had a sound impact of agricultural production, it is also suffering from a little fluctuation.

#### 3.3. Market and Planning Reform

As reviewed literature has shown the prevalence of planning in agriculture before the reforms was a result of the self-sufficiency in grain, which was a component of the Stalin type heavy industry-oriented development strategy that the Chinese government pursued since 1952 [30].

China's agriculture is whorl-known for the reform of the late 1970s and subsequent successes. Many have tried to determine what underlies these successes. The changing role of inputs, the rapidly updating technology, and the effects of deepening human capital and evolving institutions are of particular interest.

In the years immediately following the agrarian reform, [28] attributed a large share of productivity growth to institutional change that eliminated much of the "shirking" of labourers under collective farming. The role of the increased usage of modern inputs such as modern crop varieties, fertilizers, and pesticides on agricultural production may have been underestimated [56]. Based on reviewing paper this study suggested that labour productivity in the agricultural sector remained low as a result of continuing large surpluses of rural labour. Meanwhile, they found that the returns to capital investment in agricultural production were much higher than those in urban sectors, suggesting underinvestment in the agricultural sector.

#### 3.4. Rural Land Reform

One of the big reform package was rural land reform in the history of the present communist part of PR China, which is the foundation of the brought sound changes and improvements in the agricultural production.

#### 4. Can China's Agricultural Production Efficiently Be Sustained?

It is not as such easy task putting the exact scenario of agricultural growth fate. For instance, adverse climate change impacts, environmental degradation and pollution costs, labour migration and expansion of urbanization will be the challenge of future agriculture in China. Firstly, the recent evidence strengthens China's contribution to the emission of Nitrogen into the atmosphere as many developing and the developed nations, it has a recognized associated cost in future agriculture [35]. Nevertheless, atmosphere, nitrogen emitted both naturally and anthropogenically. However, it is an ill for agriculture and costs China as Europeans' and North America to stable or reduced it.

Secondly, alternation of land used coupled with climate change resulted in rapid degradation of mountains and hillsides across the globe. Nonetheless, the Chinese are pioneers in soil bio-engineering in the world history yet soil degradation accelerated at with many at a faster rate. To mention some of the main causes for ecological depletion such as poor farming practice, deforestation, road, and dam construction. This ecological deterioration alerts the central government to establish a natural forest protection program (NFPP) and rehabilitate of steep slopes by conversion of cropland into forests and orchards (Sloping Land Conversion Program-SLCP) (see, [46]. This tells us the continuity of agricultural production will be restricted if those problems not nearly arrested.

Thirdly, the authors argue that intensive cultivation and widely utilization of inorganic fertilizers may cause infestation threat [21]. However, the Chinese government has set regulation parallel to the broader use of agricultural chemicals. Later intensive pesticide application is shown reduction due to the spread of host-plant resistant varieties [20]. To date, biotechnology became a remedy for the avoidance of chemical residual, increasing mouth of the stomach and assuring food security in China.

There was an excessive labour with negligible productivity in some crops, this make happened through vastly use of pesticides use outspread in China's agriculture. During the period from 1995 to 1999 output of agriculture was elastic with massive fertilizer application [9; 13]. This is, therefore, agricultural production efficiency highly under threat to sustained because climate change, environmental degradation and resource depletion, pollution, population growth, and overutilization of chemicals may have an adverse impact. Concurrently, increasing age of the population, out-migration of labour from agriculture, the rapid expansion of urbanization and wealth accumulation could also handicap for continuity of this foremost and game changer sector. The nature of agricultural activity always seeks fresh and energetic employees. As examined reviews revealed that hiring fresh labour from the market will be limited due to the aging<sup>6</sup> of

population, urbanization, rural-urban migration<sup>7</sup> and increment of wealth from time to time.

Luckily, the birth of biotechnology and its positive remarkable result will also the other side of evidence that supports our prediction on continuity of agriculture with success story.

#### 5. Conclusion and Implications

As many of literature, we have explored indicated that the myth of China's agricultural production efficiency was the result of the radical reform held in the rural household farming system, market-oriented production and institutional change in the agricultural sector in particular. Although the reform had a great impact on agriculture to play its share of the current China's economy, It had also fluctuation in terms of efficiency and inefficiency of allocative, technical and economic measurements. Agricultural production efficiency is the result of the amalgamated of various reform packages. All reform packages are interlinked and interdependent plays a win-win result in China's economy. This was stimulated agricultural producer in one way and the government had also provided agricultural inputs through the subsidized package in another way and the cumulative impact was sounded in this primary sector. Total factor productivity (labour and capital), labour-intensive and fixed capital investment implementation was quite efficient.

Agricultural production in China was remarkably efficient and stimulated the industrial sector expansion, later fuelled the economic growth even if it under the threat of adverse environmental impacts due to overdose chemical fertilizer utilization, pesticide use, intensive and poor farming practice.

Generally, agriculture had played a pivotal role in current china's economy. Thus, in order to sustain the central government of China should take measures on a child policy, migration, environmental pollution and degradation, climate change and replace with sound policies with the environment and ecology-friendly agricultural technologies. The emerging biotechnology expansion and its fruits will also a high value to keep sustainable growth of agriculture in this nation

#### Competing Interest

The author (s) declared that there is no competing interest

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Chinese people will have 60 and more years of age by 2050 (see working paper series, Banister *et al.*, 2010). It is not that Labour availability has direct influence on economic growth and agricultural productivity. Over the past two decades, increasing elderly citizen and stress. This is associated with one child policy, low mortality and troubled health carrying system (see population reference Bureau scientific report, 2010)

<sup>7</sup> A group of investigators has been proved that seeking psychological well-being-with a single generation increased rural to urban migration and diminishing inter-generation adult to elderly labour substitution in rural China (Silverstein, cong, Li, 2006)

<sup>6</sup> According to UN's projections, the world of population aging will be 60 or older year of which about 2 billion found under this category by 2050. Similarly, 30%

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