Policy Brief

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Analysis of the Trends of Agricultural Mechanization Development in China (2000–2020)

Prof. BAI Renpu, China Agricultural University
A saying goes that "if you fail to plan, you plan to fail"; therefore, analyzing development trend is a pre-condition for sizing up the situation, and of critical importance to sound decision-making. Accurate analysis leads to sound decision and prosperity, while false analysis results in wrong decision and failure. Trend analysis is, in essence, a comprehensive analysis covering status, context and prospect of development. Status and trend development provides both practical and forward-looking insights, generating evidence for insightful decisions.

Thirteen years - an unprecedented period for mechanization development

Agricultural mechanization witnessed unprecedented development from 2000 to 2012, with the most rapid growth, continuous quality improvement, astonishing performance and enormous contribution. In spite of those achievements, mounting challenges remain to be addressed -- uneven, fragmented, and unsustainable nature in development.

Total power of agricultural machinery increased by 503 million kW in 12 years, from 523 million kW in 2000 to 1.026 billion kW in 2012, with an annual growth margin of nearly 42 million kW. Worth noting are the past ten years, when total power ascended 5 major steps -- 600 million kW, 700 million kW, 800 million kW, 900 million kW, and ultimately exceeded 1 billion kW in 2012, making it the headline among top 10 news for agricultural machinery industry in China for that year. In other words, total power increment for the 12 years after 2000 was nearly equivalent to aggregate total power of agricultural machinery over the past 50 years. In those 12 years, annual growth margin was around 29 million kW between 2000 and 2003, and around 46.8 million kW between 2004 and 2012. Those 9 years constituted a golden era.

Original value of agricultural machinery went up to 780.56 billion yuan in 2012 from 282.81 billion yuan in 2000, by 2.76 times and nearly 500 million yuan. In that period, annual increase registered some 18 billion yuan between 2000 and 2003, and around 49.4 billion yuan between 2004 and 2012. The four-year-period from 2009 to 2012 was a climax, when annual increment increased from 62.79 billion yuan to 69.1 billion yuan, thanks to the application of modern technology in agriculture.

Rural population employed in agricultural machinery sector rose to 53.54 million in 2012 from 34.13 million in 2000, up by 19.41 million in 12 years time and 1.6 million annually. New-generation farmers skillful of operating modern agricultural machinery have grown dramatically in number.

Households with agricultural machinery expanded to 41.923 million in 2012 from 27.147 million in 2000.

1 Published on 17th June 2013 on China Agricultural Mechanization Herald

2 Household with agricultural machinery: refer to household that owns/rents agricultural machinery (≥2 kW) for their own usage or providing services for others.
representing an increase of 14.776 million in 12 years time and an annual increase of some 1.2 million. Those figures serve as good indicators of farmers' initiative in developing modern agriculture. Given their increasingly proactive role in mechanized production, farm households skillful of operating agricultural machinery keep expanding as new business entities in agricultural production.

Total spending in purchasing agricultural machinery grew by 4.5 times, from 19.057 billion yuan in 2000 to 85.696 billion yuan in 2012. Continuous expansion of investment underpinned a sustainable mechanism to support agricultural development through modern means.

From 2000 to 2012, mechanized ploughing area went up from 62 million ha. to 110 million ha., lifting the coverage of mechanized ploughing from 47.7% to 74%; mechanized plantation area rose from 40 million ha. to 76.8 million ha., driving up its coverage from 26% to 47.4%; mechanized harvesting area expanded from 26.45 million ha. to 71.17 million ha., raising its coverage from 18% to 44.4%. With growing expansion of mechanized agricultural production, traditional practices have dwindled day by day.

Agricultural mechanization and agricultural machinery industry have mutually reinforced each other in the period from 2000 to 2012. Gross output value of agricultural machinery industry exceeded 100 billion yuan in 2005, 200 billion yuan in 2009 and 300 billion yuan in 2012 (registering over 330 million yuan), making China the largest manufacturer of agricultural machinery across the world. Facing sluggish exporting situation due to global financial crisis, the agricultural machinery industry targeted domestic market by expanding mechanized production in priority areas to tide over difficulties and ensure growth. By doing so, the agricultural machinery industry supplied over 90% of domestic market and maintained double-digit growth in terms of industrial output value for six years in a row, an outperformer in China's machinery sector. China becoming the world's largest manufacturer of agricultural machinery was the second headline among top 10 news in 2012 concerning China's agricultural machinery.

Rapid pick-up in comprehensive mechanized crop production (covering ploughing, planting and harvesting), mechanized corn harvesting, and mechanized rice seedling was a visible indicator for dramatic growth.

Coverage of comprehensive mechanized crop production rose to 57.2% in 2012 from 32.3% in 2000, by 24.9 percentage points in 12 years and more than 2 percentage points annually. The growth margin was more than 3 percentage points for 5 continuous years from 2006 to 2010, hitting a historic record for the development of agricultural machinery in China. China has become an emerging highlight for the 21st century in global agricultural machinery landscape. China realized two historic leaps in this period of time. One is the leaping forward into moderately developed stage from primary stage of development. In 2007, coverage of comprehensive mechanized crop production in China hailed 42.5%, exceeding 40%. The coverage further expanded to 52.3% in 2010, exceeding 50%, representing a second historic leap from traditional production based on human labor and draught animal power, to mechanized production. Agricultural production in China ushered into a new era featuring mechanized production. Both of the leaps were enlisted among top 10 news in 2012 concerning China's agricultural machinery, and mirrored ballooning growth of the middle class.

Aiming at whole-process mechanization for grain production, China made breakthroughs in the two weakest links -- mechanized corn harvesting and mechanized rice planting. Coverage of mechanized corn harvesting expanded by 40.8 percentage points in 12 years from 1.7% in 2000 to 42.5% in 2012, with 3.4 percentage average growth annually; in particular, the past few years witnessed unprecedented growth of more than 8 percentage points annually. In Shandong Province, a major corn producing province, annual growth rate was over 9 percentage points, even 10 percentage points in some cases, for several years in a row, hailing the "Shandong Speed". The coverage of mechanized corn harvesting in Shandong Province is now over 80%, in comparison with 71.5% in
2010 and merely 3.7% in 2000. Shandong is the first province in China to realize whole-process mechanization in corn production. This was incorporated into top 10 news in 2012 concerning China's agricultural machinery as the No. 4 headline. During that period of time, the number of corn combines increased from 3,600 in 2000 to 233,000 in 2012, with annual increase of 19,000. Annual growth was over 40,000 in the past 3 years and 63,000 in 2012.

Over the past 12 years, the coverage of mechanized rice planting rose from 5.1% in 2000 to 31.7% in 2012, by 26.6 percentages points in total and 2.2 percentage points annually. Growth margin was over 5 percentage points in the past two years. Worth noting was the dramatic growth in mechanized seedling, which covered 8.92 million ha. in 2012, 10 times of 2000. With its share in total mechanized rice planting area growing from 60.5% in 2000 to 93% in 2012, mechanized seedling has become the main model of mechanized planting and is being replicated widely. Tradition model of production based on intense labor is now experiencing fast changes. In line with this trend, the number of rice transplanters increased from 44,500 in 2000 to 513,000 in 2012, representing an annual increase of 39,000. The annual increase was over 60,000 over the past 4 years, and 86,000 in 2012.

The number of tractors went up from 13.737 million in 2000 to 22.825 million in 2012, representing an increase of over 9 million. Major changes were also witnessed in terms of its composition, with the share of large and medium-sized tractors\(^3\) rising and that of small tractors\(^4\) falling. Between 2000 and 2012, the number of large and medium-sized tractors increased from 970,000 to 4.852 million and the share in total from 7.1% to 21.3%; among those, the number of tractors with engine power above 36.8 kW has grown by 1.5 folds, from 443,500 to 1.381 million. High-horsepower tractor (above 58.8 kW) witnessed rapid growth in recent years, with annual increase of over 85,000 in the recent two years. Its share in large and medium-sized tractors reached 10.5% in 2012. While the number of small tractors went up from 12.7674 million in 2000 to 17.9723 million in 2012, its share in total number of tractors declined from 92.9% to 78.7%. In 2012, the market for small tractors contracted by nearly 180,000.

The number of farm tools matching large and medium-sized tractors increased by 5.46 times from 1.39 million sets in 2000 to 7.635 million sets in 2012, while the ratio of tractors to farm tools rose from 1:1.44 to 1:1.57; the number of farm tools matching small tractors grew by 12.828 million sets from 17.978 million sets in 2000 to 30.806 million sets in 2012, while the ratio of tractors to farm tools went up from 1:1.42 to 1:1.71. Both area and scope of mechanized production have expanded substantively.

Gross number of combine harvesters increased by over 1 million from 241,000 in 2000 to 1.279 million in 2012, representing an annual growth of 86,000. Annual increment in the past five years was above 110,000, and 165,000 in 2012. Dramatic changes occurred to combine harvesters. The number of rice and wheat combines increased from 237,500 to 1.0455 million, and the number of corn combines from 3,600 to 233,300. While the share of the former fell from 98.5% to 81.8%, the share of the latter rose from 1.5% to 18.2%. Mechanized harvesting expanded rapidly from wheat to rice and corn.

Improvement in agricultural equipment and its functions facilitated bold progress in the development of resource-saving agricultural mechanization. Diesel consumption for generating every 10,000 yuan worth of industrial added value in China reduced by 57% (85.2 kg) from 149.7 kg in 2000 to 64.5 kg in 2012, indicating distinct outcome in energy conservation and consumption reduction.

Upgrade in qualification and mix of agricultural practitioners is reflected by shrinking number of workers in the primary industry, and growing number of employees in the agricultural machinery industry. While the population

\(^3\) large and medium-sized tractor: tractor with engine power over 14.7kW (including 14.7kW)

\(^4\) small tractor: tractor with engine power over 2.2kW (including 2.2kW) and below 14.7kW
employed in primary industry shrank by over 100 million from 360 million to 258 million between 2000 and 2012, rural workers employed in the agricultural machinery industry increased by nearly 19.41 million from 34.13 million to 53.54 million. As a result, the share of people employed in the agricultural machinery industry in population engaged in primary industry went up by 11.3 percentage points, from 9.5% to 20.8%. That is to say, 1/5 of employees in the primary industry are working for the agricultural machinery industry, indicating major shifts in labor mix and qualification upgrade of the primary industry. More and more traditional farmers upgraded themselves into the new-generation farmers skillful of operating modern agricultural machinery and equipment. In fact, machinery operators have become main players in agricultural production, and traditional farmers offer support. Mechanized production is now the dominant model in agricultural production.

In parallel with these trends, innovative players in agricultural production and operation, such as households with agricultural machinery and specialized cooperatives on agricultural machinery, emerged with growing business scope, higher competence, and a higher level of specialization. Till 2012, specialized cooperatives on agricultural machinery represented 20.6% of the 167,000 service organizations engaged in mechanized production, while service organizations holding 200,000 to 500,000 yuan original value of agricultural machinery accounted for 28.9%, and those holding 500,000 yuan and above original value accounted for 14.5%. Among the 41.923 million households with agricultural machinery, those involving into specialized mechanized production services took up 12.4%, among which 409,000 households hold 200,000 to 500,000 yuan original value of agricultural machinery (0.98% of total), and 54,000 households hold 500,000 yuan and above original value (0.13%). In spite of minimal share at present, development of household specialized services is extremely promising.

Aiming at whole-process mechanization, the agricultural machinery industry made bold progress in extending mechanized agricultural production. In 2012, coverage of comprehensive mechanized production of the three major grains in China was 93.21% for wheat, 74.95% for corn and 68.82% for rice. Mechanized corn harvesting and mechanized rice planting, the two weak links in the past, are catching up rapidly.

Besides the main goal of whole-process mechanization in grain production, mechanization is making headways into cash crop production and animal production, and has extended to pre-planting and post-harvesting sections. Parallel advance in mechanization and industrialization offered strong support to the 4 Synchronous Development (the new-type industrialization, informatization, urbanization and agricultural modernization). In terms of regional distribution, mechanization is advancing from plain regions to hilly and mountainous regions, and from inland to coastal and aerial regions. Potentials of matching technology and equipment have been fully tapped. Agricultural mechanization and agricultural machinery industry have both entered a brand new landscape.

Having explored a pathway suitable to the Chinese situation, agricultural mechanization witnessed expedited development, which then helped to boost agricultural productivity, enhance capacity in risk management and mitigation, and bolster sustainable growth. Mechanized production offered robust support to enhance land and labor productivity, improve resource utilization, increase grain output and farmers’ income, and ultimately ensure food security. Furthermore, agricultural mechanization is driving forward industrialization and urbanization, and constitutes an integral factor behind China’s rise into the world’s second largest economy, and per capita GDP growth from US$ 1000 to US$ 6,000. Between 2000 and 2012, the coverage of comprehensive agricultural mechanization went up from 32.3% to 57.2%, and labor productivity in the primary industry rose by nearly 5 times from 4146 yuan/ca. to 20322 yuan/ca.; total grain output increased from 462.175 million tons to 589.575 million tons, up by 127.40 million tons. Over the past 6 years, total grain output maintained at above 500 million tons, hitting a historic record of increase for 9 consecutive years. Per capita grain availability grew from 364.7 kg to 435.4 kg, up by 70.7 kg; per capita net income of farmers increased for 9 consecutive years from 2253 yuan to

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5 The concept of 4 Synchronous Development was proposed at the 18th National Congress of the Communist Party of China in November 2012.
7917 yuan with a 1.75 times growth, presenting a good opportunity to narrow urban-rural income gap. In that period of time, employees in the primary industry declined by over 100 million, in comparison with nearly 150 million increase in secondary and tertiary industry; urbanization rate increased from 36.2% to 52.6%; rural population dropped by 166.15 million from 808.37 million to 642.22 million, while urban population increased by 252.76 million from 459.06 million to 711.82 million. Agricultural mechanization cemented the foundation of modern agriculture, and made significant contribution to fueling GDP growth from US$ 1.2 trillion to US$ 8.26 trillion, and per capita GDP from less than US$1000 to US$ 6100.

Mounting challenges remain to be addressed

In spite of those achievements, we must be fully aware of challenges ahead. Barriers must be cleared to strive forward. There are many challenges in the course of development, which are essentially caused by unbalanced, fragmented and unsustainable nature of development.

Unbalanced development is seen in the regional disparity and uneven progress in different sectors of agricultural mechanization. Progress varied in the northern dry-land areas and southern paddy areas, in plain regions and in hilly regions. The national coverage of comprehensive mechanization is 57.2%. In the 3 leading provinces -- Heilongjiang, Xinjiang and Tianjin, the coverage is already above 80%, in particular 89% in Heilongjiang; in contrast, the coverage in 9 provinces -- the lagging regions in mechanization, was below 40%, not even 20% in Guizhou. Retarded progress in agricultural modernization remains the weakest link in the modernization drive. In terms of sector disparity, uneven progress is apparent in grain production vs. cash crop production, and in crop production vs. animal production. Disparity, on the other hand, indicates potential and space for further growth. Taking a holistic approach to reduce disparity is what we should aim at.

Fragmentation has been seen in many ways: contradictions between the demand for whole-process mechanization and lagging progress in weak links; between mechanized grain production to ensure food security and mechanization in special agricultural segment to increase farmers’ income; between replacing man power with machinery and inadequate transfer of labors; between dramatic growth in machinery and equipment and insufficient relevant skillful workers; between current machinery supply and pressing needs for restructuring and industrial upgrade; between mechanized production and agronomy development; between demand for increased input and financial difficulties; and ultimately between demand for science-based development and barriers created by existing systems and mechanisms. Fragmentation occurred in the course of growth and development, mirroring the major contradiction between pressing demands and insufficient supply (covering the supply of technology, equipment, funding, human resources and institutions). This challenge must be addressed through science and technology breakthrough, deepening reform and innovation. Tackling weak links and enabling holistic development, in the process of transforming mode of agricultural production and advancing agricultural mechanization, will be the direction achieve sound and rapid growth.

The unsustainable nature of the agricultural mechanization development is reflected by the resource scarcity and mounting pressure on environment with growing population and improved livelihoods. Agricultural mechanization is in face of gloomy challenges to overcome constraints from resources and environment. There is a pressing need to develop resource-saving and environmental friendly machinery, to ensure sustainable growth of the industry.

In short, agricultural mechanization is in a critical period with unprecedented opportunities and challenges. Our job is to size up the new situation, seize opportunities, develop new ideas and take new measures to tide over difficulties and challenges, and consequently embrace a new stage of agricultural mechanization.
Enabling environment for development

China is in the moderately developed stage of agricultural mechanization, a period with strong potential for growth and strategic opportunities. The environment for development is very enabling.

First, robust legal environment, with sound national legislations to facilitate growth. China enacted in 2004 the *Law on the Promotion of Agricultural Mechanization*, which provided clearly in Article I its goal, i.e., “boost agricultural mechanization, and advance modern agriculture”. The law put agricultural mechanization onto a law-based track of development, and offered legal guarantee. Agricultural mechanization was highlighted more than once in several No. 1 Document of the central government.

Second, strong policy support. China began to subsidize purchase of agricultural machinery after 2004. With growing size of support and improvement of policy system, the government has already put in place mechanisms to ensure sustainable government input and stable growth of fiscal spending on agriculture, in a bid to grow agriculture with modern means and advance modern agriculture. From 2004 to 2012, central fiscal budget allocated to subsidize the purchase of agricultural machinery increased from 70 million yuan to 21.5 billion yuan. Such strong support from the government is unprecedented, in terms of scale, scope and criteria of the subsidies and mechanisms designed accordingly. In the meanwhile, supporting measures, such as subsidies to mechanized agricultural production, and agricultural machinery liquidation and renewal policies, are being piloted and replicated. No.1 Document of this year further proposed to “develop a series of major policies that will give more, take less and be liberal’, and will enable industry to nurture agriculture and cities to support countryside”.

Third, with economic strength, China is now in a new stage of development, that is, supporting agricultural and rural development through industry and cities. In the course of socio-economic development, when an agricultural society evolves into industrialized society and city-based society, industrial and urban development are often nurtured by agriculture. In this context, the government tends to explore agricultural resources to support industries. When industries and cities develop into certain stages and become strong, then the situation will be reversed. These rules do not apply in low-income countries, but only emerge when a country is moderately developed. The higher the income is, the more robust the rules are. In line with the World Bank classification, countries with per capita GNP (or per capita GNI) less than US$ 800 are low-income countries; when per capita GNP (or per capita GNI) is between US$ 800 and US$ 10000, the countries are middle-income countries (less than US$ 3000 for lower rank middle-income countries, and between US$ 3000 and US$ 10000 for higher rank middle-income countries). Countries are classified as high-income countries when the per capita GNP (or per capita GNI) is higher than US$ 10000. China joined the middle-income country community in the late 1990s and early 2000s, a turning stage for its economy. Government began to give higher priority to agriculture, by having enacted a series of pro-agriculture policies, rescinded agricultural tax, and offered ever-growing subsidies to agriculture. For agricultural machinery, subsidies for the purchase of agricultural machinery were introduced in 2004, when government formally incorporated this subsidy into the pro-agriculture policy system. At that time, China’s GDP exceeded that of France and ascended from the 6th to the 5th in the world; however, with per capita GDP of US$ 1490, China was still among the lower rank of middle-income countries. Central fiscal input in subsidizing the purchase of agricultural machinery was 70 million yuan that year, covering 66 counties and state farms of 16 major grain-producing provinces. 6 categories of machinery for grain production were the main subjects for subsidies. As the economy grows, the scope of subsidies has expanded to cover all crop and animal producing counties (or state farms), while subjects of the subsidies have also expanded to cover machinery dealing with grain, cotton, oil crops, cash crops, livestock, forestry and fruits as well as for precision agriculture. It was provided clearly in the 2006 No.1 Document that "China is now in a stage of facilitating agricultural and rural development

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6 No. 1 Document: refers to the 1st document released each year by the Central Committee of the Communist Party of China (the highest authority within the Communist Party of China). The Documents were all about rural issues consecutively between 1982 and 1986 and from 2004 to 2013 underscoring the top priority status of agriculture in China.
through industries and cities, with primary means and resources to better support agriculture, farmers and the countryside", which advocated "vigorous development of agricultural mechanization". In 2006, China surpassed UK to become the 4th largest economy in the world, with per capita GDP of US$ 2070. In that year, central fiscal budget allocated to subsidize the purchase of agricultural machinery increased to 600 million yuan. In the 2008 No. 1 Document, the central government noted that "agriculture is increasingly multi-functional, and its role as the foundation of economy is more visible in the new stage of socio-economic development. We have to proactively cement the role of agriculture as foundation of economy, and formulate more favorable policies to support agriculture"; "better leverage development of agriculture through industries and cities"; and "increase categories of machinery subject to subsidy, lift subsidy criteria, and make sure that the subsidies are accessible by all agricultural counties". In that year, China overtook Germany as the third largest economy in the world with per capita GDP of US$ 3414, marching into the higher rank middle-income countries community. Central fiscal input in subsidizing the purchase of agricultural machinery doubled to reach 4 billion yuan in 2008. In 2010, the No. 1 Document put forward to "improve means to support modern agriculture and facilitate changes to the mode of agricultural growth", and "further expand subsidies to the purchase of agricultural tools and machinery, increase categories subject to subsidy, and incorporate equipment dealing with livestock, forestry, draught resistance and water conservation into the scope of subsidies". In that year, China surpassed Japan to become the second largest economy in the world, with per capita GDP of US$ 5447. Central fiscal budget allocated to subsidize the purchase of agricultural machinery increased to 15.5 billion yuan. In 2012, China's GDP registered 8.26 trillion USD, with per capita GDP of US$ 6100. Central fiscal input in the purchase of agricultural machinery reached 21.5 billion yuan. Policy support to agriculture and the countryside have never been stronger in history. While emphasizing to "accelerate agricultural mechanization", the 2012 No.1 Document tabled a new requirement to "explore whole-process mechanization in agricultural production". With those developments, China is now with means and resources to nurture modern agriculture through industries and cities. Recognizing the new situation, government took forceful measures and established sound mechanism, thus rendered a golden era for agricultural mechanization.

Fourth, China is now in a new landscape, striving for integrated urban and rural development, and parallel progress in industrialization, urbanization, informatization and agricultural modernization. Agriculture will further cement its role as the foundation of economy as advancement is made in agricultural mechanization and modernization. On the other hand, urban and rural gap will be narrowed with rapid progress in industrialization and urbanization. Dramatic changes occured in social economic structures. The year 2003 witnessed a historic turn when employees of the secondary and tertiary industries outnumbered those of the primary industry for the first time in Chinese history. In 2011, two other historic changes took place -- employees of the tertiary industry outnumbered those of the primary industry, and urban population exceeded rural population. Robust food security, sharp income increase, and mighty economic strength have all testified the insightful argument in the Decisions of the CPC Central Committee on Major Issues Related to Advancing Rural Reform and Development, namely "agriculture is of strategic importance to ensure national stability and people's livelihood, and modernization of a country will never be achieved without modernization in agriculture". Premier Li Keqiang further highlighted the significance of agriculture in his visit to Jiangsu Province this year, that is, agricultural modernization is needed to facilitate the new model of urbanization, thus to balance urban and rural development, and enable parallel progress in industrialization, urbanization, informatization and agricultural modernization. This shall become the guiding theory for integrated urban and rural development in the new era.

Fifth, more favorable environment is created as reform and opening-up is deepening. Reform and opening-up benefit are championed by the Chinese citizens. By liberalizing economy and keeping pace with the times, China recorded extraordinary achievement and drew close attention from the world. In the eighteenth CPC National Congress, the CPC central committee made it clear to persist with reform and opening up, deepen economic institutional reform, implement innovation-driven strategies for development, and facilitate strategic
transformation of the economic structure; umbrella strategy is formulated to enable integrated urban and rural development, let farmers be an equal-footing partner in the modernization drive and share the outcomes of modernization, and advance modern agriculture; efforts will also be made to further liberalize economy and innovate models of opening up, sharpen international competition edge of Chinese companies so that China and other countries will mutually benefit each other in the global market. Through those means, we can bring more vitality and competition edge to the Chinese economy. By earnestly implementing decisions of the eighteenth national congress of CPC, China is now facing a more favorable situation for reform and opening up, generating more dividends from reform and opening up. Reform is also intensified in agricultural mechanization, by implementing more proactive strategies for opening up, injecting new vitalities, and introducing innovations in practice, theory and institutions. While agricultural machinery companies set their foot in global market, more and more multinational machinery companies made their ways into the Chinese market, creating an open, diverse, efficient and mutually-benefiting economic environment, which will surely generate larger technical, economic and social benefits.

Outlook for future development

Agricultural mechanization in the new era has four important characteristics. First, the sector is in need of transformation and upgrade in the process of rapid growth, and thus needs to value quality and efficiency more than ever. Second, agricultural mechanization is advanced in the context of “4 Synchronous Development”, which represents trend of the times. On one hand, agriculture related industries will be vigorously developed, to supply more advanced technology and equipment for agricultural production; on the other hand, the expansion of agricultural mechanization will need to purchase more machinery and equipment, which then help proper the agricultural machinery market, create more job opportunities for the secondary and tertiary industries, and facilitate the advance of industrialization and urbanization. Third, responding to the new target of “ensuring food supply security and farmers' income increase”, the agricultural machinery industry will proactively explore mechanization practices that can increase yield and income. Fourth, agricultural mechanization in the new era will be oriented towards resource-saving and eco-friendly practices which can overcome resource and environment constraints, and introduce more innovations.

In 2007, No.1 Document of the central government -- Suggestions of the CPC Central Committee and the State Council on Proactively Developing Modern Agriculture and Advancing Progress in Building Socialist New Countryside, summed up measures in developing modern agriculture, that is, to “equip agriculture with modern means, transform agriculture with modern science and technology, upgrade agriculture with modern industrial system, advance agriculture with modern operating models, navigate agriculture with modern philosophies on development and develop agriculture by culti-vating new-generation farmers”. Those six dimensions serve as important reference in guiding the development of modern agriculture, and need to be materialized following trends of the times.

Equip agriculture with modern means. In the new era, equal importance will be given to quantity growth, and improvement in structures and functions. As mechanized production is replicated and more stringent requirements on energy saving and consumption reduction are put into place, agricultural machinery will have to develop with larger diversity and higher quality. A market with higher quality but differentiated products will emerge. It should be noted that, total increment of agricultural machinery includes both fresh increment and machinery that replaces the obsolete ones, the number of which is rather sizable. Studies find out that a large portion of agricultural machinery are serving beyond the warranty, resulting in problems of high energy consumption, heavy pollution, poor safety record and high risks for incidents. At present, over 500,000 large and medium-sized tractors (10.5% of total), as well as nearly 10 million small tractors (55% of total) are reaching their age limit; for rice and wheat combine harvesters and rice transplanters, the number was around 200,000 (20% of total) and 39,000 (7.6%) in
In 2012, Ministry of Agriculture, Ministry of Finance and Ministry of Commerce jointly issued a document, to launch pilot projects on subsidizing the renewal of obsolete agricultural machinery, and harmonize purchase subsidy policy with renewal subsidy policy in 11 provinces/municipal cities. The number of agricultural machinery subject to renewal is quite sizable and worth close attention from the machinery industry. It is now a golden time for agricultural machinery, but machinery companies both in China and abroad are watching closely the Chinese market. To compete and survive in the market, companies will have to examine practical needs and potential demands in the market, follow policy directions, and position themselves accurately in the market. In this way, they can deliver safe, reliable, energy-saving, and cost-effective products which can distinguish themselves from other competitors. Also worth noting is that companies shall not focus exclusively on government behaviors, but also conduct in-depth analysis on practical needs of farmers. Farmers are the main buyers of machinery with autonomy and freedom of choice. They will do value-for-money calculation when they purchase the machinery, and thus value practical benefits. In recent years, central fiscal input in the purchase of agricultural machinery has been growing year on year, with substantive margin; however, some provinces showed downward trend in total purchase spending. For example, while central fiscal input in the purchase of agricultural machinery registered 17.5 billion yuan in 2011, 10 provinces witnessed decline in total purchase spending -8 due to less spending by farmers, and 2 because of shrinking input from local government. Therefore, examining practical needs of farmers is an essential part of market analysis.

Transform agriculture with modern science and technology. Modern science and technology can be employed in many ways to drive forth the development of agricultural machinery: increase the integration of agricultural mechanization and agronomy; build modern agricultural demonstration zones to guide and leverage development in a larger scale; develop and test new technology and new machinery, to introduce and extend resource-saving and eco-friendly machinery; explore to set up a market-oriented agricultural machinery innovation system that can pool resources from industries and research institutions, to enable innovation-driven development.

Upgrade agriculture with modern industrial system, advance agriculture with modern operating models, and navigate agriculture with modern philosophies on development. A series of measures will be taken: roll out integrated operation in agricultural mechanization; strengthen R&D of integration technology and its operating mode for modern agricultural industries; improve sophistication and cost-effectiveness of agricultural machinery; consolidate infrastructure and advance informatization drive; cultivate new players in mechanized production, and enhance capacity for intensive and large-scale operation, thus to increase return for the operation. Reform will be intensified to consolidate legal environment, allow transfer of land-operating rights to support operating at appropriate scale, encourage land transfer towards master farmers, farms household and farmers’ cooperatives, and support mutually reinforcing development of large-scale operation and agricultural mechanization.

Develop agriculture by cultivating new-generation farmers. Efforts will be needed to cultivating workforce for modern agriculture. Professionals for management, research and practicing will be cultivated for agricultural mechanization, to ensure that competent workforce with adequate quantity and sound structure are in place to attain the goal of mechanization. The number of rural workers skillful of operating agricultural machinery already reached 53 million and keeps growing; however, performance varies between trained workers and those with no prior trainings. Trainings, both in theory and in practice, are needed to cultivate those people into new-generation farmers who are well-educated, skillful of operation and proficient in market practices. Talent pool and training bases will also be established, to offer trainings for leaders of agricultural machinery cooperatives and managers, so that those people will become pioneers in building the socialist new countryside and developing modern agriculture.
About the Author

Prof. Bai Renpu, born in 1937, is a full professor and doctoral supervisor with the China Agricultural University and Chairperson of the Advisory Committee of China Research Center for Agricultural Mechanization Development.

Since 1962, Prof. Bai has been engaged in teaching and research on rural development, agricultural mechanization, economic analysis of modern technologies, and development strategy, policy and planning. Prof. Bai was the member of the Leading Group for the drafting of Law of the People's Republic of China on Promotion of Agricultural Mechanization. He was also the team leader of the Drafting Group for the Tenth and Eleventh Five-Year Plans for National Agricultural Mechanization Development, and member of the Expert Advisory Panel for the drafting of the Twelfth Five-Year Plan for National Agricultural Mechanization Development (2011-2015). In recognition of his remarkable contribution to the education and development of agricultural mechanization in China, Prof. Bai won numerous awards and honors from the Ministry of Agriculture, China Agricultural University, and relevant committees and associations. In 2013, Prof. Bai was granted the "Honorary Award of Lifetime Achievement for Agricultural Mechanization Development in China" by the Chinese Society for Agricultural Machinery.
CSAM, Centre for Sustainable Agricultural Mechanization, is a regional institution of the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), based in Beijing, China. CSAM started operations in 2004, built on the achievements of the Regional Network for Agricultural Machinery (RNAM) established in 1977 with support of UNDP, FAO and UNIDO, and the United Nations Asian and Pacific Centre for Agricultural Engineering and Machinery (UNAPCAEM). CSAM serves the 62 members and associate members of UNESCAP.

The vision of CSAM is to achieve production gains, improved rural livelihood and poverty alleviation through sustainable agricultural mechanization for a more resilient, inclusive and sustainable Asia and the Pacific.

CSAM’s objectives are to enhance technical cooperation among the members and associate members of UNESCAP as well as other interested member States of the United Nations, through extensive exchange of information and sharing of knowledge, and promotion of research and development and agro-business development in the area of sustainable agricultural mechanization and technology transfer for the attainment of the internationally agreed development goals including the Millennium Development Goals in the Asia-Pacific region.

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