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Brief history of agricultural engineering development in China: In memory of Mr. Zou Bingwen

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Born in 1920, Professor, founder and Founding President of the CAAE and the Former President of CSAE.

Mr. Zou Bingwen, also known by his English name P. W. Tsou, struggled for the cause of building Chinese agriculture all his life. He has made fundamental contributions in many aspects such as agricultural education, research, extension, inspection of farm products, foreign trade, and even rural banking and financing. Agricultural engineering as a relatively new area of agricultural science and technology was also brought to China under his initiative and direct leadership.

Mr. Zou Bingwen(P. W. Tsou)

In June of 1944, Mr. Zou Bingwen, as FAO's then vice-chairman, president of the Agricultural Association of China and resident representative in the United States of the Chinese Minister of Agriculture and Forestry, attended the Annual Meeting of the American Society of Agricultural Engineers at Milwaukee, Wisconsin and delivered a speech titled "China Must Have Agricultural Engineering". He said, China had a large population, about 80% of which was engaged in farming. This gave rise to most small size farms in China. The income of a farm could not and had never been enough to provide the farmer and his family a decent living. So the size of farms in China would have to be increased as a first step towards elevating the farmer's living standard.

He said, therefore China needed agricultural engineers to improve farmer's hand and animal-powered implements to suit his increased acreage, and to introduce tractors, especially in the large plains of Northeast, North, and Northwestern China.

He said postwar industrialization in China would need a large supply of labors from rural areas. The only way to keep agricultural production would be the improvement of existing implements and the mechanization of farms.

He said China would like to have thousands of small manufacturing and processing plants erected in rural areas. The machinery for those plants must be designed by agricultural engineers to suit rural conditions in China.

He said farm housing, farm storage, and handling of farm manure would also need the inventive genius of agricultural engineers to make the designs and to discover the proper materials for construction.

He said: "All of these require the work of agricultural engineers, and it explains why China must have agricultural engineering.

"How can China best develop agricultural engineering?" Mr. Zou continued: "There are three things which require immediate action as follows:

1）A department of agricultural engineering to be established in the National Bureau of Agricultural Research. At least two American experts should be invited to start its research program.

2）A department of agricultural engineering to be established in the College of Agriculture of the Central University. At the same time, the existing Department of Agricultural Engineering in the Agricultural College of the Nanking University should be strengthened. In each of these two institutions, at least one American expert should be invited to push their educational program.

3）A program of training 90 Chinese experts in agricultural engineering to be started by sending thirty selected college graduates over to the United States for the next three years. These men should spend at least three years in America——two years studying in school and one year training in factories and on farms."

The clear and concrete program proposed by Mr. Zou was immediately supported by many society members. International Harvester Company (IHC), the biggest farm

machinery manufacturer in the US, then decided to employ four most famous agricultural engineers in US to set up a Committee on Agricultural Engineering to work in China.

Dr. J. B. Davidson, invited by IHC and approved by the Chinese government then, was appointed as the team leader of the Committee. Dr. J. B. Davidson was professor and dean of the Department of Agricultural Engineering, Iowa State University, and was also the founder of the American Society of Agricultural Engineers, sharing lofty prestige among American Agricultural Engineers. Three group members recommended by Dr Davidson were Howard F. McColly, chief engineer in water conservation in the Farm Administration of the US Department of Agriculture; Edwin L. Hansen, agricultural engineer from Portland Cement Association; and Archie A. Stone, the former dean of Department of Agricultural Engineering, New York State University. IHC cooperate with 24 other farm machine and general machine manufacturers in donating their products for education and demonstration in China. IHC paid for committee members' salary, moving and travel expenses, and provided fund for teaching instruments and equipment.

Dr. J. B. Davidson

Howard F. McColly

Edwin L. Hansen

Archie A. Stone

The committee members left San Francisco for China on January 24, 1947. They planned to work in China for three years. But in the beginning of 1949, they had to return to the US because of the changes of political situation in China.

As for the program of training 30 Chinese professionals in agricultural engineering in the United States as mentioned above, 20 candidates of college graduates were confirmed through negotiation with IHC by Mr. Zou. Full scholarships were provided by IHC. The twenty students were selected through an open selection exam in Chongqing, Chendu, Kunming and Xi'an administered by the Chinese Ministry of Education in the beginning of 1945. According to Mr. Zou, among the preset 20 candidates, ten should come from agricultural universities and the other ten from departments of mechanical engineering of technological universities. Both groups of candidates should have over three years of practical working experiences.

At that time, there was no such term as "agricultural engineering" in China, and nobody knew exactly what it referred to. However, there were words such as "farm implement" and "agricultural machine". So, the aim was said to go abroad for studying design and manufacture of farm machines. The final ten candidates with agricultural educational background were Wu Xianggan, Wu Qiya, Li Hanru, Yu Youtai, Cui Yin'an, Cai Chuanhan, Zhang Jigao, He Xianzhang, Fang Zhengsan, and Xu Mingguang. The other ten candidates originally majoring mechanical engineering were: Zeng Dechao, Wang Wanjun, Shui Xinyuan, Wu Kezhou, Chen Shengzu, Gao Liangrun, Zhang Dejun, Li Kezuo, Xu Peicong, and Tao Dinglai. The twenty students left China for the US as two groups, one in May and the other in August 1945.

According to the arrangement made by Mr. Zou and IHC, the ten agriculture oriented students entered the Department of Agricultural Engineering of the Iowa State University to make-up study on engineering courses, and the other ten mechanical engineering oriented students entered the Department of Agricultural Engineering of the University of Minnesota to make-up study on agricultural courses. Both spent two years for Master's Degree in agricultural engineering. One year of practical field work in factories and on farms should be finished in school holidays and the time after studying courses.

During the study, the students found that "agricultural engineering" was not limited to design and manufacture of farm machines, but had much wider scope. The courses of agricultural engineering offered by universities generally included design of farm machine, farm mechanization and electrification, water-soil relation, rural building, etc, which were the several aspects needed by Chinese agricultural development as mentioned by Mr. Zou in his address.

Although those aspects were very important to agriculture, in view of technology of engineering, they were just simple applications of then well-developed

Old photo taken at Stockton, California, USA in May of 1948. Nineteen students in the picture are as follows: Front row, from left: Zhang Jigao, Wu Kezhou, Zhang Dejun, He Xianzhang, Wu Xianggan, Cai Chuanhan, Zeng Dechao, Tao Dinglai, Wang Wanjun, Wu Qiya, Li Hanru. Back row, from left: Shui Xinyuan, Li Kezuo, Gao Liangrun, Yu Youtai, (Three from IHC), Fang Zhengsan, Xu Mingguang, Cui Yin'an, Chen Shengzu.

technologies. They were not enough to form a new science. That was why only Master's Degree rather than Doctor's Degree was conferred to students majoring in agricultural engineering in US universities at that time. However, situation changed quickly after the Second World War. US agriculture based on overall mechanization presented problems which could not be easily solved only by using the existing technologies. And then a hot discussion on what "agricultural engineering" should cover was aroused among American agricultural engineers. The consensus reached was that "agricultural engineering" should include two aspects: "engineering for agriculture" and "engineering of agriculture". The former referred to the use of well-developed engineering technologies, while the latter involved in extensive and insightful engineering issues concerning agricultural biology, agricultural economics, etc. Therefore, agricultural engineering is not only an applied technology for developing national economy, but also a relatively independent science needed studying seriously and carefully.

Study and practical field work in the US made the students aware the great significance of the program initiated and implemented by Mr. Zou at the critical time of the ending of the World War Ⅱ and revitalizing China. Knowing the scientific contents of agricultural engineering given by American scholars reconfirmed their confidence and determination to engage into this great cause. In the beginning of 1948, on the eve of completing study in the US and returning to China, 30 Chinese students, including those studying farm machines in the US from other channels, got together at Stockton, California to set up Preparatory Committee of the Chinese Society of Agricultural Engineers. It was planned to set up formal society in connection with domestic scholars after returning to China.

In middle 1948, among the 20 people, 18 returned to China on schedule, excepting Xu Peicong prolonged his stay in the US to study for PhD of chemistry, and He Xianzhang stayed temporarily because of wedding. Some returned students were assigned to work in Mechanized Reclamation Administration, Town and Country Industrial Administration, and Farm Machine Company, all under the Rehabilitative Commission of UN. Others went to the Departments of Agricultural Engineering of the Central University and the Nanking University to engage in teaching, and to work in the Central Agricultural Experimental Station.

In 1949, the People's Republic of China was founded. By learning the experience of the former Soviet Union, central and provincial governments in China set up public institutions concerning agricultural mechanization one after another. Specialists trained by Mr. Zou's program, were certainly assigned to those institutions. In the field of manufacturing, North China Farm Machine Main Workshop was founded, in which Li Kezuo, Wang Wanjun and Zhang Dejun were assigned. In mechanized agriculture, Tao Dinglai, Shui Xinyuan and Xu Mingguang were assigned to three large state farms. In the field of education, after adjustment of higher institutes, Beijing Agricultural Mechanization College (Zeng Dechao, Li Hanru), Northeast Agricultural College (Yu Youtai, Wukezhou), Nanjing Agricultural University (Wu Xianggan, Wu Qiya, and Gao Liangrun), Agricultural

Machinery College of Jilin University of Technology (Zhang Dejun, Cui Yin'an), Department of Agricultural Engineering of Shenyang Agricultural College (Zhang Jigao), etc were founded in succession. In scientific research, Beijing Research Institute of Agricultural Mechanization (Tao Dinglai), Nanjing Research Institute of Agricultural Mechanization (Shui Xinyuan), and Guangdong Research Institute of Agricultural Mechanization (He Xianzhang) were established one after another. Agricultural engineers trained by American experts in the two Chinese universities were assigned also to those institutes and colleges after graduation.

In March 1978, China held the first National Science and Technology Conference in Beijing. The conference decided that agricultural engineering should be one of the 25 most urgent sciences and technologies to be developed. Emphasis was put on "agricultural engineering" rather than "agricultural mechanization" because the result of stressing agricultural mechanization for years was evidently not sufficient to achieve agricultural modernization, with many engineering problems other than mechanical ones in badly need of study in agriculture. The decision was also a result of learning from western developed countries after implementing opening policy. In May of 1979, the State Council approved to set up Chinese Academy of Agricultural Engineering (CAAE) under the leadership of the Chinese Ministry of Agriculture and Forestry, and Tao Dinglai was appointed as president, and Zhang Jigao as vice-president of the CAAE. In November of 1979, Chinese Society of Agricultural Engineering (CSAE) was founded as a secondary society to the Chinese Association of Agricultural Science Societies (CAASS).

Since founding, the CAAE studied hard foreign experiences, and made in-depth investigations on engineering issues in domestic rural areas. Research and design of land use, agricultural environment, rural energy, agro-product processing, and the applications of computer science and technology, remote sensing and system engineering in agriculture were actively carried out. All those technologies, combined with quite matured and actively functioned farmland water conservancy and agricultural mechanization enriched the contents of Chinese agricultural engineering. Typical examples include comprehensive land restoration of saline soils in the North China Plain with a project funded by World Bank loans, and the research and design of household biogas digesters in large rural areas of China.

In 1985, the State Education Commission decided to change all the original departments, colleges, and universities of agricultural mechanization into those of agricultural engineering, expanding their teaching contents, to provide better chances for them to serve for agriculture. In the same year, the CSAE was upgraded to a first-level national society, independent from the CAASS. Also in 1985, Transactions of the CSAE was launched. Since then, the discipline of agricultural engineering established its own status in China.

Agricultural engineering has played critical roles in agricultural development of China. In addition to the great role of irrigation and water conservancy played in ensuring yield against flood and draught disasters, the roles of agricultural mechanization are also critical. In 1984, Chinese agriculture gained a bumper harvest, with the yields of grain, cotton, animal husbandry and fishery all reaching the highest level in history, so that the Chinese government could declare to the whole world for the first time that China has solved her problem of adequate food and clothing. The great success resulted from the elevated motivation of farmers was mainly due to rural system reform, but also due to agricultural mechanization as the production enthusiasm of farmers was revealed by buying farm machines.

Farmers have demands, and factories design and manufacture farm machines and other equipment, thus farm machine industry has now become one of the most important components of the Chinese industry. Therefore, farm mechanization did have played a vital role in pushing forward industrialization in China.

Agricultural engineering in China has made great contributions to the rapid development of national economy. Meanwhile, agricultural engineering itself has achieved grand development. For example, in the summer of 2007, the number of large-size wheat combines across China reached as many as 800 000, which reflected the agricultural mechanization level of present China.

Mr. Zou Bingwen returned to new China in 1956, appointed as advisor of the Ministry of Agriculture of China. He greatly concerned the education and scientific research of agricultural engineering. He died in Beijing on June 11, 1985 without chance to see the great achievements of Chinese agricultural engineering today. Looking back on his tentative plan and a lot of concrete organization work dozens of years ago, as it were, his plan and idea had been realized and verified with great success. Some achievements and progress that have outreached his primary vision and imagination should be what he was willing to see.

(Translated and edited by Dr. Wang Yingkuan)