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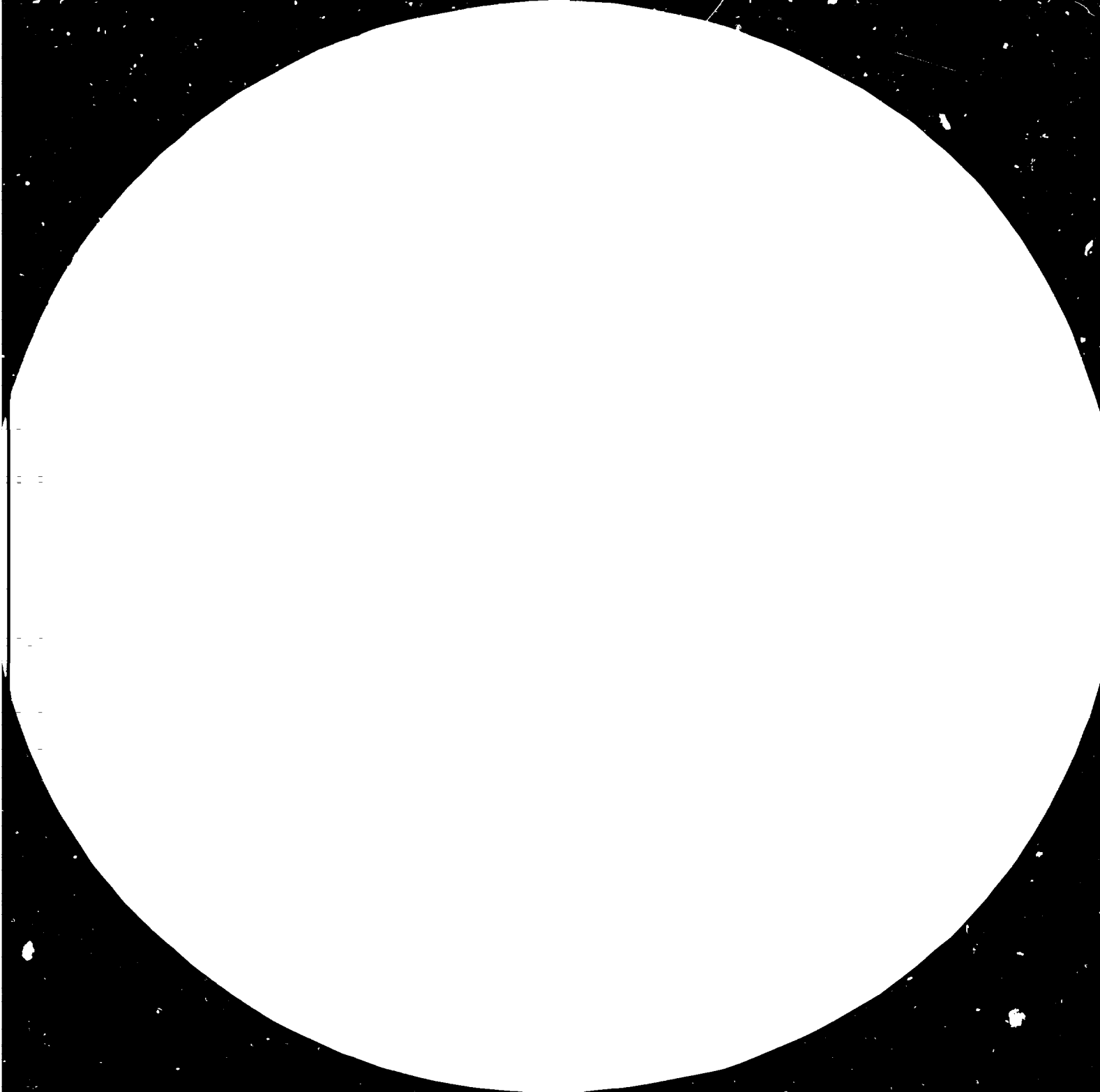

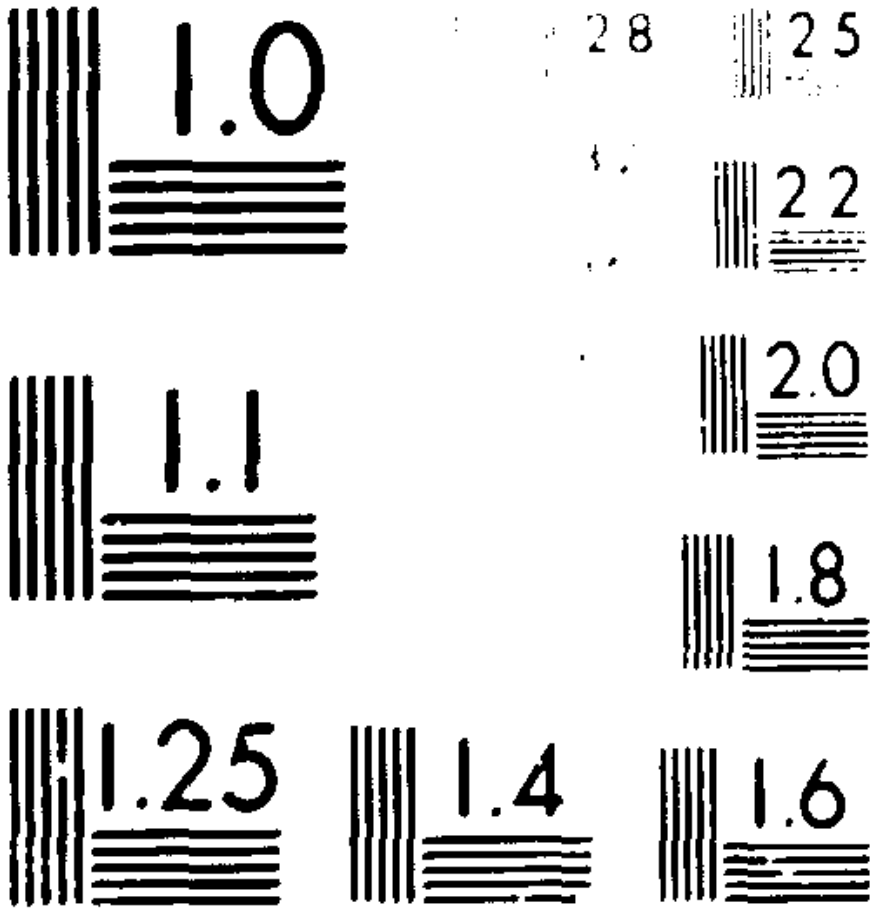
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The policy for Agricultural Mechanization in China and its possible applications to other countries and regions

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CONTENTS

1. Introduction

China feeds and clothes one fith of the world's population with less than 7% of the world's total cultivated area with about 80% of her population on the farm and about 0.12 hectares per capita. Bearing in mind her huge population and the low bottom line from where she started in 1949, the founding of the People's Republic, before which femine and starvation prevailed, it is by no means an easy task at all. On the basis of social reform to let each farmer own his land, she increased the gross grain output by 150% of that before 1949 and sees to it that no one is in want of food and clothing through building up her own industries, developing forestry, animal husbandry, fishery, side line production and agriculture by means of combination of measures, e.g. land capital construction, irrigation and drainage, application of fertilizer in addition to farm manure, prevention of diseases and pests, improvement on a variety of crops and employing better seed, better cropping system etc.

Agricultural mechanization is one of the most important factors China has taken. She has built up her own agricultural machinery industries to meet the need of the realization of her agricultural mechanization, an industry of more than 1,900 factories producing more than 1,800 products and power equipments ranging from fraction to several thousands in horse power. Farm machinery per se is, at least in the major part of it, a mean but not entirely an end, and the mechanization of agriculture involves almost every phase of problem from social to economical, technical and biological as well. The agricultural machinery industry can go no much further with negligence of those factors involved in agricultural mechanization, at least not when things are taken into consideration in a national or regional level.

2. Situation before the founding of the PRC

Before the liberation, the Chinese peasantry, living in poverty and backwardness under the oppression and exploitation by feudalism, imperialism and the Kuomintang reactionaries, had to cultivate their land with primitive hand tools and draft implements, produced by the traditional blacksmith and foundry shops. Before the second world war, a few people made trials of mechanized farming in several districts such as the Great Bend of the Yellow River, Ding county of Hopei Province, Nada county in Hainan Island etc. But it did not work as the fuel cost alone was higher than the gross income per hectare. During the War of Resistance against Japanese invasion (1937-45), some farm

machinery factories were set up for manufacturing 3-5 H.P. low speed heavy fuel engine, spare parts for petrol engine, spraying and dusting equipments and so forth, but they did not make much ground neither. In the post war period, the Kuomintong Government received a certain amount of agricultural equipment, material and financial aid from UNRA, and set out some mechanized reclamation projects, some powered irrigation and damage stations, some pilot plants of rural industry, a factory manufacturing small engines etc. As a matter of fact the first employment of power machinery in Chinese agriculture can be traced back as far as the year of 1905. Nevertheless, on the eve of the founding of the People's Republic of China the annual production for uses in agriculture was not up to 20,000 H.P. The main reason for its failure to grip ground was that the farmers just could not afford machinery.

3. Stages of Agricultural mechanization development since the founding of the People's Republic of China

3.1. In the period of national economical rehabitation (1949)1952)

- a stage of ensuring sufficient supply of traditional tools, improving animal drawn equipments, and setting up large scale mechanized pilot state farms.

The founding of the People's Republic of China led to a period for rehabitation of the national economy. Land reform was carried out so that each farmer got his own land and draft animal. To see that no one ran short of farm tools indispensible for agricultural production, the People's Government, first of all, rendered agricultural loans and other aids to farmers for purchasing them and to the blacksmith and foundry shops for restoring the production of farm tools. In the meanwhile, for the purpose of further boosting up the agricultural production, design and development works were carried out to improve animal drawn implements, water lifting facilities, sprayers and dusters, wheel barrows etc. Farm equipment factories with modern manufacturing technology were also set up. A few large scale mechanized state farms and tractor stations were established as pilot projects to acquire experience. Technical training centers and research institutes for agricultural mechanization at various levels were also on growth.

3.2. In the period of planned economical construction (1953 and continuing.

Since 1953, the country has launched into planned economical construction. Agricultural producers' cooperatives started to appear in the country-side and spread all over the country in about 1956, and eventually emerged into the form of people's commune in the year of 1958. Several tens of small individual farmers pooled their land, draft animals, implements and other capital goods together to form a production brigade[1] and ran it under common ownership among themselves. Small plots of field were put into large ones. The expansion in production scale called for bigger tools and better technique. Meanwhile, the Government established extensively large scale mechanized state farms by land reclamation in the border areas such as Heilongjiang Province, Xinjiang Autonomous Region, Yunan Province and Hainan Island etc. In order to supply farm equipments needed for the development of the collectively owned agriculture and the large scale state owned mechanized reclaimed agriculture the Government began to set up factories to manufacture tractors, trucks, internal combination engines and farm machinery as well as plants for fertilizer, pesticide, plastic film and explosive for agricultural purposes. Up to the end of 1978, there had been more than 1,900 agricultural machinery factories all over the country and 1-2 repairing shops in each county. With a very few exception, each province and municipality had its own small scale, in its comparative sense, electric power stations, coal mines, steel works, fertilizer plants, cement mills, etc. 90% of the people's commune and 70% of the production brigade had also set up some kind of industries and enterprises in their own level. Quite a number of tractors and walking tractors had been in use and the total mechanical power in agriculture amounted to 170 million H.P., approximately 1 H.P. in 2/3 hectares in average. Area under drainage and irrigation summed up to 44 million hectares with powered irrigation up to 24 million hectare.

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1 Normally, there are several tens of People's Communes in a county and several tens of production brigades in a People's Commune.

Take Shandong Province for example, in the three years of 1975-1977, the area ploughed with tractors went up from 28% of the total cultivated area to 48.6%, irrigated area from 48% to 60%, fertilizer application rate from 188 kg to 525 kg per hectare while the food production increased at a rate of 8.5% a year in average. In such a large country like China, with her large population and vast territory, to carry out agricultural mechanization itself is a great social practice.

The experience in China has shown that the development of agricultural mechanization plays an indisputable part in raising agricultural production, increasing agricultural productivity, improving working conditions, enhancing the capacity against natural calamities as to ensure bumper harvests, speeding up the national industrialization and consequently consolidating and developing the collective economy of the people's commune.

3.2.1. The intermediate stage of mechanization - a stage of mechanizing most of the stationary processing operations and some of the indivudal items of field operations.

3.2.1.1. The continuity in its development of agriculture.

The restoration and development of agriculture can only be achieved on its original basis and tradition. Such was the case in China. Agricultural mechanization in the initial period in China arose from the actual needs of the agricultural cooperatives and the later production brigades of the people's communes. Along with the improvement in hand-tools and animal-drawn implements, powered machinery were also introduced to bring about a more intensive and timely cultivation and to strengthen the capacity against natural calamities, so as to increase crop yields, to reduce crop losses, and to reduce labour intensity. The powered machinery employed in this stage neither did nor could replace the draught animals from the farm and bring about a sharp reduction in agricultural labour force. Yet the employment of powered equipment on the basis of its original manual and animal drawn operations did give a great impetus to the agriculture development. For example, drawing water mechanically for drainage and irrigation was of pronounced effect. At the very beginning, manual and animal driven water lifting equipment was used and improved, and before long, this was replaced with pumps driven

with electric motors, stationary diesels, and tractors or water turbo pumps. Another good example was the replacement of shoulder pole carrying with wheel barrows and trailers drawn with walking tractors or 4-wheel tractors for farm transporting work which commonly summed up to about 50% of the total farm work in the country-side and had even more prominency in the mountainous regions. Spraying and dusting equipment of various types, ranging from the hand-operated one to the knapsack type and large size powered sprayers and aeroplane dusters did their share of contribution. Electrically driven processing machinery for rice hulling, flour milling, fodder chopping and feed grinding spread the most rapidly. Deep ploughing, timely cultivating and sowing, fertilizer applying, harvesting, threshing with improved animal-drawn implements and implements drawn by the walking tractors and the conventional tractors also went into practice. The utilization of plastic film and other environmental facilities, the utilization of construction machinery and explosive for farmland capital construction, and the development of bio-gas producing units run on organic refuses and other types of power generating units with local natural energy resources were also in rather extensive use.

3.2.1.2. The policy for agriculture adopted in this intermediate stage of mechanization.

Agriculture was to be developed in continuity to its original basis. As dictated by the food demand of the nation, the basic policy for agricultural production in this period was to grasp unswayingly grain growing as the key link, while at the same time taking care of all-round needs. Consequently, it was not unusual practice to grow grain, cotton, vegetable oil, meat, eggs or fruit simultaneously in the same commune or production brigade. The diversity in crops obviously made it difficult to mechanize all the items of field operations. So as to make full use of the natural resource in agricultural production, double or even triple crops were grown in a year and interplaning (sowing the next crop in-between the rows of the previous crop) was also in general practice. All these gave rise to inconvenience in using machinery and the variety of implements needed were large in number too, since the kind of field operation was so much. Mechanization at this period could not be otherwise but based on hand-operated and animal-drawn implements with introduction of powered implements by individual item and left alone to make its ground through its own merit.

At this stage, manual, animal and mechanical power existed simultaneously on the same farm. Even in those newly reclaimed large-scale state farms, due to the same reasons as mentioned and due to the lack of proper prototype of powered implements for every item of its field operation, and furthermore, due to the non-existence of agronomic technology which facilitates its mechanization, and due to the influence of tradition, mechanization was practiced almost in the same way as that in the collective agriculture, that is to say, manual, animal and mechanical power existed simultaneously on one farm.

3.2.1.3. The development of appropriate prototypes for all items of field operation to realize a complete mechanization for a locality required a considerable span of time so it was impossible to skip this intermediate stage of mechanization.

Generally speaking, the conventional tractors and machinery used in the developed countries are applicable to the north-eastern part and the northern part of China with a less degree of modification while for southern China, extensive modifications are needed. We need tractors with all their matched implements of really good performance for the rice paddy fields, the muddy fields, hill-side terraced fields and for ridge farming areas where the soil temperature is low and wind erosion prevails. In order to develop and design the prototypes of tractor and various agricultural machinery suitable to the local conditions, the Government established research institutes of tractors and agricultural mechanization and design and development centres of tractor and agricultural machinery at all levels with professional contingents to be responsible for the task and at the same time launched mass movement in tool innovations in which peasants' ideas of ideal implements and their creative expressions were summed up and further improved by professional technical personnel with no handicap of patent rights. To me, in some sense, mass movement in technical innovation was a sort of movement in which the masses were self-taught to learn technique, to improve their own tools and the methods of working in their production.

3.2.1.4. The policy for agricultural machinery industry in this intermediate stage of mechanization.

All agricultural machinery should fulfil the agronomic requisites dictated by tradition and local conditions. Consequently, the policy

for agricultural machinery industry at this intermediate stage of mechanization was as follows: the majority of the principal machinery was to be of medium and small size so as to suit the field size. This machinery was to be manufactured mainly in factories in the locality. It was purchased primarily by the collective agriculture.

3.2.1.5. The inherent shortcomings of this intermediate stage of mechanization - mechanization by item of field operations.

At this intermediate stage of agricultural mechanization, there was great expansion both in agriculture and industry of agricultural machinery in China. However, there also existed some inherent shortcomings. Firstly, the unit agricultural production cost was high due to the provision of three sets of power on the same farm - manual, animal and mechanical, leading to a reduction in economical profits in agricultural production. Investigations on 2,162 production brigades in 1978 showed that in a span of 12 years (1965-1976), as a result of this intermediate mechanization item by item of field operations (altogether with other measures such as application of chemical fertilizers, etc. grain yield per hectare increased by 36% while the production cost per hectare increased by 54%, netting a 20% reduction in work day pay to the commune members. What is more, the consumption of grain for feed and fodder by draught animals sums up to a considerable amount, besides the man labour needed for tending item. Were all the draught animals replaced with tractors in agriculture and all this grain fodder and labour to be used in raising beef cattle instead, that would bring substantial increases in production and income as well. For the province of Heilongjiang, the amount of grain alone consumed by draught animals ran up as high as one million tons per year.

As to the agricultural machinery industry itself, small and medium size factories scattering in various localities, making machines and equipment in different types, not in series, with unstandardized parts, and manufactured in small scale production was a very expensive industry for a country to burden. Each one of these agricultural machinery factories was supposed to supply many kinds of products to the local community. In a comparative base, for such a factory, the specific capital investment was high, production efficiency was low and cost of production for each piece of equipment was high. Due to less degree of interchangeability of parts, the assembly, maintenance and repair were less convenient. Usually a piece of machinery could

not be used efficiently and put into full operation. For a factory of small and medium size, efficient use of facilities was generally a problem.

3.2.2. The advanced stage of mechanization - a stage trying to realize complete mechanization, i.e. replacing all draught animals as form of power in agriculture.

3.2.2.1. The advantages of complete mechanization

The criterion for the status of complete mechanization is to replace all draught animals with tractors and machinery so as to raise labour productivity sharply, to release labour force so far tied up in grain production, and to open up new frontiers of production and construction, to broaden them and to deepen them. China has a vast arable and exploitable area in mountainous region, grass land, desert and fresh water districts facing which the individual peasant operating in small scale before the establishment of the peoples' commune could be but helpless. There is no reason why some of them cannot be exploited with profit. Besides, there are various propable kinds of industry, side-line production, enterprise, service activities and so on. It is only then that the people mass of a country like China can be supplied with bumper material and spiritual welfare. That is why the Government of the People's Republic of China takes agricultural mechanization as the highest strategy in her task of developing agriculture. After the long journey we groped through in the last twenty years, in our process of developing the agricultural machinery industry as well as the agricultural mechanization with all its successes and failures, we come to the point of organizing a new long march. The Government plans to realize the four modernizations at the end of the century with agricultural mechanization as one of her biggest policy in the modernization of agriculture. As all phases of factors are involved in agricultural mechanization, namely, social, economical technical, financial etc. a number of representative county and state farm, typical to various districts, were selected as experimental stations to take the lead in experimenting how to realize the complete agricultural mechanization status and to seek the best way through with as less detour as possible.

3.2.2.2. Some agricultural policies facilitating mechanization felt needed in this advanced stage of mechanization to realize the status of complete mechanization.

The capital investment in the portion of mechanical facilities for the complete agricultural mechanization is high by itself. It would be still much higher if a large variety of crop are grown on the same farm as the prevailing practice now in China. Take Tong Country in the suburb of Beijing for example. The main crops are wheat and corn. Number of field

operations and primary processing after harvesting sums up to 32 items for wheat and 37 items for corn. The capital investment on machinery will be 2 to 3 times higher than that for the present intermediate stage of mechanization with only a few items in this case, 7 or 8 of field operation mechanized. Investigation will also be much higher than that in the developed countries where agriculture is highly specialized. There are cases in China showing that when a farm specializes on what is best for its natural conditions and resources, it will increase its gross income several times. For instance, it is more profitable to grow cotton, sybeans, sugar can, sugar beet, tea, mulberry etc. in their suitable districts instead of grain. For greater agricultural production and lower production cost, also for less capital investment in mechanization the national agricultural policy has been adjusted slightly from taking grain production as they key link to that of specialized farming to an appropriate degree in accordance with the conditions of each region and properly centralized into belt so as to let each area always stresses on its suitable crops.

Plant breeding, cropping system, agronomic requisites etc., which all, in a real sense of it, dictate the specifications of prototypes of agricultural machinery, should also be considered and modified in light of facilitating mechanization.

3.2.2.3. The problem of raising funds for this advanced stage of mechanization

The fund needed to realize the complete mechanization of agriculture in a country is enormous. Therefore, it is very important not only for the Government but also for the production brigades to make a good decision on the very first how to make the most use of a limited initial fund so that the investment in mechanization would be most effective, assuming a quickest return and be ready for further investment in a second cycle so as to put the process into a flying cycle. To get answers to questions such as where what and when investment should be put, extensive surveys and comprehensive investigations in the field of agricultural mechanization economics should be carried out.

Generally speaking, for investment, the Government practices a policy of priority and doing things in a concentrated efforts. As positive measures to promote agricultural mechanization the Government decided to increase state investment in agriculture, to readjust price differentials between industrial products and agricultural produces, to step up agricultural credits, to exercise special preference and convenience in providing loans of low interest, financial allowances and aid for mechanization projects. The collective accumulation of funds by the communes and the production brigades come not only from agricultural produces alone, but also from industries and all kind of sideline production owned by them as well. The Government at the same time decided to step up all out aid for expanding commune or production brigade owned enterprises and to practice a tax-free or low tax policy.

3.2.2.4. <u>The problem of employment of excess labour force in this advanced stage of mechanization</u>

In order to help providing funds for agricultural mechanization as well as to arrange the employment of excess manpower arisen from mechanization, a great many communes and production brigades run their collectively owned enterprises such as to process agricultural produces before they are sold to the market, to set up industries to make full utilization of local resources, to go into all kinds of side-line production, to receive contract arrangements with factories and enterprises in the city to do some processing, turning out parts, or any other kind of work in good use of their labour force. With the expansion of commune-run industries and enterprises the manpower transferred from agriculture after the realization of complete agricultural mechanization would not be necessarily flocking into large cities from the countryside but instead, can be organized into some kind of combined enterprises even in the suburbs and in the state farms.

For example, Xiashitang Brigade of Jiajie Commune in Yibin County, Sichuan Province, which is sited along the bank of Mian River, with a big mountain behind, set up kilns to make bricks with the yellow clay from the hillside and transported them by water with their own yunks to Yibin City for sale. With the money they earned they built a pumping station in the gullies, set up a mill for rice hulling, fodder chopping and flour. With all the by-products of the mill they raised pigs in scale. In taking away the clay for brick making they dug it in a planned way so that small plots of fields were turned into larger ones.

By mixing clay to the sandy fields and mixing sand to the clayey fields they raised the productivity of the fields up to more than 15 tons of grain per hectare. The area of favourite spots on the hillside was turned into terraced fields for sugar cane growing, which gave yields up to 30-40 tons per hectare. Among their gross production, agricultural comprised only 37%, animal husbandry 11%, while industry 51%. With the industrial income they bought tractors, stationary diesel engines, walking tractors, electric pumping units to meet the serious labour shortage. They brought about in their own case, an all-round development of agriculture and industry.

3.2.2.5. Policy for the agricultural machinery industry in the advanced stage of mechanization

To realize the status of complete mechanization of agriculture the agricultural machinery industry has to supply all types of machinery needed, to produce them in better quality (both in the agronomic sense as well as in the mechanical sense), to cut down costs drastically from the present level, to guarantee adequate and timely supply not only of equipment alone, but also the spare parts as well, and to render satisfactory maintenance, repairs and service of all kind. For these purposes, the whole agricultural machinery industry has been under an organizational reform, taking all the existing enterprises as the backbone and turning them into specialized production in large scale: machines to be turned out in series, parts to be standardized, management to be improved, advanced technique and modern scientific management infused, and so on.

Emphasis was also stressed on strengthening strategical research work on agricultural mechanization, on experimental research work in co-ordinating agronomic measures with machinery in the field of plant breeding, cropping system, machine system, requisites of individual machines etc. on design and development work of prototype of a complete series of tractors and thier matching implements for each district, and also on research work into metal processing, material treatment and technological innovation.

3.2.2.6. Policy for the full use of equipment owned collectively in the advanced stage of mechanization

In order to make full use of any equipment available, in some communes agricultural machinery owned by different production brigades were pooled together in busy seasons in the principle of self voluntary and mutual benefit without change in ownership, to be utilized in unified command. According to the experience of Xiexiang County, Shantong Province, such an arrangement raised the productivity of tractors by 30% with fuel consumption reduction by $\frac{1}{5}$, and shortened the span for summer harvesting and planting and that for autumn harvesting and planting by $1/5 - \frac{1}{4}$.

3.2.3. A general summary:

Generally speaking, ever since the founding of the People's Republic of China, the Government has been adopting a very active policy in her agricultural mechanization. After the three years of early stage of mechanization by supplying hand tools and animal drawn implements, China launched immediately into the intermediate stage of mechanization which lasted more than twenty years and is now heading for the advanced stage of mechanization. Facing the tremendous problems in this advanced stage, some of which are mentioned in 3.2.2.1. - 6., some modifications on general policies have been made. Amongst the most important is the policy of welcoming and co-operating with foreign investment on the basis of self-reliance and of equality and mutual benefit. In technical innovations, the policy of walking with both legs - the role of professional contingents and the role of mass movement - is to be continued with the modification that introduction and transfer of advanced technology from abroad that is the most relevant on the basis of self-reliance are encouraged. It makes also a policy to lay emphasis on the kind of mechanization that really suits the local natural conditions, social economical background and original status; taps to the full the potentiality of the socialist system in the arrangement of excess labour and in the depositing of huge funds for mechanization, and promotes the whole economy in the countryside and the national economy as well through agricultural mechanization.

The foregoing is just what I know about it, concerning the process of realization of agricultural mechanization, the adopted policies and measures in China.

4. Some remarks on the possible applications of agricultural mechanization experiences in China to some other countries

China is a developing country. All the developing countries in Asia, Africa and Latin America at different stages of their development have rich experiences in developing agricultural mechanization in accordance with their own natural conditions, social and historical backgrounds. We would like to exchange experiences with them and learn from each other. China has its very specific conditions in mechanization. China went through her early stage, has been in her intermediate stage for so many years and now is heading for the advanced stage. Most of the developing countries are now in their intermediate stage and some are in the early stage. The experiences of both success as well as failure in both stages in China may be worthwhile taken for references.

3.2.3. [illegible]

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4.1. Generally speaking, industrial development had better go alongside with agricultural development in a country. It might be advisable for any country, whichever stage she may be at, to adopt a policy of developing industry and agriculture at the same time in accordance with her local natural resources. Without a resolute policy of taking agriculture as the foundation and industry as the leading factor in her national economic construction it would be absolutely impossible to solve the problem of providing food and clothes for such a large population like China. The introduction of powered machinery into agricultural production in the intermediate stage, coupled with other measures taken in agriculture are the prerequisites for increasing yields. It would also be impossible for a country without industry, including the agricultural machinery industry to go into the advanced stage of mechanization after their intermediate stage. It is in the advanced stage that the really further increase in yield in productivity, liberation of peasants from fetters of small-scale peasant economy and drudgery and the march towards the reclamation of waste lands, grasslands, deserts, mountainous areas and water areas, environmental controlled agriculture and all sideline productions as well as industries at various levels and scales can be realized. Only in this way of taking industry simultaneously with agriculture will it be possible for a people to bring a better life if her population is under strict control in the meanwhile.

4.2. Some sort of agricultural mechanization appropriate to local conditions are indispensible for developing rural economy

4.3. Defining stages of development of agricultural mechanization

For clarity of issue, might it be preferable to define the process of agricultural mechanization itself into different stages in addition to the classification of agricultural machinery into the four categories as a result of discussions in the previous Expert Panels, and which I think is the most relevant. Similarly, it might be also preferable to classify the type of agricultural machinery industry in different stages of agricultural mechanization development as well.

For a developing country or district, you start with the present status of agricultural mechanization, wherever you may be and then try to get up to a status of complete mechanization - a status to do away with draft animal and drudgery and a status that the developed countries attained already in a different number of years ago, e.g. U.S. in the Thirties, the European countries in the Post War time, etc. When you move from the present status of a country to this complete mechanized status, there are three distinctly characteristic stages of development in agricultural mechanization according to the experience in China. In the early stage you try to supply sufficient and improved

hand tools and animal drawn implements for the existing agricultural practice. This early stage lasted only for a few years (1949-1952) in China, speaking in the level of the nation as a whole, a little longer for some particular districts of course. In this stage, the agricultural machinery industry is of the most elementary and basic type. In the intermediate stage of the agricultural mechanization development, you direct your effort in trying to apply mechanically powered machinery and implements and for various individual item of farm operation for an intensifying agricultural practice evolving in continuity to its original basis and tradition, as long as that particular item is profitable to be mechanized, no matter which category of machinery you might use, category III or IV. Usually, operations such as pumping, produce processing, threshing, spraying, material handling and a few of the key field operations are among the more easy items to be mechanized with profit. The agricultural machinery industry in this stage is mostly of versatile factories in medium scale of production. In the advanced stage of agricultural mechanization development you try to mechanize all items of field operation with your tractor and do away with draft animals. In this case, the traditional agricultural practice must be changed drastically into that of a highly specialized and socialized agriculture and so are your agricultural machinery industries too. Agricultural machinery industry in this advanced stage of development must be of the type in highly specialized large scale production. The internal combustion engine tractor made its debut in the early years of the 20th century. It took some 30-40 years for U.S. to realize her complete mechanization and many more years for the other developed countries to achieve that status. China has been in the intermediate stage of mechanization these last some twenty years and is getting into the advanced stage in her course of modernization of agriculture.

4.4. Different category of implements and different type of factories are needed for different stages of development of agricultural mechanization.

For countries and districts in their early stage of development with no electricity nor convenient communication, when tractor or small stationary power are introduced into use, there will be difficulties in the supply of fuel, oil and spare parts and the operation would be very expensive. We has that kind of experience for so many years before the founding of the People's Republic. The main task is then to supply, to improve, and to introduce from abroad better hand tools and animal drawn implements for the agriculture. There are

much rooms, judging from the point of view of modern technology, to improve the tools and implements in many developing countries and districts in using better materials so that it may be made somewhat lighter for easier handling and to keep sharp in a longer time for less effort, in using better engineering and technology so that it may be designed in better form and made cheaper. The advanced technology and experience of the agricultural machinery industries in the developed countries can certainly do much in these.

For those countries and districts with local natural energy resources available, even in their early stage of development, the introduction and erection of small power units such as small hydro-electric stations bio-gas producer on organic refuse, wind mills and solar energy utilities etc, to run processing and pumping equipments would be of tremendous help to the locality.

That is what we did in the inner provinces, Tibet, Inner Mongolia, etc. We had tens of thousand of small hydro-electric stations and hydro-turbo pumps, hundreds of thousand of bio-gas producing units in operation, not sufficient in number and not advanced enough in technology of course. The industry in the developed countries are certainly in the position to render help in this line too.

For countries and districts that are in the intermediate stage of mechanization, there are many operations that can utilize power profitably, such as pumping water, processing grain, fibre, oil and feed stuff, threshing, drying and handling grains, spraying, transportating and deep plowing, timely sowing and harvesting, etc. In the developing countries, it may be inevitable to have a certain period in which manual, animal and mechanical powers are used simultaneously on the farm, an intervening picture of aeroplanes in the sky, trucks on the road, animals in the field and manual wheel barrows on the levee.

For the supply of the equipments needed in this intermediate stage of development of agricultural mechanization, China has set up more than 1900 factories scattered all over the country manufacturing, various products of agricultural machinery. For a period of time, most of these factories followed a direction of management stressing to its extreme, the self-sufficience in machinery products in each locality, and croneously turned themselves into a vast number of almost identical versatile enterprises of small to medium scale production making various kinds of products. We found it was very expensive to run such enterprises especially so numerous in number from the national point of view. These factories have been undergoing convertion into specialized production of limited products in large scale.

For the repairing of tractor and machinery, 1-2 repairing shops were set up for each county. This country repair shop has two missions, firstly, takes care of all the capital repairs whatever the commune repair shop cannot handle, and restoring worn parts, and secondly, turns out parts, or equipment or installations not in regular sale. Typical facilities for this country repair shop are: Foundry with small cupola, forgeing with small drop forge and press,heat treatment furnace, machine tools running from lathes to grinding machines, welding equipments, parts restoring facilities such as metal spraying, electric plating, c.i. welding, crankshaft and cam shaft grinding, boring and honing machines, injection pump testing bench, engine power testing bench etc. The controversy about how far it should be to restor and make use of worn parts beneficially has not yet been settled in China.

For countries and districts that are in the advanced stage of development in its agricultural mechanization, problems they face may be more or less the same like us in China even though the solution of them might be different due to the diversity in social and economical background.

One of the main problem in realizing a complete mechanization in agriculture is the re-arrangement of the excess labour force. We have taken the course of developing industries in all level, especially in the commune and brigade level, and have stressed all kind of side-line production and broadening and deepening agriculture itself, and tried to smooth any shock that might arise by unemployment through appropriate arrangements in planned economy. In other developing countries the problem of the excess farm labour force can be solved also only through appropriately developing her industries and enterprises.

The second problems is that of source of funds. In China we mainly relay on our own effect. We take the developing of industry in all level and broadening and intensifying agriculture as means of raising fund too. On the basis of self-reliance we are open to international cooperation in investment, loan and credit in appropriate terms

The third problem is to provide the technology, including technology on design and development of prototypes, technology on manufacture and management, and technology on testing and experimenting agricultural machinery.

We take self-reliance on technical innovation, depending upon professional contingents and mass movement. In the same time, we seek technology transfer from abroad and international exchange of experience and opinion.

The fourth problem is to provide scientific management for agricultural mechanization itself. By this we mean to put the planning of mechanization on the basis of scientific research so as to pin down the most profitable project with maximum crop yield. Besides, we put emphasis on coordination between agronomic measures and engineering design of prototypes.

5. Some comments on the issues to be submitted to the Consultation Meeting for consideration and role of UNIDO

It is of common experience that some kind of agricultural mechanization compatible to local conditions would bring economic growth to a country. Developing countries are therefore encouraged to build up their own agricultural machinery industries for the realization of their agricultural mechanization. The agricultural mechanization together with the agricultural machinery industry in the developing countries offer a huge international market for industries in the developed countries and great opportunities for cooperation among the developing countries themselves.

In expanding their agricultural machinery industries the developing countries need facilities, technology and fund, which the developed countries have. In the meanwhile developing countries in different stages of their development can solve some of their problems through cooperation in the basis of mutual benefit amongst developing countries themselves, not only in exchanging experience, technology, but facilities and investment as well. The basic philiosophy of a consultation system on agricultural machinery industry to let representative people to come together to make arrangement for international cooperation seems to be sound itself. After the consultation meeting specific programmes for action between developed countries and developing countries and those among developing countries are expected to bear fruitful results the most promisingly.

Issues to be submitted to the consultation meeting on the topic of strategy, facilities and international cooperation arrangement are among the most relevant. Some supplementary details added might be worthwhile.

The makret for ther agricultural machinery ind stry in a developing country depends closely to her agricultural mechanization. If something goes wrong in the process of agricultural mechanization the agricultural machinery industry would be affected as well. The main problems constraining the expansion of agricultural machinery industry come not only from the industry itself, but from the agricultural mechanizatior side as well. In this sense, agricultural machinery industry itself in a country is just more or less a mean, not entirely an end. No strategy for agricultural machinery industry can suffice without putting the process of development in agricultural mechanization into consideratior in the same time.

Since developing countries are in quite different stage of their development, the basic production facilities needed may run from that for simple tools and animal drawn equipments to that for various types of stationary processing machinery, to tha for small to medium prime movers utilizing local energy resources, to that for tractors, more complex cultivating equipments and self-propelled machinery. These may be further grouped into production facilities for simple implements, for versatile factory of small to medium scale production of intermediate machinery, for specialized production of tractors and complicate machinery.

In expanding their agricultural machinery industries, the developing countries need financial aids, the facilities and technology in manufacture and in design and development of prototype as well. International cooperations should not only be arranged for the manufacture of complicate machinery, for financial cooperation of some kind, but also for technology transfer.

According to experience in China, it is of prominent importance for a country in developing her agricultural machinery industry to have the most appropriate and effective prototypes of tractors, other machinery and simple implements. The field in developing such appropriate prototypes in various developing countries and districts has not been explored sufficiently far from exhausedly at all. They are in need of some really good kind of power machinery utilizing effectively local energy resources, small and medium sized tractor together with all the matching implements really suiting to the locality, improved implements and tools, simple and effective

environment control facilities, various processing and storing equipments and so forth. I take this as one of the important problems in developing agricultural machinery industry in a developing country and recommend that, not only arrangement in investment and facility provision, but also some kind of concrete arrangement in international cooperation on research, development and design work to be discussed in the Consultation Meeting and specific programmes in this field of international cooperation between the developed countries and the developing countries and among the developing countries themselves are to be followed up after the meeting.