The Association of Academies of Sciences in Asia (AASA)

TOWARDS A SUSTAINABLE ASIA

THE CULTURAL PERSPECTIVES

Science Press
Beijing

Springer

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With 9 figures

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ISBN 978-7-03-029011-3
Science Press Beijing

ISBN 978-3-642-16668-6 e-ISBN 978-3-642-16669-3
Springer Heidelberg Dordrecht London New York

Library of Congress Control Number: 2010937229

Cover design: Huabin Huang

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

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Thematic Report of the AASA Project "Sustainable Development in Asia"

TOWARDS A SUSTAINABLE ASIA: THE CULTURAL PERSPECTIVES

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Foreword

Asia is not only the largest and most populated continent in the world, but also the region with the most diverse development models and most dynamic economies. In the past half century, Asia has been witnessing rapid economic growth and playing an increasingly more important role in world's political and economic arena. At the same time, Asia has developed the commonly-called "Asia Model", which has attracted worldwide attention. The Asia Model shows a new way for the developing nations or late-development countries on how to realize industrialization and modernization. All these achievements are made by Asian countries with a focus on the advantages of their late development, re-examination of their internal cultural values, active absorption of modern S&T and management experiences and constant exploration and innovation.

These social progresses have made great contributions to the realization of the UN Millennium Development Goals and have played a pioneering and demonstration role on what can be accomplished in today's world. However, Asia is facing big challenges. The most prominent one is that the rapid development of Asian economies is based on large input of production factors at the huge expense of natural resources and environment, which has been sharpening the conflicts in population, resources, environment, socio-economic development. The sustainable development in the region is being severely threatened and challenged. The rethinking and questioning of the Asia Model in the international community is growing especially in the era of post Asia Financial Crisis and Global Financial Crisis.

It is not only a common challenge for the governments of Asian countries, but also a common task for the Asian scientific communities to cope with the resources and environment crisis and to seek a new way of sustainable development in Asia. AASA, as a non-governmental and regional international scientific organization with 26 member academies, is mandated to initiate and conduct investigation on issues concerning S&T, economic and social development. As early as April 2007, AASA proposed to initiate a project on "Sustainable Development in Asia" (SDA) within AASA framework in the hopes to provide consultation and advice for national and regional governments in Asia and relative international organizations. This study proposal was approved at AASA board meeting held in Russia in August 2007 with the Chinese Academy of Sciences as the initiator. The project covers environment, energy,

resources and culture with the establishment of four working groups among AASA member academies.

Soon after, the SDA project was officially launched and implemented at different levels. The efforts include the clarification of the research content, emphasis, structure and division of tasks. Various meetings at the working level and international workshops have been held to coordinate the research activities and project progress: the first international workshop under this project was held in February 2008; the AASA Workshop on Sustainable Energy Development in Asia in November 2008; the AASA Workshop on Agricultural Culture and Asian Sustainable Development in August 2009; and the AASA Workshop on Environment and Resources in September 2009.

With the joint efforts of AASA member academies, the SDA project has now come up with a series of studies including four thematic reports, namely, "Towards a Sustainable Asia: Energy", "Towards a Sustainable Asia: Environment and Climate Change", "Towards a Sustainable Asia: Natural Resources", and "Towards a Sustainable Asia: The Cultural Perspectives" . Based on these four reports, a synthesis report has also been written entitled: "Toward a Sustainable Asia: Green Transition and Innovation". All these reports have looked deeply into the common issues and challenges for the Asian sustainable development from different perspectives.

The synthesis report is an integration and extension of the four thematic reports. It aims at the major resource and environmental challenges and issues in Asia in the general context of the challenges of financial crisis and climate change, and in line with green transition and innovation in Asia. Of its major findings, it includes: the diagnosis of key resource and environmental issues in Asia, such as water, minerals, land resource, environmental pollution, eco-degradation, energy and environment and climate change, the revelation and reflection of the diverse, different, complicated and severe nature of resource and environmental issues in Asia, the systematic analysis of the main driving forces and future trends of resource and environmental changes in Asia, the empirical analysis and discretion of current evolution of the relationship between environment and development in Asia with the establishment of theoretical and conceptual models, the initiation of principals, strategic framework, focus and advice for promoting the green development of Asia on the basis of summarizing Asia's advantages and disadvantages.

The synthesis report differs from other similar reports. It focuses more on the combination of theoretical and empirical research in the evolution of environment and development, on the combination of trends analysis in time series and comparative study at spatial scale, and on the combination of Asia's integrated analysis and regional and national differences. Besides, attempts have been made here on the innovative modeling of the evolutionary and theoretical relationship between environment and development, analysis of the driving

forces in environmental evolution, and utilization of newly developed composite index to conduct empirical research of Asia's environment and development relation in the evolution.

We hope the reports will be of good value to the facilitation of the green development in Asia, providing advice on dealing with the shortage of conventional resources, environment pollution and climate change, fostering new economic growth and enhancing Asia's competitive advantages. This is the first time that AASA has ever undertaken such a study, and it surely leaves grounds for more detailed study and analysis of various issues and challenges that Asian countries face in the future.

The SDA project is sponsored by AASA. I want to give my special thanks to all AASA member academies for their consistent support, advice and assistance, without which, the accomplishment of such an internationally interdisciplinary scientific project would be impossible. My thanks also go to all the members in the working groups, especially Professors Namık Aras and Yi Wang, co-chairs of this study, without whom, efficiency and quality of the study would not be guaranteed. I also need to thank United Nations Environment Programme (UNEP), InterAcademy Council (IAC) and InterAcademy Panel (IAP) etc. for providing us the references and various advice and inspirations. Last but not the least, I want to express my thanks to all friends and the institutions that have rendered us encouragement and assistance all the way along.

The SDA project features with a wide range of fields and a huge amount of data, some of which are still in their early stage of development. Any comments or suggestions from our friends and various international institutions are warmly appreciated.

Prof. Jinghai Li

President

The Association of Academies of Sciences in Asia (AASA)

September 20, 2010

Preface

Sustainability is more about resources, energy and environment, but at the same time it also concerns with culture. In the back of their different cultures, people hold different attitudes towards resources and environment and they also differ in the ways, efficiency, scale and duration of resource utilization. Thus, the pressure they get from resources and environment is also different.

With the view that sustainable development in Asia can not depend solely on local economic breakthroughs but should be based on a more extensive cultural foundation and a wider strategy in future, the Association of Academies of Sciences in Asia (AASA) launched a study project entitled "Sustainable Development in Asia". In this project culture is considered as one of the key elements of sustainable development, like resources, energy and environment.

As is well known, Asia is still a basically agricultural society, and agriculture is Asia's biggest cultural legacy. Sustainable development in Asia is relied on the resolution of issues such as farming, the farmer and rural areas. In this study, we focused on the farming culture of Asia, attempting to reveal the secret of how Asian people fed the bulk of the population in the world over a long stretch of history. We sum up their experience, discuss the lessons learned, and make proposals for sustainable development through the overall description and analysis of the history and culture of agriculture in Asia.

We chose East Asia, South Asia and West Asia as the main regions for this study and invited productive scholars in these fields to discuss the problem within the framework of farming culture in Asia.

We organized a successful international conference on farming culture and sustainable development, which was held in Beijing in August 2009. Scholars were invited from China, Japan, Rep. of Korea, Canada, India and other countries. This was the first conference held in China on this subject and indeed very few conferences with this focus have been held in other countries. The collected papers presented at the colloquium will be published soon by the China Agricultural Press under the title of Agriculture in Asia: Past, Present and

Future.

In March 2010 we invited Professor Andrew M. Watson of University of Toronto, Canada once again to visit the Institute for the History of Natural Science of the Chinese Academy of Sciences. Professor Watson has a long-standing interest in the agricultural history of West Asia. On March 8, he gave us a lecture entitled "The Future of the World's Food Supply—How Will We Feed Ourselves Around the Year 2050?"

With a focus on farming culture, this report briefly discusses Asian history, culture and their present-day importance. It covers a wide range of topics including an overview of Asia's main civilizations, Asian religions and related cultures, a discussion of the characteristics and similarities of Asian civilizations, an examination of the role of agriculture in Asian civilizations; and an analysis of the differences between eastern and western civilizations from a global perspective and, more particularly, western civilization's impact on eastern civilization. This report will also summarize the major achievements of Asian traditional agriculture and analyze the main challenges faced today by Asian agriculture and culture. It hopes to show how cultural roots can point the way towards sustainable development in the future.

To prepare and publish this report, we have received helpful advice from many colleagues, experts and scholars. Thanks are due to the Association of Academies of Sciences in Asia (AASA), the Bureau of International Cooperation, Chinese Academy of Sciences (CAS), the Institute for History of Natural Science (CAS) and the Institute of Policy and Management (CAS). We also wish to thank Yi Wang, Deputy Director of IPM (CAS); Shaofeng Chen, Research Associate of IPM (CAS); Professor Andrew M. Watson, Department of Economics, University of Toronto, Canada; Professor Mitsutoshi Tokunaga, Osaka University of Economics, Japan; Professor Duk Kyung Choi, History Department of Pusan National University, Rep. of Korea; Professor Gengpan Li, Institute of Economics (CASS); Professor Chenggui Li, Institute of Rural Development (CASS); Professor Lingfu Li, China Shaanxi Normal University; Professor Wangsheng Xu, China Agricultural Museum; Professor Luling Wei, South China Agricultural University; Professor Qingwen Min, Institute of Geographic Sciences & Natural Resource Research (CAS); Professor Huoqi Yan, Nanjing Agricultural University, China; Professor Y. L. Nene, Chairman of the India Asian Agri-History Foundation; Ms. Bo Ren, PHD Candidate of University of Nottingham, England; Jianting Yang, Research Assistant of Research Centre of the Song Dynasty in Hebei University, China; Ms. Rongguang Huang, Research Associate and Japanese interpreter of IHNS (CAS); Yichao Wang, Research Assistant of Beijing Capital Mountain Rural Development Research Center, China; Ms. Dongling Peng,

Mr. Xiaolei Shi and Mr. Xinhao Du, staff and students of IHNS (CAS); Ms. Xiaohua Li and Ms. Xuting Wang, editors of Science Press.

Study Group on the Cultural Perspectives

August 2010

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1 Introduction: Sustainability is also a Matter of Culture

Culture is the aggregation of all the material and spiritual products created by human beings. The basic factors of culture are traditional concepts and values, of which value system prevails all. Culture is a complex system composed of various factors. All components of culture are interdependent in function, interconnected in structure, jointly playing a role of social integration and orientation. However, certain culture sometimes may hamper social transformation and the development of mankind.

Sustainability is more about resources and environment, but at the same time, it also concerns with culture. Beneath different culture, people hold different attitudes towards resources and environment and they also differ in the ways, efficiency, scale and duration of resource utilization. Thus, their pressure on resources and environment is also different. As for how sustainable development becomes a problem, it is closely related to western civilizations. Western civilization focuses on conquering the nature by taking advantage of science revolution and industrial revolution in politics, economy, military, diplomacy and religion so as to become the mainstream culture in the world. It accelerated human's exploitation of natural resources and finally in a "silence spring", people recognized that "there is only one earth", thus the problem of sustainable development was put forward.

With half of the global population and over a half of the world history, Asia embodies the most ancient civilization in the world. In thousands of history, Asians dealt with nature, used resources and protected themselves in their unique culture, and developed today's Asia. In terms of resources and environment, Asia doesn't outperform Europe and America. However, from historical perspective, Asian culture has well dealt with the relations between survival, development, resources and environment. Only in modern times, the problem of sustainable development becomes more acute because of influence of Western culture.

Looking back at man kind's history, we discover that the capitalist way of production and life which is the mainstream in today's world is actually only one of the hundreds of effective ways of survival. The tough reality tells us that to indulge western culture may cause disastrous consequences. We should be fully aware of the negative effect of western civilization and treasure Asian tradition and wisdom of survival and development so as to seek the possibility of sustainable survival and development.

As the birthplace of world civilization, Asia has a long historic and cultural tradition. To know Asia including its present and future, the best way is to learn its history and culture. The long history and splendid culture can not only enhance Asian people's pride and confidence, but can also provide historical lessons for its sustainable development. The 21st century is called "Asia's Century", as Asia will play a more and more important role in world affairs. Sustainable development in Asia can not only depend on local economic breakthroughs while ignoring the foundation of more extensive culture and strategy. Culture leads the solution of problems related to energy, resource and environment. Asian culture developed in history will definitely have an impact on Asian development in the future. The vicissitudes of ancient countries like China and India is most relevant in discussing a long-term issue like sustainable development. Chinese civilization is the only ancient civilization that hasn't been interrupted or died. We need to learn from and summarize the experience and lessons from the ups and downs of civilizations.

Generally speaking, Asia basically is still an agricultural society as agriculture is Asia's biggest cultural legacy. Asia's sustainable development relied on the resolution of agricultural problems (issues of agriculture, farmer and rural area). Agriculture serves as the foundation of all civilizations. Without a sustainable agriculture, Asian will not have a sustainable development. While modern western agriculture based on oil and energy exposing a series of crisis and weakness, it is worth to look back at traditional Asian farming culture to broaden our horizon and to better explore the future of Asian agriculture, which is greatly significant to Asia's sustainable development.

This report focuses on farming culture, and briefly discusses Asian history, culture and its modern value. It covers a wide range of contents including introduction of Asia's main civilizations, Asian religion and related culture, characteristic and similarity of Asian civilizations, the role of agriculture in Asian civilization, agricultural history and geography, an analysis of difference between eastern and western civilization from a global perspective and western civilization's impact on eastern civilization. This report will mainly analyze main challenges faced by Asia agriculture and culture, summarize major achievements and experience of Asian traditional agriculture, and discuss cultural root of its sustainable development so as to draw from Asia's history—the driving power for its sustainable development.

2 Asian History and Culture

Asia is the birthplace of human civilization. Forefathers of Asian lived and multiplied in the vast land a long time ago. Since the Neolithic Age, the Mesopotamia region in the so-called Entre-Deux-Mers which located in the middle or lower reaches of the Tigris River and the Euphrates River of West Asia, the Indus and Ganges Region of South Asia and the valley of Yellow River and Yangtze River of East Asia were the cradled of human civilization. All global regions were born in Asia including Christianity, Buddhism, Islam and Hinduism. Before the Industrial Revolution in the 18th century, as the world economic center was in Asia, most of human scientific, technologic, literature and artistic achievement were produced in Asia. Asian civilization, especially Chinese, Arabic and Indian culture have a huge impact on world civilization.

Asia has vast territory, a lot of ethnic group, long history and diverse culture. Asia has such a rich diversity that there was no unified "Asian civilization", particularly because Asia doesn't have the same language and character. Therefore, when it comes to discussion on Asia problems, we have to use English which is a western language. Despite the diversity, Asia also enjoys some regional similarities such as Confucianism in East Asia, Hinduism and Buddhism in South Asia and Southeast Asia and Islamic culture in West and Southeast Asia.

2.1 Main culture in Asia

The earliest creators of the Mesopotamia civilization in West Asia were the Sumerians from the east mountain regions in 4000 BC.

After Sumerians set up city-states, kingdoms came into being one after another in the Mesopotamia Region and West Asia including the Old Babylon, Hittite, Assyria, Hebrew (the State of Israel and Jewish), the Chaldeans Kingdom (New Babylon) and Persia. The Mesopotamia Civilization has made the earliest contribution to human in agriculture, metallurgy, law, architecture, astronomy, calendar system, literature, art, etc.

After the 7th century, Islam founded by Mohammed began to spread from Arabia to surrounding areas, integrating Palestine, Syria, Iraq, Persia, Central Asia, the whole North Africa and most Spain into the Islamic world. Islamic civilization maintained a strong and lasting influence as long as 500 years and its branches even went to India via the Central Asian Steppe in the 16th century. Because of the time and geological location, Arabs and other people who believe in Islamism became important bridge between ancient and modern civilization, the eastern and western world. Islamic civilization has translated and preserved a lot of achievement and thoughts of ancient west which turn to the cradle of Renaissance. In addition, Muslims also made unique contribution to civilization and science.

The earliest civilization in the valley of the Indus River was Harappa civilization, dating back to 4000 to 5000 years ago. However, the ancient Indian culture didn't derive from the same origin because India was subject to constant foreign invasion with the first invaders from Indo-European Tribe namely Aryans. Under the rule of Aryans, India began to have character. The earliest document was called "Veda" which literally meant "knowledge". The Indian subcontinent was invaded by other nationalities from West Asia, South Europe and Central Asia after Aryans' invasion, leaving it in disunity for a long time. It was only until the establishment of the Mogul Empire in 1526 that India regained its unity and cultural prosperity.

India is a big religious country where various religions like Brahmanism, Hinduism and Buddhism were born. It was once rule by people who believed in Islam. The ancient India as a while held deep respect for knowledge and education from literacy to math and philosophy as well as the Vedas. India is one of the birthplaces of the most ancient science, math and medicine. Arabic numerals and Greek philosophy originated or were influence by India.

The valley of Yangtze River and Yellow River of China is the cradle of civilization in East Asia. 5500 years ago, China already crossed the threshold of urban civilization. About 3500 years ago, China already entered the civilized period represented by Jiaguwen (inscriptions on bones or tortoise shells) and bronzes.

Thinkers of numerous schools during the Spring and Autumn and Warring States Period (770 BC-221 BC) did not only set the foundation for China's virtues and cardinal guides, but also started the tradition of rationally exploring questions on nature, society and politics. The representative figure Confucius(551 BC-479 BC) is honored as "Teacher of All Ages". Although China was also invaded by other nations in history, on the whole, other nationalities always turned out to be assimilated by Chinese culture.

As an ancient civilized nation, China contributed a lot of inventions to the world including compass, powder, paper making and printing. In terms of economic and social development, China and Europe were close to each other until the 18th century. Not until 19th century did there appear the so-

called the Great Divergence (Pomeranz, 2000) between East and West when westerners began to use powder invented by Chinese to fight against Chinese people.

Chinese civilization is the only ancient civilization that hasn't interrupted in the world. Besides, it also has a profound impact on world civilization. Its neighboring countries like Korea, Vietnam and Japan followed Chinese traditional way of farming, calligraphy as well as its philosophy, literature, politics, social structure and art.

2.2 Religions and related culture in Asia

Religion occupied an important place in Asian people's lives. Generally speaking, the four major religions in the world namely Buddhism, Confucianism, Islamism and Christianity all emerged in Asia. Religion serves as the foundation of the prosperity of certain cultures. On the bases of the four major religions developed Buddhist, Islamic and Confucian culture. The connection between religion and philosophy serves as the foundation of thoughts and also of all human activities like politics, economy, society and art. These religions and culture have existed for several hundred or thousand years, still jointly influencing the lives of most people in the world.

Polytheism is the common characteristic of most Asian's religious belief. In China, three religions namely Confucianism, Buddhism and Taoism are complementary to each other. In Japan, Buddhism, Shinto and Confucianism co-exist. The complementary components constitute the whole, representing religion of nearly one third of the total population in the world. Among them, Confucianism has become a doctrine transcending culture and nation while Hinduism has always been the synonym of Indians' religion. Buddhism originated from India, but is now mainly in Southeast Asia and East Asia. It has brought in elements in Indian culture like art forms and also developed some features related to cultures that have received it.

Hinduism, Buddhism, Confucianism, Taoism and Shinto also believe that human are born good and will maintain the kind nature which is different from the "Original Sin" Theory in Christianity. What is most notable is the different attitude toward natural environment between eastern and western religions. To worship or conquer nature is the watershed between eastern and western religious civilization. Western civilization tens to regard humans as ruler of the universe, Asian civilization tends to regard nature as more significant, stronger, more deserve to be praised, imitated or obeyed than any things created by man.

Asian culture believe that the world is a whole and nature are inseparable, which is the so-called "Heaven and Man are One" and "All in One". "Comeuppance", "Telepathy between Man and Nature" and "Induction between Similar Objects" are all used to interpret the relations between man and nature and emphasize that man are equal to everything on earth or even put nature above

man. Human beings are required to respect the value of nature, refrain from activity to nature(Needham, 1956), restrain their desire, value lives and abstain from killing. Out of the concern for the living conditions, Asian religions expand love to man and animals to the plants and the earth. Religious scenery like temples and Taoist palaces are usually in an environment with good quality, demonstrating Asian religions' pursuit and preservation of beautiful environment. Many original or civil religions in Asia often strictly protect some important water-source forests and Fungshui Woodland as sacred forest.

Asian culture emphasizes harmony and unity between man and nature. However, out of the pressure of survival, Asians have to strike a balance between protection and rational exploitation of nature resources by combing preservation and utilization. "As long as the green hills last, there' ll always be wood to Burn" is the living philosophy known to all. Many famous ancient Hindu religious works mentioned utilization and management of wood, where sustainability is the ever-lasting theme(Kumar, 2008). Ancient Chinese recognized that "if the mountain receives its proper nourishment, there is nothing which will not grow. If it loses its proper nourishment, there is nothing which will not decay away" (the first part of Gaozi from *Mencius*). Timing, land and substances should be taken into consideration while preserving and utilizing natural resources so as to "ban logging according to time and never end the growth of forests", which means it is only allowed to hunt or collect plants at certain seasons and it is forbidden to do so in times of reproduction, a total ban on exhaustive exploitation of nature resources so as to maintain ecological balance in nature and constant rebirth of nature resources which can provide everlasting resources for human. This principle is also true for using land resources which requires man to "add new soil and fertilize the land with manure" so as to ensure the vitality and capability of land.

In terms of how to treat environment, Asians adopt the principle of combining transformation and adaptation. On the one hand, Asians change the nature of environment to make it suitable to the need of man's survival and development with subjective efforts. Popular approaches of building water conservation, intensive farming and fertilizing abundant manure aim to provide good environment for agricultural production by transforming nature. As long as "appropriate methods are applied, soil of different nature can all be improved" was discussed in Arabic and Chinese documents in the 11th and 13th century. By transforming nature, mankind have successfully expanded areas of agriculture, changed the distribution of crops and maintained the productivity of land. On the other hand, while maintaining the environmental conditional as much as possible, humans farm according to local oil and circumstances so as to make the best soil based on its characteristics, which was called "Observe the land and plant suitable crops" by ancient people. Lvxiang Zhang, a Chinese agronomist in the 17th century, said: "Different soil has different farming rules", and "agricultural activities should conform to local conditions", which became popular concept in the agricultural books

in East Asia (Tokunaga, 2006). Asian traditional agriculture usually selects different species and resistant corps to adapt to unfavorable natural environment.

Asians believe that life and death are interdependent. Thus they value both of them. How different the advocacy of cautious behaviors and commemoration of forefathers and the western life view of "Après moi, le déluge, After me, the deluge!" Out of respect for forefathers, East Asia people who believe in Confucianism usually use inhumation to bury their ancestors. Although inhumation inevitably occupied some land, and influences cultivation of some important grains to different extent, people always adopt some remedial measures like planting trees and growing grasses so as to use the occupied land. In this way, the limitless expansion of monoculture is prevented, vegetation and ecological balance is maintained, which is not only conducive to biodiversity but can also provide development space for husbandry, forestry and fruit industry, correcting traditional structural defects of traditional agriculture to some extent. At the same, inhumation also inspires people's love for homeland and soil which is exactly the spiritual sources of sustainable development.

2.3 Features and commonality of Asian civilization

As the most ancient one in the world, Asian civilization possesses one half of the world population and constitute over a half of the world history. The four major ancient nations are mostly located in Asia except the neighboring country ancient Egypt. India and China had advanced culture and technology far early than Europe (China was the most developed country in the world before 18th century) and they were leading the world for as long as 2000 years in economy, politics, civilization and technology. Now, they are still the most populous economies in the world. Korea, Japan and Southeast Asia developed their own sophisticated civilization during centuries after the decline of Roman Empire while Europe was in the dark and long era of middle century full of foreign invasion.

Asian countries have many things in common or similar culturally. However, cultural diversity and imbalanced development are also everywhere. Differences between systems of Chinese culture, Indian culture and Arabic culture are obvious. Even within the same cultural system, the development is still imbalanced. India is greatly different from other Asian countries while development gaps exist between central and west regions and east region of China. Today's Asia is not coordinated or unified in politics as some countries are socialist, some capitalist, some follow a democratic system while the rest are governed by monarchies. All shows the diversity of Asian culture, which makes it fair to say that Asia has no unified civilization in some sense.

The complex and splendid Asia civilization also has some common features and values, for instance, diligence and thrifty, valuing family, men's superiority over women (not applicable in Southeast Asia and South India), class society, respect for tradition, collectivism and other common culture features full of Asian flavor. Even against the backdrop of different history and culture, Asian civilization's commonality exceeds diversity.

2.3.1 Diligence and thriftiness

Diligence and thriftiness are traditional virtues of Asian people. Land is the source of wealth while diligence is the only way to fortune. Diligence is the main reason of Asia's economic development. The most remarkable features of traditional Chinese agriculture dependent on intensive farming is "fertilizing much manure and working hard". The success of Islamic agricultural revolution is also attributable to hard operation. Some scholars name the fast economic growth in East Asia since last millenary "industrious revolution", which is different from western industrial revolution. One characteristic of industrious revolution is the development of labor-intensive technology which successfully resolved the problem of natural resource restraint and narrow arable lands with labor intensity, which is intensive farming with the aim of enhancing yield per unit area when reflected in agriculture. Diligence and thriftiness have won high praise, regarded to be the cornerstone of society. One of the slogans of Rep. of Korea's Saemaeul Undong in 1970s is exactly "diligence".

However, Asians also realized that it is necessary to decrease expenditure when increasing income. A limited production shouldn't go with excessive consumption, and it is the only way of sustainable development, otherwise, it can't carry on. "Make it in proper way, and take it with restraint" is the main principle in handling production and consumption. Consumers should hold gratitude towards producers and should waste recklessly. "The growing of rice and of grain, think on whenever you dine; remember how silk is obtained which keeps you warm and looks fine." This presents a relatively sharp contrast with commercial civilization. Thriftiness is not only a respect for other's labor but also a preparation for future uncertainty. Thriftiness is a virtue while luxury is evil, therefore "it is better to be frugal than extravagant".

The choice of farming based on corn also reflects thriftiness. In production, thriftiness firstly means save agricultural land. In terms of land utilization, it is proposed that "it is better to use a few land well than utilize many land badly", and "without intensive farming, even the production of one ha will not be higher than that of a mu (1% ha)", the philosophical foundation of intensive farming in East Asia. Conservation in Central Asia and West Asia is mainly manifested in saving water. In Islamic ideology, water must be strictly managed as it is so precious and any waste of water should be banned. Different technology of water management is applied so as to use resources most efficiently. Karez can reduce evaporation, and is

still in use now. Farmers apply clepsydra to decide each household's time of irrigation. Clepsydra is measured by minutes and runs day and light, accurately controlling water usage of each farmer while taking into account of seasonal variables(Anonymous, 2009).

Asian thinkers all advocate people to restrain their desire of consumption. Chinese ancient thinker Hsun Tzu (313 BC-238 BC) suggested people follow "thriftiness and get rid of desire" (Husn Tzu on Honor and Disgrace). Mahatma Gandhi (1869-1948) of India has a famous saying "Earth provides enough to satisfy every man's need, but not every man's greed."

Vegetarian is also a manifestation of Asians' thriftiness. Gandhi is proponent of vegetarianism. People in East Asia, Chinese in particular, live mainly on vegetative food and seldom squander while cooking, always making the best of everything. Leftovers can be left to the next meal. Even the water used to wash kitchen ware like pan and bowls become feed for domestic animals. They save not only food but also fuel and cloth.

Thriftiness also reflects Asia's resource view which is to make the best use of everything. King Parakrambahu the great (1164-1196), the builder of rainwater reservoir "Sea of Parakrama" of Sri Lanka once said: "Not one drop of water must flow into the ocean without serving the purposes of man". During the same period, there was a Chinese poem: "Not one drop of water should go without being used and not one piece of mountain should be wasted without being farmed except the rocky terrain." Chinese people pressed snow in the cornfield to prevent it blown by wind so as to irrigate the land.

Asians' view on resources is more reflected on the utilization of wild animals, plants and the so-called "waste". Herbal for Relief of Famines, written by a Chinese prince in 14th or 15th century, recorded 414 kinds of edible wild plants. The Hani People in Yunnan, China still have a lot of potherb in their vegetable accompaniment. Japanese still refer vegetable as potherb. In eastern civilization, local wild life can be used to eat, to make medicines and to perform the function of healthcare, a good source of health diet with no need for special planting and management as they are suitable to local conditions. It is also preferable to transfer natural resources that can't be eaten directly. For instance, weed and acorns can be used to feed pigs so as to expand the sources of feed and water chestnut can be grown on the surface of water so as to make best use of the room without destroying environment. People are also making every effort to collect and utilize various resources.

Turning waster into treasure is also one aspect of Asians' resource view. Weed can be used us organic fertilizer, one source of agricultural manure. Pests can be used to feed chickens, ducks whose excrement can turn into manure. Birds and beast and even locust become dishes at table. In India, mice are directly made into liquid organic fertilizer (Kunapajala).

Traditional farmer always make the best use of every part of crops (e.g. grain, straw). Besides for eating, rice is extensively used as fuel, feeds, fertilize, raw material and materials, and it also use to prepare meals, feed domestic

animals, fertilize the land, weave shoes, twist ropes and build houses. Cotton can be used for spinning. And cotton seed can be used for oil manufacture, daily food, lubrication and even hair care. Cotton seed pastry can be used to feed cattle after being used for oil manufacture while cattle manure is important fertilizer and feed for fish. Cotton seed can be processed into food as well. Straw is the best fuel for farmers. Pigs can provide meat to eat and are also main source of fertilizer. Farming and raising pigs makes the best combination of production.

To enhance the efficiency in utilizing resource, people also invented energy-conserving technologies. For instance, waste from thrashing was burned to warm brick bed; dung was used to make marsh gas; kitchen stove that can save firewood. Multiple utilizations and recycling have made breakthroughs of the concept of mono-crop productivity, greatly enhancing its economic yield (or Harvest index) which is close to biological yield in traditional agriculture.

2.3.2 Value family

Family is the basic bond of all Asian societies, which usually refers to the emotion and responsibility network made of three generations living under the same roof and relatives by blood or marriage. This supportive system can help deal with difficulties, start one's own business and development, thus is highly valued.

Value collective is the extension to value families as collective is regarded as big family. Big family emphasizes collective power instead of individualism. Nearly all Asian societies put collective interest above individual interest, almost attributing various efforts, achievement and responsibility to collective. Collectivism is the most fundamental essence of Asian tradition and is also the cultural root of current economic miracle in East Asia.

Chinese people elevated the concept of family and collective to nation where the Chinese character of nation is made up of two words with the meaning of family and state respectively. Family is the epitome of country where officials can be regarded as "parents" of people. Family is regarded as the foundation of social order and "cultivating oneself and bringing order to family" is the starting point of "governing the country" and "bringing peace to all". "If one can bring order to family, he can also govern the country well."(*Classic of Filial Piety*)

Most Asian societies maintain the characters of patriarchal system with the eldest as the head of the household who plays an important role in readjusting relations between family members and whose authority must be respected. Attention to family forms the tradition of respecting the old. Age equals wisdom and authority while seniority is equivalent to quality.

The respect for family and older generation is obviously related to agriculture. Traditional farming is completed with one household as the production unit. If the family live in harmony, all will prosper. A harmonious

family is the guarantee for smooth agricultural production. Traditional agricultural skills are the accumulation of experience which is passed orally from fathers and brothers. Thus, age becomes a reason for respect and trust. As men undertake most agricultural activities, the foundation of men's superiority over women was also developed. However, as men manage external affairs women internal, women are entitled to more say in family life.

2.3.3 Hierarchical system

When the seniority rules in Asian families expand to society, the hierarchical system is formed. Rigid hierarchy is everywhere in Asia from horses people ride, daily costumes, social division of labor to social positions, rarely to be changed in general. Emperors or kings who hold supreme power are hereditary. Under the emperors or kings were appointed officials of different ranks from central to local level and from officials to subjects, forming a structure of pyramid. In hierarchical society, loyalty is more treasured than talents and wisdom. The selection of talents values both integrity and competence with the former coming first. Emperors and officials also regard setting up a good moral example as their top responsibility. Social hierarchy is more obvious in India where all are strictly distinguished from the date of birth according to their task, power, responsibility and capability and all classes are also divided into many sub-classes.

Large populations in traditional Asian society are protected by centralized rule and hierarchical system. After entering modern society, Asian class society started to face many new problems. After independence, with industrial development, changes took place in Indian's ideas of caste and ethical status. Modern classes in Asian society are manifested in wealth gap between rich and poor. Although green revolution, reform and opening up have boosted agricultural and economic development in some Asian countries, wealth gap was not bridged. In countries like India and Pakistan, irrigation, fertilizer and high quality sees from green revolution are all in the hands of rich farmers and landlords who are able to pay. Similarly, only rich farmers can take part in white revolution via milk cooperatives. Only people of high income can afford pricy milk products. After the establishment of new China, it was an aim to end the three major differences (between urban and rural area, between industry and agriculture, between mental and physical labor). However, after more than 60 years, the gaps haven't been narrowed but are tend to be widening. In the future, the widening income gap is inevitable. At present, the Gini coefficient of Chinese urban citizens is 0.46, exceeding the international warning line, which draws great concern in academia and society.

2.3.4 Men's superiority over women

Although in some countries in Southeast Asia, women enjoy relatively higher status, the phenomenon of men's superiority over women still exist in Asia's class society. Women are regarded as property of their husband, and

wives must obey their husband and never go against their husbands' order. Wives are never to leave home without husbands' permission. Confucianism also emphasizes women's obedience to men, and requires them to "obey her father before marriage, her husband when married and her sons in widowhood. It is a common future in Asia that after marriage, as member of husband's family, women should move to live in her husband's home and village. Women are unable to make contributions to their own original family, become the economic resource of new family. They can't fulfill their duty to parents but bring burden to family because of dowry. Sons become the main source of family income and labor force, the only reliance of aging parents. Therefore, raising a son to provide for old age becomes the fertility motivation of many couples and sons also regard having a son as a way to show filial piety to parents, which is the so-called "there are three ways to be unfilial, the worst is not to produce offspring". This is also one of reasons of boy preference over girls which reflected in education shows the low literary of women while Asia generally values education.

2.3.5 Respect for knowledge

Asians attach great importance to knowledge. The oldest document in India is called "veda", literally meaning "knowledge". Chinese ancient philosopher Lao Tzu has a very famous saying which means that if one knows something but is still aware of the unknown, it is the best. If one doesn't know something but think he knows all, it would be very bad. If one can tell the wrong from right and identify wrongs, then he would not do bad things. Confucianism advocated people to "study the phenomena of nature in order to acquire knowledge", "to study extensively, inquire prudently, think carefully, distinguish clearly and practice earnestly". Islamic prophets admonish that "acquiring knowledge is the due responsibility of every Muslim". Knowledge is also treated as means to get honor and status. Even in ancient Japan or early contemporary Japan ruled by samurai, samurai work hard to master Confucian classics to become "warriors with dignity". Priests and monks in India and Southeast Asia and Islamic Koran scholars won honorary status by acquiring literacy and knowledge. Zen in Buddhism advocates people to explore the mysteries in the world by practicing their heart to know the real self and resolve the conflict between pursuit for absolute freedom by nature and reality by inner intelligence and wisdom. Many monks studied hard and even made achievement. Followers of Indian Brahmanism are usually a scholar and a priest. Scholars, priests and monks are usually respected and can be free of physical labor and are treated leniently by law.

Although some Asian countries have a short history of seclusion, in the long period of time, they are learning new things, exploring new knowledge and make great achievement in science. Japan are especially good at learning, first from China and then from the west after Meijirshin Restoration. Since modern times, Japan has successfully integrated with modern west in a unique way.

Today, Asians' contribution to science and technology is still impressive and 38% of the people working in Silicon Valley of US are Indian.

2.3.6 Respect for education

Respect for education and knowledge are complementary to each other. Although the rigid class has hindered mobility in society to some extent, people born of humble parentage may stand out among others by receiving education. Asians who value family always send children to school with all they have to bring honor to the family name. Asian society is always in the hands of a group of intellectuals and other dignitaries who have land and operated efficient agriculture which services as foundation to all via some form of learning. Modern Asian countries usually connect education with national development, regarding "education as the vital strategy for long-term prosperity of a nation". The success of Meiji reform in Japan is mainly attributable to educational reform, reform of primary and middle school education in particular. School is regarded as the main base of knowledge innovation, communication and application, as well as the cradle to cultivate creativity and innovative talents. Some underdeveloped regions even proposed that "Children should never suffer bitterness even in times of adversity and education should not be ignored even in extreme poverty".

2.3.7 Respect for tradition

Asian peoples have profound respect for their traditions while keeping an open mind to new things. Since 19th century, the Asian people had been subdued or subjected to indignities by western invaders, but held on to native cultures and naturally combined respect of tradition and aspiration for western knowledge. Zhidong Zhang (1837-1909), an eminent Chinese politician, put forward the phrase "Chinese learning for fundamental principles and western learning for practical application"; Japanese created "Japanese spirit and western techniques"; the Koreans believe that "Body and land are not separate". Political leaders of India and Middle Asian countries wear national costumes in international occasions to demonstrate their national confidence.

2.3.8 Middle-of-the-road and peaceful

Agriculture production form Asians' dislike to migrate from native land, they even will not change their profession easily. This profession orientation is conducive to pass technology. It also contributed to relatively high yield per unit area in Asia. To give full play of land efficiency in enhancing production is more in line with the requirement of sustainable development.

Asian people who deal with land and crops tend to be restrained in character. They are not interested in land afar. They love peace and oppose invasion. Chinese Confucianism set "benevolence, justice, ritual, wisdom, trust; moderation, kindness, respect, thrifty, humility" as the moral principle to get along with others. Even the culturally symbolic Great Wall is only a defensive fortification aiming to protect the normal operation of agricultural activities in its south

and prevent them from invasion and ravage of nomads. Ancient India was famous for its benevolence as they attached great importance to clemency and gentleness. Islam originally meant "obedience" and "love", which also reflected Asian's character. Yamato was also a peace-loving nationality before modernization. Taika Reform in 645 set the precedent of social reform without great bloodshed in Japanese history. Civil Obedience Movement led by Gandhi in the history of national liberation movement in the 20th century absolutely showcased Asians' pacific character.

Asian people's respect for family and collective is also based their pursuit of "harmony". To meet nature's challenge and to realize a rational, efficient, fair and sustainable utilization of natural resource, the thought that "harmony is the most precious" emphasizing harmony between men and between man and nature is developed. Harmony is an organic combination of different factors which boost each other so as to achieve common development. Ancient people said that "harmony generated everything" (Guoyu·Zhengyu). Peace is the foundation of development. Mencius said: "Opportunities of time vouchsafed by Heaven are not equal to advantages of situation afforded by the Earth, and advantages of situation afforded by the Earth are not equal to the union arising from the accord of Men." Traditional agriculture is mainly carried out with family as basic unit, thus family harmony is the guarantee and secret of the of agricultural production and all courses(Tokunaga, 2004).

Related to Asian's peaceful character is their philosophy of life namely the doctrine of the golden mean. They don't like extremes, believing that "too much" is as bad as "not enough". The golden mean is a philosophy of flexibility which aims to strike a balance between two extremes. For instance, although Confucians advocate "sparing the extravagance" but also stand for moderate consumption so as to "lead a thrifty but no bitter" and "a well-off but not luxurious" life.

Asian's middle-of-the-road and pacific character is quite different from the invasive character of marine civilization and Nomadic civilization. Western civilization represented by Greece and Rome reflects more features of marine civilization as commerce and trade is full of mobility, competitiveness, expansion, and invasiveness and conquering which is the main factor that influenced Asia's development since modern times. Some hold that Asia's development in modern times is actually a response to external impact.

The gentle and introverted character and the consciousness of farmers with small land who believe that "happiness lies in contentment", "the trouble lies not in scarcity but in uneven distribution" and "satisfaction with well-to-do" also have an impact on Asians' initiative and creativity, leading an involution trend socially, economically and politically, a reform and growth without real improvement or enhanced efficiency. Universal involution is also one of the reasons of Asia's lagging development. This is also one of the reasons why the scientific revolution only took place in Europe not in China of the Needham Puzzle. Today's Asia already realized that one of its relative disadvantages is that

it isn't good at innovation. China's exports (till now) only contain little added-value but a lot of cheap labor. The high-grade products like smart phones made in China are almost designed by the West. Although Japan and Rep. of Korea are more innovative, they usually make some improvements based on products and service designed by the West.

2.3.9 Asiatic mode of production (AMP)

Many features in Asian civilization are related to agriculture so are the mode of production and social system in Asia. The so-called "Asia society" can be used to describe the way of production in most eastern ancient civilization which based on a lot of relative self- sufficient villages, relies heavily on land without obvious division of agriculture, handicraft industry and commerce. In politics, it features centralized despotism with state machines meeting the demand of military expedition and magnificent projects, which is especially obvious in flood management and irrigation. This way of production results in super-stability in social structure. And barbarous conquerors are usually conquered by the advanced civilization of the nation which they conquered.

Water conservancy is the lifeline of agriculture. Irrigation has always maintained the fundamental status as the center of all agriculture and origins of life. Out of the need of irrigation and grain transportation, water conservancy is valued greatly in Asia. As water conservancy projects are from the affordability of individual farmer, they are required to participate together, then a set of complex and advanced bureaucrat system came into being, which serves as the nature of "Oriental despotism"(Wittfogel, 1957). Some big projects are still used now, a good example of sustainable development. It is not only because of scientific design and construction which keeps harmony between man and nature but also due to constant maintenance of people for they played an importance role in agricultural society.

3 Farming Culture Serves as the Foundation of Asian Civilization

Farming culture is the foundation or main body of Asian civilization, and is also where cultural commonality and diversity was born.

3.1 Main history of agricultural development in Asia

3.1.1 Origins of Asian agriculture

Most cultivated plants in the world today originated in the East, especially in China and India, two countries providing almost half of the cultivated pants followed by West Asia and Mediterranean regions. Agriculture gave birth to the ancient civilization of Asia. The four major ancient civilizations, the Old Babylon, ancient India and China are all located in Asia, except the old Egypt in the neighboring Africa.

West Asia is where the first agricultural civilization developed. The two rivers civilization, also known as Mesopotamia culture represented by the Old Babylon, and Sumerian culture were the earliest civilization in West Asia, where located one of the centers of origin of agriculture. As early as 5000 BC, residents began to engage in cultivation activities. And after one or two thousand years of exploration, an irrigation network was gradually established and improved. Representative of crops originating from West Asia are wheat, barley, peas, horsebeans, flax, etc. and of domestic animals dogs, goats, sheep and cattle. Around the 17th century BC, the ancient Babylonians used cuneiform to write *Calendar of Farmers*, the earliest known agricultural literature by far, which recorded the skills of plowing, harrowing, building irrigation ditches and burrock, and controlling water in way of home teaching.

In 3000 BC, during the civilized period of Mahenjo-daro and Harappa in the Valley of Indus River, primitive agriculture appeared in northwest of India.

Grains, cotton yarn, spindle and bronze farming tools (e.g. plow, spade, and scythe) excavated from the ancient ruins demonstrated that metal tools were already applied in producing wheat and cotton. During the Veda Period (1500 BC-600 BC), Indians already used a group of eight or six bulls to plow, grow wheat, barley, rice, panicum, sesame and cane. Simple artificial irrigation and even fertilization were also applied. Bulls were raised for labor while milk cow, water buffalo, donkey, sheep and goat were also on the record as domestic animals.

East Asia is also one of the cradles of world civilization. 5000 to 10, 000 years ago in the Neolithic Period, residents in China's Yangtze and Yellow Rivers already entered the period of farming civilization. In 2010, the 10, 000 years of rice—planting culture of Wan Nian County, Jiangxi, China, was listed to the GIAHS pilot site by FAO.

In the Xia Shang and Zhou dynasties about three or four thousand years ago, China already had a very advance agriculture, and formed an agricultural pattern based on grains and complemented by husbandry according to the records of Jiaguwen and *The Book of Songs*. Great progress were made in agricultural technologies including ridge tillage and related cultivation and weeding technology, fertilizering, irrigation and pest control technologies. The main crops included grain (or miliaceum), panicum, bean, wheat and barley, rice and hemp, among which grain and panicum is most important in the North and rice in the South.

Southeast Asia is very like to be the origin of world agriculture. Farmers firstly plant root crops like taro and yam which grow easily and then rice and grain. People in Southeast Asia are likely to be the first to tame and raise pigs, chickens and water buffalo. Then these domestic animals were brought westward to India, Mesopotamia and Europe, and northward to China, Korea and Japan.

3.1.2 Agricultural revolution in middle ages

In Western Han Period (202 BC-8 AD), with the promotion of ironware and cattle farming, China enjoyed fast agricultural development with great increase of arable lands and yield of per unit area. Every agricultural workforce had a capacity of 1000 kilograms of grains with 243 kilograms of grain ration per capita. Everyone occupied 320 kilograms of grain annually nationwide(Ning, 1980). Han Dynasty has a population of 59.59 million, the most populous country in the world. Since then, China's agriculture continued to develop and an agricultural technology system based on drought control and water preservation was developed in North China in the Middle Ages(220-618), and a technology system in paddy field based on rice cultivation was formed in early modern times(618-1368). Application of irrigation tools like chainpump (Figure 3.1), and maturing and resistant varieties expanded the arable land, raised the level of fertilization and strengthened capability to withstand natural disaster, thus food production was increased. In Song Dynasty, China's population exceeded 100 million for the first time.

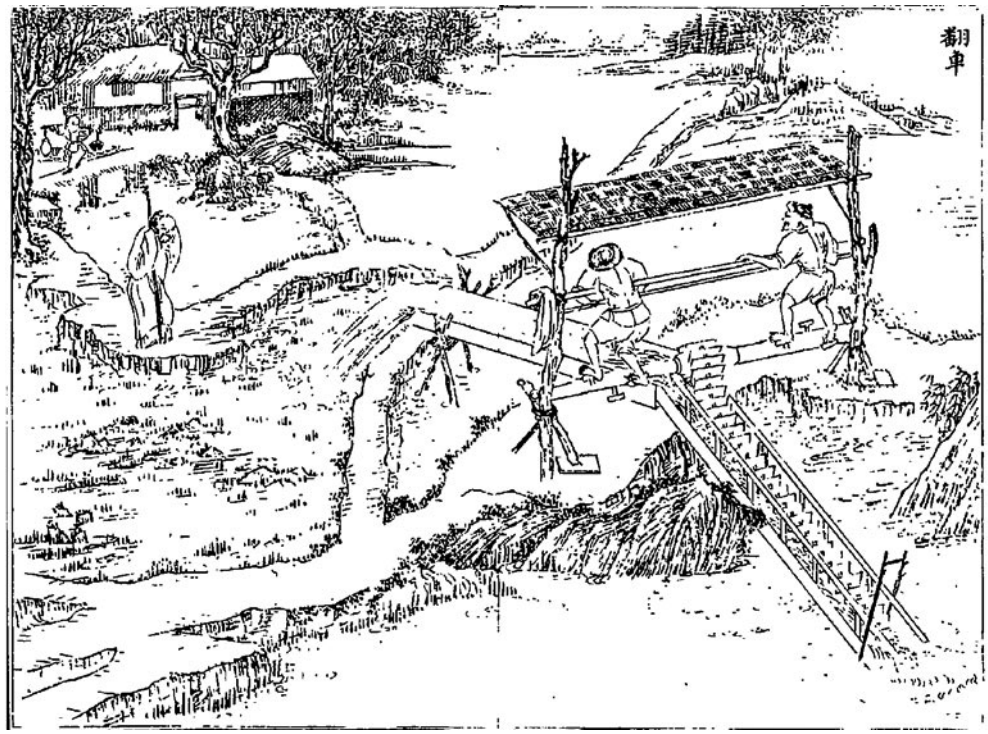

Figure 3.1 Chainpump
Source: *Agricultural Book* of Zhen Wang in the 14th century in China

Chinese agricultural technologies also had a positive impact on neighboring countries. Chinese agricultural books were introduced to different nations like Japan and Korea, which was also the main model of communication of farming culture in East Asia. "As Korean agriculture was greatly influenced by farming methods in North China, the two regions had a lot of similarity in farming." *Complete Treatise on Agriculture* wrote by Guangqi Xu of China in the late Ming Dynasty was brought to Japan after its publication in 1639. In 1679, Yasusada Miyazaki of Japan wrote Book of Agriculture under the influence of Xu's book. Then, some local agricultural books based on it appeared in different regions in China. Champa Rice from Vietnam to China was then introduced to Japan with the name of "Tang (China) Rice". In Japan's reclamation, "Tang Rice is an indispensable variety suitable to low temperature farmland". The technology of seedling in dry-land of Song Dynasty was introduced to Korea and was recorded as "Dry Paddy Rice" in Korean agricultural book in 17th century.

Around 10th century, an agricultural revolution took place in the golden days of Muslims, which resulted in urban development and many important changes in agriculture and economy (Watson, 2008). With territorial expansion, Muslim encountered a lot of plants and trees they never knew before and merchants brought back a lot of exotic plants, seed and species from their journey. A lot of valuable crops such as sugar cane, bananas and cotton need plenty of rain and extensive artificial irrigation system. Artificial irrigation needs to raise

water by several meters high to guarantee constant gravity irrigation. Noria became the foundation of this set of mature irrigation system. Introduction of new corps, together with promotion of irrigation developed a complex and diverse farming system, which enables efficient utilization of different types of soil. Land once followed the most popular farming method of one crop a year now can yield through rotation and method of three crops a year. Agricultural production provided cities with products of all kinds to meet the increasingly complex and changing demand of populations in metropolises.

From the 9th century to the 11th century, Indian agricultural production made comprehensive development, and had remarkably rich experience in rice cultivation. Farmers cultivated various kinds of rice by diverting water from pool, river and lakes through ditches in the land. Rice has a lot of different varieties including white Sali, red Sali and kalama. The advice of Kashyapiya. krishi.sukti(800) to farmers and king on farm management shared some similarities in technological details of rice cultivation in China, which also demonstrates that Asia's traditional rice cultivation technology had basically formed around the 10th century. In late 16th century, most arable land in India had been turned to farmland. Crop diversity, universality of fertilizer usage, complexity of rotation system and expansion of irrigated land all reached a relatively high level. Geological patterns of agricultural production was formed with rice-farming based on two crops one year in coastal plain and river valleys of abundant rainfall and dry-farming based on cereals grown once a year including wheat, panicum and chickpeas in dry areas, plateau and mountains.

Agriculture boosted population growth in India. In the beginning of Christian era, there were over 30 million people within India's boundary, 20 million of who were living along the Ganges. Over the past long history of 1500 years, because of foreign invasion, dynasty changes, war destruction and social disorder, agricultural productive were greatly damaged and population also grew very slow. It was no until the end of the 15th century that population exceeded 100million for the first time. In 16th century, the Moghal Empire emerged, expanding almost to the entire subcontinent of South Asia, and its population also grew from 100 million in 1500 to 140 million in 1650.

3.1.3 Asian agriculture following introduction of modern western agriculture

Prior to modern times, Asia is the most developed region in the world. From 1500 to 1820, due to the rising global population driven by Asian countries with China and India as prime contributors, the substantially increased world GDP dwarfed per capita GDP. According to the analysis made by an economist Pranab Bardhan based on statistics from the World Bank, nearly half of the global wealth were possessed by China and India in 1820(Tan, 2009); furthermore, Asia region contributed 52% to the world GDP, among which, China 29% and India 16%. In the same year, six countries in East Asia and Southeast Asia accounted for 35% of the global GDP, while six developed

countries in the West only 18%. Though China's population soared from 100-150 million to 400 million by the end of 18th century, it did not induce sharp degradation of people's lives. This phenomenon, named by economic historians as "China Miracle", exerted greater impact on the world GDP than the United Kingdom did after Industrial Revolution, whose share was less than 6%. Japan in 17th century also experienced the same situation due to China's influence(Arrighi et al., 2006).

In 16th century, as great geographical discoveries were made and commercial capitalism further developed in European countries, more western merchants sought business opportunities in the East world. Gradually, the natural economy featuring self-sufficiency in Asian countries has been altered, and agriculture was integrated into the linkage of the world capitalist economy. The agricultural industry in certain Asian regions showed signs of fragmentation. In the south of the Yangtze River where rice farming and sericulture were dominating, such phenomena as planting mulberry instead of rice, cultivating cotton rather than grains were seen in 17th century, resulted in reduction of grain-growing. Similar scenario occurred in India as British colony: the animal husbandry and sericulture region in the northwest, the indigo planting region near Agra, the oil-bearing crops region in middle-lower of Ganges plain, the cotton and sugar cane region in Bangladesh, the region of silk(tussah), coconut, and spice in the southern part of India, and cotton growing region in Gujarat. From the mid 19th century to 1930s, a batch of specialized agricultural regions emerged in India, for instance: the Jute planting region in Bangladesh, the cotton growing region in Mumbai and central India, the tea plantation in Assam, the tropical crop plantation of coffee, rubber and spice, etc. in South India, the peanut plantation area in Madras, and the sugar cane growing area in the middle of Ganges plain. Mono-crops were produced concentrated in those regions whose planting areas and output accounted for 60%-70% nationwide and the commodity rate was as high as 80%-90%, gaining them important positions in the world.

The mono-crop area of rice, Than-javur in South India was a case in point. That region did not exported rice until 1799. However, it edged out Bangladesh and monopolized the rice market of Madras in 1817. In 1830s, colonialists in South Asia and Southeast Asia embraced running plantations partially for rice consumption of the laborers in their colony. From 1830s to 1880s (half a century), Than-javur became the rice supply center of plantations in South Asia and Southeast Asia, but as of 1890s, it only produced rice. In 1906, the paddy fields accounted for three quarters of the total cultivated land. The figure further grew to 86% in 1951(Institute of World History, CASS, 1981). While Than-javur planted rice only, more regions became mono-growing areas of cash crops, with the acreage of non-food crops continue to rise each year.

The introduction of modern western agriculture transformed Asian agronomic traditions. Japanese agronomy began to change after the introduction of western agronomy in the former half of the Meiji period and further changed

in the latter half of the Meiji period and the Taisho period. The attitude of bachelors of agriculture toward research changed. They aimed to make use of the results of theoretical studies on individual crops/element technology for agriculture in each region without giving consideration to crop "rotation" appropriate for each region as a system. Thus, the flow of Japanese agronomy originating in Edo farming textbooks became an underground stream. Farmers accepted anything useful. The relationship between theories and experience in each region was complementary rather than fusion(Tokunaga, 2006).

Scaled monoculture enjoyed fast development after the Second World War. As breakthroughs were made in industrial technologies in the West and the rising of oil industry, agricultural machinery, pesticides, fertilizer, herbicide, and agricultural film were widely used in farming industry, the second agricultural revolution was triggered. Then cheap agricultural products produced during the second agricultural revolution started to hit Asia's market, furthermore, the traditional agricultural industry later lost the tariff protection with the promulgation of WTO rules. People assessed the value of agricultural industry through productivity and economic returns, and neglected those that could not be weighed by profits. Given that, traditional agriculture was not deemed science-based or economical; many conventional valued vanished consequently. Faced with the pressure from the market and competition of western agriculture, countries in Asia phased out the conventional model of small-scale diversified farming, which accelerated the process of large-scale monoculture, giving rise to the so-called "Green Revolution".

3.1.4 Green Revolution and White Revolution

After World War II, the population in Asian countries soared, brought about the food problem. Under the support of western consortiums, many Asian countries launched "Green Revolution" and focused on promotion of HYV (High Yielding Variety) supplemented by inputs in such modern technologies as water conservation, fertilizer, pesticides, and agricultural machinery so as to enhance the yield per unit and the proportion of commercial farm produce.

In India, the total area under the high-yielding-varieties program was a negligible 19, 000 km^2 in FY 1960. Since then growth has been spectacular, increasing to nearly 154, 000 km^2 by FY 1970, 431, 000 km^2 by FY 1980, and 639, 000 km^2 by FY 1990. The rate of growth decreased significantly in the late 1980s. The major benefits of the Green Revolution were experienced mainly in northern and northwestern India between 1965 and the early 1980s; the program resulted in a substantial increase in the production of food grains, mainly wheat and rice. Food-grain yields continued to increase throughout the 1980s, but the dramatic changes in the years between 1965 and 1980 were not duplicated. By FY 1980, almost 75 percent of the total cropped area under wheat was sown with high-yielding varieties. For rice the comparable figure was 45 percent. In the 1980s, the area under high-yielding varieties continued to increase, but the rate of growth overall was slower (Anonymous, 2010a).

During the first thirteen years of the "Green Revolution", India saw the total agricultural output hike by 70.7%, production per unit area by 45.2%, and the multiple crop index by 6.5%. All kinds of crops enjoyed substantial increase of yields, among which, the food crop had the largest growth of 82.3%, and rice took the lead by soaring nearly 2.5 times within thirteen years. The food shortage therefore had been reversed and the supply and demand of cash crops balanced.

The Philippines is the cradle of the Green Revolution in Asia. In 1963, the International Rice Research Institute (IRRI) was instituted, which cultivated the IR Series rice and was dubbed Miracle Rice. This new breed enhanced the rice yield per hectare by at least 2.5 times on average in the Southeast Asian countries within ten years, and the planting area of it also grew by 2000 times. Located in equatorial zone, the paddy field in Indonesia originally had an average yield of 1.8 tons per hectare. After the introduction of the new variety developed by the Philippines, the output was rapidly boosted to over 5 tons.

The Green Revolution varied among the Philippines, India and the West Asian country Israel, which took the path of irrigation revolution for agricultural development. Half of the national land in Israel was arid or semi-arid, and only 20% of that soil was arable, to make it worse, half of the 20% must be irrigated. The invention of drip irrigation technology in 1962 greatly stimulated the efficiency of irrigation, transformed the conventional farming method, and created agricultural miracle in that country. In the following thirty years, the agricultural water was stabilized at 1.3 million cubic meters, while the agricultural output increased by 5 times. Started from 1970s, Israel shifted its agricultural structure from grain production to farm commodities capable of earning foreign exchange through exports like high-quality flowers, livestock, vegetables and fruits. It capitalized on high-tech and modern management, continuously improved agricultural efficiency, formed the characteristics of high investment, high technology, high efficiency, and high output, and built a set of modern managerial system gearing with water-saving irrigation, agricultural science and technology and factory farming. Rural population only made up 9% of the total population. One agricultural worker was able to feed ninety people, and agricultural exports accounted for 9% of the total exports. Calculating by the agricultural standards of Israel, the earth can support three times the present population.

Since the founding of People's Republic of China, a series of top-down rural reform including land reform, the Great Leap Forward, people's commune, Emulating Dazhai on Agriculture, and the household contract responsibility system had been carried out in order to emancipate agricultural productive forces from the relations of production and change the poverty and backwardness in China. Although these movements brought changes to China in short term and influenced the agricultural development and production in later years, for instance, hydraulic works built during the Great Leap Forward period laid material foundation to some degree for agricultural development in

the future, they inflicted environment damages to certain areas and triggered natural disasters: the great famine between1959 and 1961 was somewhat related to the Great Leap Forward movement. Given all those setbacks, China's achievements in the agricultural industry in the past sixty years were obvious to all: it fed 1.3 billion people, or 1/5 of global population. Fertilizers, pesticides, irrigation and high yielding varieties which was remarkable played a key role in the process, and the short-stem crop and hybrids made enormous contribution. Hybrid rice expert Longping Yuan was hailed as "father of hybrid rice" to mark his dedication to this field. China was different from other countries in Asia who mainly depended on foreign consortium and capital, it basically achieved agricultural miracle by self-reliance. China's agricultural success was also part of the Green Revolution started from 1960s.

While launching the Green Revolution, India also rapidly implemented the "Operation Flood" nationwide and strongly advocated raising cows to boost milk production quickly with the purpose of increasing farmers' income, enhancing public nutrition, and improving national physique. Since the late 1980s, India's relatively prosperous rural areas experienced a "White Revolution": to carefully feed highly reproductive cows to produce dairy for cities and export. This movement lifted the livestock and milk products in India. In 1970, India only produced 20 million tons of dairy products; while in 1985, the figure was lifted to over 40 million tons, making it the largest cattle-raising country in the world. The standing stock reached 270 million, accounting for about 20% of the world total. In average, three people owned a cow and each people possessed 150 grams of milk per day. In the late 1980s, India has become the third largest milk producing country in the world. In 1999, dairy output hit 74.6 million tons, replacing the United States as the biggest milk producer. In 2004, the total yield was as high as 88.1 million tons, making the per capita possessed dairy increased from 39 kilograms to 84 kilograms and the country at the forefront of the developing world. The annual production value of dairy products surpassed 10 billion U.S. dollars, second only to grain in terms of the proportion in total agricultural revenue. Each year, exports of milk powder and other dairy products are over 200 thousand tons. In the vast rural area, rural households are gaining valuable and stable income through raising cows or buffalo and selling milk to the market. Since the "White Revolution", the adequate and affordable supply of milk to a large extent satisfied the daily nutrition demands the India people. The milk consumption has soared, which not only improved physical quality of Indian nationals, but also extent the average life expectancy of Indians for twelve years.

In 1954, Japan adopted legislations stressing that milk must be supplied with nutritious lunch for students; lunch should be offered with 200ml of milk at the same time. In 1960s, in order to enhance the national quality and population physique, it proposed "let a cup of milk strengthen a nation". Since then, it has become a trend for the Japanese people, in particular the children to drink a glass of milk each day. Today, the average per capita amount of milk was

up from 12 kg to the present 91 kg. Average height of the Japanese was lifted by 11 cm over the previous generation, weight by 8 kg, and it is now among the countries with the highest life expectancy. Japan's achievement is internationally recognized as "the miracle of human physical development".

3.1.5 Crises generated by the "Green Revolution"

The "Green Revolution" fended off major food crisis in Asia, and acted as the foundation of phenomenal economic growth in China, Southeast Asia, and South Asia. However, while solving the problem of food and clothing for Asian people, the "Green Revolution" generated a potential crisis which originated from monoculture that already existed implicitly before the Revolution. In 17th century, the phenomenon of preferring sericulture to rice-planting existed in the south of the Yangtze River which gradually shifted from a grain-exporting area to a grain-importing area (Zeng, 1994). During the reign of Britain, the "land of rice in southern India" Than-javur could not feed its own people. After 1872, Than-javur had to import 7000 tons of brown rice from Burma each year(Institute of World History, CASS, 1981). Within about half a century since the early 20th century to the eve of independence, grain production in India fell 4.3%; while in the same period, the 37% increase of population incurred food shortage and frequent famine. The former "granary" of the British Empire later was known as "the country of hunger". When natural disasters caused poor harvests internally and external supply was cut, famine was unavoidable. The major famine in Bangladesh in 1943 led to death of more than three million people, which directly threatened Britain's colonial rule in India. The monoculture introduced after colonial intrusions triggered these disasters.

Single operation has the following disadvantages: first, due to the reliance on labors and instruments of labor, the single-crop farming inevitably led to extreme consumption of certain elements and waste of other elements. Taking monoculture for example, "continuous cropping" will result in extreme consumption of some important nutrients in the soil and accumulation of irrelevant elements for the crop, and further lead to decline in soil fertility, even degradation, desertification and salinization of soil. At the same time, seasonal use of labor, machinery and facilities cause more idle time, and monoculture farming also induce low utilization rate of agricultural by-products. Second, single-crop farming is susceptible to diseases, pests and various public hazards. "Continuous planting" could easily cause many diseases and pests gathering in soil and even results in "cropping land". Taking into consideration the low utilization of agricultural by-products like straws and night-soil, the expansion of scale might incur serious public hazards over a long period (especially in suburban areas). Third, single-crop farming is vulnerable to natural disasters and economic volatility. Single-crop farming is more fragile to natural disasters than agricultural farming. In addition, supply and demand and price of agricultural products and other changes in economic environment pose a severe challenge to single-crop farming, because "a single-crop farming entity is

lacking of functions to diversify risks and lessen disaster impacts". The "Green Revolution" further aggravated large-scale monoculture.

Crises triggered by monoculture originated from the "Green Revolution" were in the following areas:

First, more burden was inflicted on farmers. Such necessities for traditional farming as seeds, fertilizer, irrigation, and farm tools basically can be prepared by farmers themselves. Traditional crop varieties are highly adaptive and have low demand for fertilizer. Human and animal wastes are main sources of fertilizer for traditional agriculture. Relying on scatter breeding, traditional animal husbandry uses agricultural by-products such as straw and chaff as feeds and farmyard manure as major fertilizer. Cow dung was once an important fuel material in many places in Asia. After burning, ashes return to fields, which not only solved the problem of environmental pollution, but also turned waste into valuable things. East Asian countries conventionally used intertillage and non-stop weeding, which also preserved soil moisture and fought droughts. However, after the "Green Revolution", farmers had to spend more money on agriculture resources than that they gained from selling agricultural produce. Because seeds of cross high-yielding varieties are not qualified as reserve seeds, farmers had to purchase seeds from the market on high price. The technical contents are in direct proportion to the price of seeds. According to a survey in 161 rural households in western Hunan province, China, 153 households or 95% purchase rice seeds from the market, only 8 households or 5% use seeds by way of self-reproduction(Liu, 2008). High-yielding varieties have higher requirements on fertilizer and water and are more vulnerable to diseases, pests, and weeds. Without fertilizer, pesticides, and insecticides, its yields are lower than that of traditional breeds with minimum investment, which was a cause of failure of the Revolution in some places(Anonymous, 2010b). Single-crop farming also deprived fields the natural barriers to resist floods and droughts, and disease and pests, further increased dependence on relevant elements. Even though herbicides relieved the physical burden on farmers, the lack of intertillage might exacerbate droughts. Drought control's reliance on water pump, diesel and power also increased dependence on the nature and the burden on farmers. All these passed over burden on farmers. Spending on pesticides in Warangal in central and southern India has shot up 2000 per cent from $2.5 million in the 1980s to $50 million in 1997(Shiva, 2000). Due to high threshold of the "Green Revolution", it was carried out in regions with those elements; as for the places without those conditions, achievements were limited or trivial(Anonymous, 2010a).

Most of the modern agricultural materials are based on oil, and farmers bear the burden of hiking prices due to scarcity of oil resources. The application of oil for agricultural transportation added burden on farmers' shoulders, reduced livestock, thereby cut the amount of fertilizer, reinforced reliance on chemical fertilizer, damaged agricultural environment, and further put on more loads on farmers. Since 1970s, there was tension of supply and demand in global oil market, and the "oil crisis" induced by soaring oil prices haunted

agricultural industry. In some places, oil prices inflicted unbearable burden on farmers. Recently, more farmers in northeastern Thailand started to plough land using buffalo again, some people even cultivated land by themselves to resist high oil price. In Chiang Mai in northern Thailand, farmers re-employ elephants to till lands in order to save costs, making a picture in 1980s. Tractors were once something to be proud of, but now they were abandoned by farmers. The 2009 UN Food Security Report warned that since 2006, the price for seeds and fertilizer have been doubled. The price of agricultural materials has become unbearable.

Second, returns on investment declined. In parts of South India, thanks to expansion of cultivated area and application of green manure and careful interplanting, the output increased by 65% in 1950s; but during 15 years following the "Green Revolution" between 1960 and 1976, that figure was only 45%. Moreover, most of the villagers regarded new rice variety and fertilizer as additional expenses(Institute of World History, CASS, 1981). Since the 1990s, the "miracle seeds" that drove the "Green Revolution" run out: the output growth rate of either rice or wheat began to be lower than that of the population, with annual growth rate dropped by 0.5%. Obaidullah Khan, representative of FAO Asia-Pacific region publicly stated that the cost of Green Revolution model was on the rise while output declining. The achievements of the Revolution also faded in other countries like Indonesia and the Philippines, with the yield per unit rose and ratio of energy output/input decreased.

The tendency of continued rise of energy consumption and product costs were seen in Japan. Comparing to 1950, the yield per unit only increased by 50% in 1974, and the price of rice by over three times, while energy consumption by four times. In recent years, Japan found that for most of crops and livestock products, one more unit of food energy requires multiple times of minerals input, which is not economical. The higher the intensity is, the higher per unit cost is, and the smaller the operating scale is and the greater the per unit yield cost is. According to the investigation of Hokkaido, for production of 100 kg of milk, the cost in 1965 was 2913 yen, accounting for 60% of produce revenue; in 1983, the figure was 8063 yen, or 80% of produce revenue. The cost for feeding over 30 cows are 7877 yen, but that for raising 1-10 is as high as 10500 yen or more. Though the rising cost is attributed to growing energy consumption and increase of land, labor, and other service costs, the issue of high investment brought about high cost has become an urgent problem in developing modern agricultural industry. Japan as a country depending on oil for its modernization has to reconsider its way out for agricultural industry(Li, 1991).

The diminishing marginal return is a clear trend. The output growth of agricultural industry in Than-javur in 1950s was higher than that of the following 15 years. In 1950s, due to expansion of cultivated acreage and carful interplanting, the output grew by 65%. Influenced by the "Green Revolution", between 1960 and 1961 and 1975 and 1976, it was only raised by 45%. Moreover, most of farmers considered new rice variety and fertilizer as additional expenses.(Insti-

tute of World History, CASS, 1981). It is calculated that for 1 kg of grain output growth due to application of fertilizer was 20-22 kg on average in 1960s, 8-10 kg in 1970s, 7-9 kg in 1980s-1990s, and now it is only 5-8kg. According to another set of figures, the average output grew by 11.56 kg during 1980-1985, 8.24 kg during 1986-1990, 2.03kg during 1991-1995, decreased by 28.7% in 1986-1990 comparing to 1981-1985, and further down by 75.4% in 1991-1995 comparing to 1986-1990. Between 1981 and 1985, the output growth that could be realized by applying 1 kg of fertilizer needed 5.7 kg of fertilizer during 1991-1995.

Economic downturn also happened in some small villages and even in non-agricultural areas such as fishing industry. Some villagers in Sipai village of Raohe county in China's Heilongjiang province, during 1968-1983, 8 fishing boats of the production team could catch more than 100 kg of fishes everyday; between 1983 and 1991, 20 boats in the village fished 30 kg per day; in 1991-2000, 35 boats caught 10 kg of fishes daily; from 2000 to 2006, over 30 boats fished 2-10 kg each day (Zhuang, 2009).

The economic benefits generated by scientific and technological investment also shrank. Under the impact of the "Green Revolution", excessive scientific and technological investments were channeled in breeding field. China's agricultural research has inappropriate structure with insufficient commercialization of research findings. Thousands of scientists focused on genetic breeding, leaving vacancy in techniques for cultivation and field management, further hampered the per unit grain growth (Qiao, 2008).

Third, the environmental damage was severe. Human and animal excrements were taken as fertilizer for traditional agricultural industry, which not only turned waste into wealth, but also avoided polluting the environment. With the promotion of the "Green Revolution", those farmers who indiscriminately pursued efficiency relied on modern agricultural techniques, equipments and means of production, and discarded traditional farmland manure. In 1980, there was a new proverb reads: do not use the yellow (human waste); do not dredge the black (pond silt); only want the white (fertilizer). Fertilizer overwhelmed all the organic fertilizer used in conventional agriculture. Farmers had more financial burden to buy fertilizer, the environment had another source of fecal contamination, and all the people had to pay for the treatment of pollution. A ton of toilet sewage contaminates 220 tons of clean water. If over half of the Asian population use flush toilet to treat human waste, the water consumption is not affordable, not to mention the pollution of environment. The scale of livestock farming synchronized with the "Green Revolution" also triggered corresponding problems. The concentration of livestock farming resulted in expanded business risks, inappropriate disposal of excrements and environmental pollution, making waste treatment another cost (Yu, 2002).

Greater damages to the environment are inflicted by abuse of pesticides and fertilizer, for they poison the whole food chain and in the end, threaten food security of humans. The misuse of pesticides kills bees and butterflies that helping pollination, and then fruit trees are fruitless. The increase of fertilizer,

pesticides, and herbicides in the soil and water kill helpful worms, dung beetles, and ants in the soil, and pollute streams, rivers, lakes, and costal water, thereby severely influence aquatic wildlife and birds. Natural enemies of pests like useful insects and helpful birds are lessened due to eating poisoned pests, further exacerbate destructive insects and make people depend more on pesticides. After long-term utilization of pesticides, pests will develop resistance to them, and the natural enemies of pests are also killed. Afterwards, a new round of pests is even more rampant, coupled with such consequences as pesticides residue and environmental damage. The increase of pesticides not only pollutes the environment and products, a large amount of toxic residues in farming products also pose serious threat to the health of people and livestock. Wild fauna and flora were once source of people's food, but now they are damaged by pesticides too.

Blind and non-scientific application of fertilizer, even surpassing the needs of crops and land carrying capacity not only increased costs of agricultural products, wasted means of production, but also polluted water, soil and the environment, resulted in fish mortality, soil hardening, yield decline of crops, and dysplasia of people and livestock. Increased fertilizer application and exhaustion of microbe in soil all directly influence the nutritional balance of land and land fertility. Before the introduction of modern fertilizer, rice and azotobacteria in paddy fields are in good symbiotic relationship. However, after the promotion of high-yielding varieties, due to substantial usage of fertile, the original balance was broke and developed reliance on fertilizer. Excessive use of fertilizer undermined roots of crops, leading to physiological disorders and frequent diseases. In addition, substantial use of herbicides and plastic mulching films also engendered similar problems. Increased mechanization of agriculture also caused air pollution and probably soil hardening.

Since 1960s, Japan consumed lots of fertilizer and pesticides produced from petroleum products and boosted agricultural development. However, it resulted in huge resources consumption, polluted the environment, destroyed the soil structure, and caused social hazards. Japan was therefore named "a country of pollution".

3.2 Major agricultural patterns and their characteristics

Compare with any other industries, agricultural industry is most vulnerable to natural environment. The most influential factors for agriculture are temperature, rainfall, and humidity, which are the most significant elements to determine agricultural pattern and development direction of a region. The Japanese agronomists borrowed the concept of "drought index" proposed by French climatologist De Martonne, Emmanuel (1873-1955). They took the drought

index of 20 for a year and the index of 5 for summer as benchmarks and divided agricultural patterns into 4 types(Iinuma, 1980).

The first type is the Southwest Asia and South Mediterranean area where the annual drought index is below 20 and summer index is under 5. The most typical one is the Middle East where annual rainfall is less than 400mm, and precipitation are concentrated in winter, making it a special arid area. Since evaporation from the soil surface and plants in most parts of the region surpasses average precipitation, irrigation became a prerequisite in crop farming in these regions. In general, irrigation consumes about 70% of the total national water consumption, so irrigated agriculture is the feature of agriculture in West Asia. Agricultural production in that region has to rely on the crop rotation to prevent evaporation from the soil. In that region, wheat is usually sowed in October. The two-seasonal (casual+wheat) farming method utilizing rain in winter is more common, and other desert regions are not suitable to agricultural production.

The second type is the northern Mediterranean region and the southern part of the Soviet Union where annual drought index exceeds 20 and the summer index is lower than 5, or the winter rain areas. Including the inland areas, this region has formed "two seasons" agricultural pattern where barley is planted first and then graze sheep and develop animal husbandry. From Greece to Spain and other low hilly area in southern Europe, grapes and olives among others are planted, and animal husbandry is dominated by pasturing sheep. Moreover, in southern Europe, in cities' outskirts or regions can be irrigated by rivers, sophisticated irrigated agriculture has been developed.

The third region is a special one with annual drought index lower than 20 and the summer index higher than 5, for instance, the Punjab region in India and the North China region. Although these areas are drought regions with annual precipitation lower than 200mm, 2/3 of the rainfall concentrate in the summer. The major summer crop in this region is coarse grain and the winter crop is wheat. In order to prevent water losses in the soil, these regions largely depend on the farming method of "intertillage water preservation". In the North China region, after double-crop rotation finished, people cover the plowed land to prevent moisture loss. Agriculture in these areas has something in common: choose intertillage so as to reserve water.

The fourth region is the summer rain region, or the humid region where the annual index is higher than 20 and the summer index larger than 5, with North Europe and East Asia as the most typical ones. In the Nordic region to the north of Alps, rainfall in the summer is utilized to maintain a three nursery-style agriculture. Unlike the southern Europe, this region originally was featured by summer agriculture, due to poor soil conditions and cold winter, weeding during growing period is meaningless. Nevertheless, this region is oriented to apply "three nursery style", that is to lay idle cultivated land for two years and then remove weeds. But in countries of East Asia region such as southern China, Korea, and Japan, it will be difficult to have a harvest if weeding is not

conducted on time. The characteristic of agriculture in East Asia is "focusing on intertillage weeding for the purpose of removing weeds".

In terms of Asia, during the long term agricultural development, influenced by natural, social, and economic factors, 5 agricultural areas have been formed.

The first one is the paddy field. The paddy field intensive agriculture is the most typical and representative type of agricultural area, which is also known as Asia agriculture pattern. In Asian monsoon climate district, the precipitation and summer are synchronized with high temperature and heavy rainfall. This kind of weather is conducive to the growth and development of rice. Rice planting in East Asia boasts long history and advanced techniques, making it a major rice production belt in the world. The region is dominated by family farming and implementing intensive agriculture. The per unit labor input and fertilizer utilization are high, and the yield of each acreage is between 4 and 7 tons, making it among the leading countries in the world. The modernization level in Southeast Asia and South India is quite low, and the harvest is highly dependent on the weather conditions. The single cropping rice is dominating with the yield per hectare about 2 tons. Asia produces over 7.5 million tons of rice annually, accounting for more than 92% in 1999. It is also a major rice exporting region in the world, making up over 2/3 of annual exports worldwide. Thailand, Vietnam, Pakistan, China, India, and Myanmar are major exporting countries. Rice is mainly planted in the plain area, China's Yangtze River region, the Pearl River Delta, Sichuan Basin, Red River, Mekong, Chao Phraya, and Irrawaddy delta, Java Island, the middle and down reaches of Ganges and the delta region of the Indus River.

The second one is dry field where precipitation is between 300-1000 mm and the rainfall varies a lot, so only a region with a sound irrigation system can ensure stable yields despite drought or excessive rain. The per unit yield of rice is low, with wheat, soybeans, corn, sorghum, millet as main food crops and cotton and peanuts among others as major cash crops. To meet the needs of production and daily life, horses, cattle, sheep and pigs are raised. The North China region, Northeast China region, the Deccan Plateau, the upper reaches of the Ganges, and Japan's Hokkaido region are representatives of this type.

The third one is a composite type: nomadic agriculture and semi-nomadic agriculture are main agricultural patterns in Mongolia, Inner Mongolia in China, Northwest China, Central Asian countries, and the arid grassland, semi-arid grassland, and desert regions in West Asia. The animal husbandry in these regions relies on natural grassland. Most of people migrate along with water resources and some of them have settled down. People mainly graze cattle, sheep, goats, and camels. It is a self-sufficient region with low commodity rate. Irrigated agricultural industry is developed in "oasis" and the main crops are wheat and coarse cereals.

The fourth one is plantation agriculture, emerged in modern times. There are many large farms run by the western colonialists and the production tech-

niques are advanced. Some local residents and overseas Chinese operate small plantations where tropical cash crops for exports like rubber, coconut, oil palm, sugarcane, and tea are cultivated. They are mainly dotted in piedmont and gentle slopes in sound drainage areas of tropical rainforest regions where the weather is hot and rainy all years; the average annual temperature is between 20 and 28 centigrade, with precipitation higher than 2000 mm. These areas are concentrated in Malaysia, Indonesia, Thailand and Sri Lanka.

The fifth one is shifting agriculture: this is a primitive form of agricultural management that people burn the grass in lands first and then perform cultivation without applying fertilizer or irrigation. Two of three years later when the soil is not fertile any more, people move to other lands. This is destructive to natural resources. The main plant is coarse crop. This pattern can be seen in the northern part of Indo-China Peninsula.

Some countries with cast territory always have various agricultural types co-exist, such as China and India where almost all of the farming patterns exist. Even in countries like Korea which has relatively small realm, the agricultural pattern is unique. Korean agriculture, a branch of East Asian agriculture, is categorized in the fourth area in the world agricultural zones. Located between the North China region (to the north of the Yangtze River) and Japan with humid climate, the climate in Korea has the features in North China like spring drought and more characteristics than summer floods in Japan. The inherent environment conditions of the semi-dry climate determined that intertillage weeding is applied and Korean agriculture has the features of water conservation agricultural conventions. Therefore, since ancient times, the Korean agriculture has formed a labor-intensive and compound cultivation pattern, and developed into a coordinated rice field-upland rotation method, which has the advantages of preventing the high temperature and humidity of the environment lead to luxuriant weeds and losses of organic materials in the soil. (Lee, 2004).

There's no uniform pattern for agricultural development, and the local natural environment and historical and cultural traditions must be taken into consideration.

4 Differences and Clashes of the Oriental and the Western Civilizations

4.1 Agricultural patterns of the East and the West: cereal pattern vs. cereal and hay pattern

Though the European agriculture originated in the West Asia and other Asian areas, it has big differences from that of Asia, in particular varied from that of East Asia and South Asia. It is convenient for people to identify the disparity of agriculture between the East and the West. Meat and milk are consumed more in the western table while plants and grains are preferred by people in the East, which is caused by different proportion of animal husbandry in the two agricultural patterns. To put it in a simple way, animal husbandry weighs higher in the western agricultural than in the eastern one.

The difference might be induced by dissimilar clothing materials of the two originally. Clothing materials are made from the nature, including plants like hemp and cotton and animals such as fur and silk. Different natural conditions in various places resulted in differed clothing materials. Since the beginning of Neolithic age in China, clothes were mainly made from silk and hemp, and shifted to cotton in Song and Yuan dynasties, though animal fur was used, it was not commonly used. This is the opposite of the western world especially to the Britain which started utilizing fur and linen (especially wool) as the clothing material.

The difference in clothing materials reflects variation of obtaining methods. In China it was sericulture and in Britain it was raising sheep. Nevertheless, in natural economy, both of them could not be fully depended on, and it must be combined with cereal cultivation, which formed different agricultural structures. In China, the dominating structure is the combination of cereal farming and sericulture; while in the western world it is cohesion of cereal farming and animal husbandry. This is also demonstrated in agricultural books, since ancient Chinese agricultural books were composed of cereal farming and sericulture in

all dynasties. Western agricultural books were absent of sericulture and hemp planting, instead, cereal production and animal feeding were the two major components. The production of clothing materials is the watershed of eastern and western agriculture which are divided into farming and sericulture and farming and animal husbandry–main features of Chinese agriculture and the western agriculture.

The form of China's farming and sericulture pattern was divided cultivation of food crops and fibre crops, that is to say, the two of them occupied their respective land. Cereal production has been an important target for agricultural industry in China, and the theory and practice of "taking grain as the key link".

Cereal production also takes primary position in many countries in East Asia and South Asia. In India, grain production accounts for 60% to 70% of crop faring, and cash crops and others only 30% to 40%. In terms of planting acreage, total sown area was 1.310 billion hectares in India in 1951, among which, grain occupied 973.2 million hectares, or 73.7%; in 1981, the total cultivating area was increased to 1.7332 billion hectares, and grain made up 73.0%—the ratio remained basically unchanged(Chen, 1996). In China, India, Japan, DPR. of Korea, and Southeast Asian countries and other nations in Asia all take rice as their staple. That is to say, nearly half of global population, including the entire population in East Asia and Southeast Asia consume rice. China is by far the largest rice producer in the world, accounting for 35% of global output. Hsien rice is planted in South China and japonica rice is grown in North China. Rice planting in India also enjoys long history in India. About 65% of the total population takes rice as staple, and its yield is second only to China. Bengal, Uttar Pradesh, Madhya Pradesh, Orissa, and Bihar are all relying on rice production. Japan is the ninth largest rice producer with about 2.3 million farmers planting rice domestically. 90% of the rice planted in Japan is consumed at home, for the Japanese prefer rice grown in their country. Rice is called "rice of the country" in Japan, and it once undertook the role preceded only by currency(Figure 4.1). Straw, like "Korean straw roof", has become an integral part of Korean culture.

Figure 4.1 Japanese coin

Rice cultivation has high demands, in particular to water. In arid regions like North India and North China, wheat is dominating since good harvest is achievable with intensive cultivation. Wheat is the world's second largest crop in terms out yields, second only to maize, and rice ranks third. Millet, sorghum and barley are planted in more barren places. Beans are also one of the most important crops in Asia.

Compared to other continents, animal husbandry has relatively minor position in Asia. Except for farming and transportation, livestock for meat consumption is rare. The reason is that food produced by cereal surpasses that from grazing livestock or animals fed by crops by a large margin in unit land, and a large population requires as much as possible food from unit area. Asian civilization is also known as "vegetarian civilization", because the major staples are grains and other plants (including a wide variety of vegetables), and meat are rarely consumed. Although India's animal husbandry is more advanced than that of China, the proportion in its agriculture is not high. In early 1980s, the composition of agricultural sectors in national income was: farming still held 89.2%, animal husbandry 7%, forestry 2.3%, and fisheries only 1.5%. India's animal husbandry is mainly dominated by cattle and sheep cultivation while pigs, donkeys, horses, and other livestock and poultries like chickens and ducks are less. In India, the amount of cattle and buffalo accounts for 1/6 and 1/2 of the world respectively, making it rank first in the world. However, due to religious customs, they are forbidden from killing and thereby have low utilization values.

The agricultural structure in West Asia is more similar to that of the West. Among the five industries, planting is the most important one, followed by animal husbandry, and the scale of forestry, fisheries, and sideline production is small. In farming industry, cereal is the primary product, among which, wheat and barley are the most important two. The cultivation of sheep, cattle, and goats are dominant in the animal husbandry.

Originated from West Asia, the European agricultural industry was a loose combination of farming and animal husbandry at its initial stage. A typical example is two field system and three field system: each year, 1/2 to 1/3 of idle land is used as pasture, and the other 1/2 or 1/3 of land is temporarily used as pasture after the harvest of crops. Modern agriculture in the West has formed a combination of farming and animal husbandry. A variety of lands (farmland, pasture, grass-cutting land, and wasteland) are cultivated rotationally to plant cereals and grass which is used to feed animals no matter it is legume forage or not. This broke the boundary of land and non-cultivated land, and changed the past practice of separating grain cultivation and animal feeding and also farmlands and pasture so as to organically combine farming and animal husbandry. This is the technological revolution in the European agriculture history.

4.2 Comparison of development path between the East and the West: enhance land productivity vs. labor productivity

The farms in Asia are in general small, in most places, they are less than 2 hectares on average, and they are even tinier in densely populated areas. Moreover, the small lands are scattered and fragmented. In order to improve yield per unit, labor-intensive pattern is employed to develop agricultural industry in Asia. Since ancient times, the yield per unit has been the highest in the world. Highly efficient agriculture feeds more and more population who need more food, and at the same time provided more labors to produce more. This model is compatible to the evolution history of agriculture and population in major monsoon regions in Asia during the past 4000 years.

Started from the Warring States Period (457 BC-221 BC), China took the path of "using more fertilizer and labors" to conduct intensive cultivation with the purpose of lifting per unit output. As for the utilization of land, fallowing farming system had been replaced by continuous cropping. Based on that, through mixed cropping, intercropping, continuous cropping, and rotational cropping, people cultivated two, three or even more crops on the land originally only planted one or two crops per year, so as to achieve "several harvests in one year" or even "13 harvests for 2 years". The utilization rate of land was as high as 100% or even 200% and 300%. In comparison, West Europe had extensive agriculture in the Middle Age: few farmlands were applied and intertillage was not adopted, and the restoration of land mainly depended on fallow. Spreading was the major sowing method which resulted in low yields and less labor involvement at the same time. However, as each people possessed abundant arable lands and animal husbandry made up a large share, the average amount of agricultural and livestock products were not small.

After the 15th century, agriculture in China and in the West was challenged by industries and businesses. In order to meet demands of textile industry for materials, western countries, led by British, initiated the enclosure movement which lasted from the end of 15th century to the first half of the 19th century. During the same period, "sericulture replacing paddy fields" occurred in the south of the Yangtze River. In essence, this phenomenon and the enclosure movement to raise sheep represent the challenge posed by clothing materials to food production.

The most obvious result of enclosure movement was a sharp decline of rural population. The remaining shepherds used newly-occupied land to grazing sheep and cattle with advanced techniques, planted cereals, and thereby more fur, meat, and grain were produced to satisfy people's demand for ample clothes and food. The large-scale development was a trend in the West. The enclosure movement also suited with demands of the industrial revolution in western

countries. As new industries had more demands for labor, work force in rural areas continuously flew out. To ease the tension of labor supply, it was beneficial to use machinery, which further formed the capital intensive agricultural pattern focusing on raising labor productivity and maximizing fixed capital.

The best example of this tendency was the agriculture in the United States after the Civil War. Using tractors and combine harvesters as the pioneer, it successfully realized expansion of scale, and based on that, strong work forces were utilized to make the States a strong power with the capacity to control the world. The development of modern western agriculture was mainly embodied in overcoming fallow and realizing scale production through mechanization. This tendency of scale expansion was reinforced by mono-cropping. To achieve this end, large amounts of petrochemical products like pesticides, fungicides, and herbicides have been used.

Different from the phenomenon of declined rural population after enclosure movement in the West, "sericulture replaced paddy fields" in 17th century in China resulted in rising rural population resulted from higher demand for labors to plant mulberries and feed silkworms. The most prosperous silkworm-breeding region was the most populous one in Chinese history. Without corresponding increase of arable land, the growth of population stimulated people to produce more produce in limited land and develop more application of finite agricultural products.

The trump card for agricultural development in the East is "using more fertilizer and labors", this intensive farming method was "developed by doing the utmost under extremely tough environment to meet people's needs for subsistence and lives" (Dong, 1981). It was also shaped in unfavorable circumstances to ensure sufficient usage of land so as to sustain population growth with the purpose of lifting land productivity. The intensive agriculture pattern relieved the pressure on land by rising population and supported the social and economic development in Southeast Asian countries. Though it was related to the crop type–rice–the major one in East Asia, the fact that the per unit supporting capacity largely surpassed that of major crop in the West indicated the development path of intensive farming was correct.

The most typical representative of intensive agriculture was rice cultivation technology emerged in the south of the Yangtze River after entering a new millennium. This set of technology included soil preparation, seed selection, raising seedling, transplanting, fertilization, irrigation, and multiple cropping, etc. This technique had been introduced into other regions in China and also Japan in the late 16th century. In the first half of the 20th century, under the colonial rule of Japan, the rice-planting techniques from the south of the Yangtze River was promoted to Rep. of Korea, Taiwan Province, and other regions with different soil and climate conditions in the Southeast Asia. Labor-intensive rice farming technique has been widely applied in Asia. The intensive farming pattern successfully solved the problem of natural resources constraints and bottlenecks in small arable area(Table 4.1). "It not only enhanced land utilization, but

also created prerequisites for multiple cropping. The intertillage through labors' work made cultivation more intensive. Top dressing was used on corn planting; in addition, intercropping, mixed cropping, and transplantation were applied to make full use of lands and room." (Dong, 1981) "From 14th century to 19th century, it is estimated that population and food production had increased nearly 5 times, and further climbed by 50% in the mid-20th century. Among the increment, nearly half was realized by expanding planting area, and another half was attributable to doubling of the main grain yield per unit" (Perkins, 1969). This is the reason for China to solve food and clothes problem for 22% of the global population with 7% arable land in the world.

Table 4.1 Estimation of rice yield per unit in Asian countries and regions

Country or Region	Year	Tons per Acreage
Japan	1878-1882	2.53
China	1921-1925	2.56
India	1953-1962	1.36
Taiwan, China	1953-1962	1.38
Indonesia	1953-1962	1.74
Malaysia	1953-1962	2.24
Rep. of Korea	1953-1962	2.75

Source: Arrighi et al. (2006)

There are obvious differences in terms of yield per unit area and population supported by a work force between the East and the West. For a long period of time, yield per unit area in Eastern countries was higher than that in western countries. In terms of the seed/yield ratio, the lowest yield/seed ratio in the Middle Age in Europe was 1.5 to 2, and 3 or 4 are normal; while in good years, the best case was 6. According to Walter of Henley's Husbandry in the thirteenth century in the West, the ratio was 3. But that figure was at least 10 or over 10, even dozens of times or hundreds of times in ancient China.(Ning, 1980).

In 18th century, a survey conducted by a British man in 2, 000 villages in Chengalpattu (near Chennai, a city in Southeast India) in India showed that: Between 1762 and 1766 there were villages which produced up to 12 tons of paddy a hectare. This level of productivity can be obtained only in the best of the Green Revolution areas of the country, with the most advanced, expensive and often environmentally ruinous technologies. The annual availability of all food averaged five tons per household; the national average in India today is three-quarters ton. At the best times in the States, the figure was 8 to 9 tons per hectare, and the world average figure was 3 to 5 tons. Before the "Green Revolution", it was 1 to 1.5 tons (Anonymous, 2010b). From the independence of India to the early 1950s, though arable land accounted for 42% of the total, 18% of which was fallow very often, and the multiple crop index of the real planting

area was only between 109% and 113% (Lu, 1958). However, the yield per unit area in India was still 30% to 50% of the world's highest level lagging far behind the level in the 18th century (Datt et al., 2005).

However, with regard to labor productivity, the West surpassed the East to a large extent. Judging from the evaluation on the average labor productivity of individual grain farmers in Ming and Qing dynasties, the agricultural labor productivity prior to the modern times was not only low, but also showed a downward trend (Table 4.2).

Table 4.2 Evaluation on the average labor productivity of individual grain farmers in Ming and Qing dynasties

Period	Raw Grain Produced by Each Labor on Average (jin)	Raw Material after Deducting Costs (jin)	Fine Grain Processed from Remaining Raw Grain (jin)	Population Supported (jin)
The Reign of Emperor Wanli (1573-1620), Ming Dynasty	6510	5208	3021	8.3
The Middle of Emperor Qianlong Period (1736-1795), Qing Dynasty	7037	5630	3265	8.9
The Late of Emperor Qianlong Period (1736-1795), Qing Dynasty	4749	3799	2203	6
The Middle of Emperor Jiaqing Period (1796-1820), Qing Dynasty	4286	3429	1989	5.4
The Late of Qing Dynasty (1644-1911)	3584	2867	1663	4.6

Source: Guo (2001)

In contrast, the labor productivity in the Europe and America were much higher. According to the estimation of FAO, the imbalance of world agricultural production caused disparity of grain output among countries. Canada has the highest average per capita grain output, reaching 3900 kilos; the second one is the United States, 2930 kilos, followed by Romania, 1900 kilos, and the last one is France, 1, 500 kilos. In Ming and Qing dynasties, one Chinese farmer could only support 5 people, which also can be taken as a reference for most of the times in history; one farmer in the United States was capable of feeding 98 compatriots and 34 people from other countries; one British farmer was able to

support 106 people. The agricultural labor productivity was also on the rise. At the early 20th century, a French farmer could only feed 2.5 people, but the figure was 30 in 1980s, 40 in 1990s. In 1950, one German farmer could feed 10 people, but today it is 130 people.

In short, the purpose of western agriculture is to raise the labor productivity while that of eastern agriculture (especially the East Asian agriculture) is to improve the land productivity. The labor-intensive agriculture in Asia is fundamentally different from that in the West. When it comes to land usage, it was predatory operation in the West, but the East emphasized the combination of exploitation and improving soil fertility so as to guarantee sustainable utilization. In this regard, the German chemist, and also the father of agricultural chemistry Liebig pointed out in more than one hundred years ago that those deserted and barren countries throughout the history and the European agriculture which was similar to them were all on the opposite position of China and Japan, because they only used and plundered land and never paid attention to improve soil fertility.

4.3 Challenges in front of traditional culture in Asia

4.3.1 Debates on values

After the 19th century, western colonialism was imported to Asia and challenged Asia's traditional culture. Asian culture underwent a process of self-denial, rediscovery or self-identify and continuous disputes. Initially, the conquest of western colonialists hurt the pride of some people in Asia. Some Asian intellectuals began to realize that the root cause of backwardness in Asia was the traditional culture, so they began to open their minds or even follow the western model. Nevertheless, many people still stuck to the traditional values.

To embrace the western culture or to adhere to the eastern values had become an issue. Influenced by the Confucian culture, the East Asia chose to reconcile the approaches, or "Chinese learning for fundamentals, western learning for practical application", and "Learning from western technologies while preserving Japanese values". Until today, this approach of compromise and reconciliation are visible in proposing the building of socialism with Chinese characteristics.

While accepting western cultures, Japan and Rep. of Korea also preserved cultural heritage very well. Japan is often regarded as a unique country, for it has a high degree of western-style modernization, and also possesses oriental values. The Tai Chi and Eight Diagrams on the national flag of Rep. of Korea(Figure 4.2), Taegukgi, and the philosophical work *Book of Changes* in ancient China are symbols of oriental culture.

Figure 4.2 National flag of Republic of Korea

In India, after accepting the western culture, some people suffered identity crisis, so they return to the traditional culture of India. The spinning wheel on Indian national flag is the symbol of traditional Indian culture. As one of the origins of cotton, the traditional clothes—white coarse coat made by the traditional spinning wheel and white hat are its symbol (Figure 4.3).

Figure 4.3 National flag of India

In many areas, the indisputable progress in China indicated the transition to the western values. Although the westernization process encountered resistance, for instance, some people suggested taking Buddhism or other classic doctrines in this region as Asian values, but the political attempts behind that undermined these efforts. It is equally regrettable that India failed to value and evolved Gandhi's philosophy and spirits. In the 20th century, China's Confucian culture was highly controversial. During May 4th Movement, the slogan of overthrowing Confucius was put forward; in the "Cultural Revolution" period, it was further attacked and tarnished. Fortunately, the Chinese traditional culture has been reserved in people's daily lives in mainland China, and inherited to Chinese Taipei, Chinese Hong Kong, Rep. of Korea, and Singapore. The cultural traditions like advocating cherishing family, education, enduring

hardship, and thrift are, to a certain degree, drives of economic growth in those countries and regions. China's reform and opening up ushered in a new round of cultural revitalization.

To preserve Asian culture or to practice "westernization" has been controversial. While learning from the West, how to retain the fine traditions of Asian culture and guard against malpractices from the western culture remains a question. In a sense, many difficulties in materializing sustainable development are triggered by the western culture (the commercial civilization to the opposite of eastern agricultural civilization).

4.3.2 The significance of agriculture remains unchanged

The Asian culture is evolving, but what has not been changed is the importance of agriculture in Asia. For thousands of years, Asian agriculture nurtured the largest amount of population with limited natural resources, and has developed a unique farming culture. After the Second World War, agriculture's proportion of GDP in Asian countries all declined, but its fundamental position was not changed. So far, most of Asian people are earning a living in agricultural industry. However, due to uneven development of Asian countries, they face different agricultural difficulties (Figure 4.4).

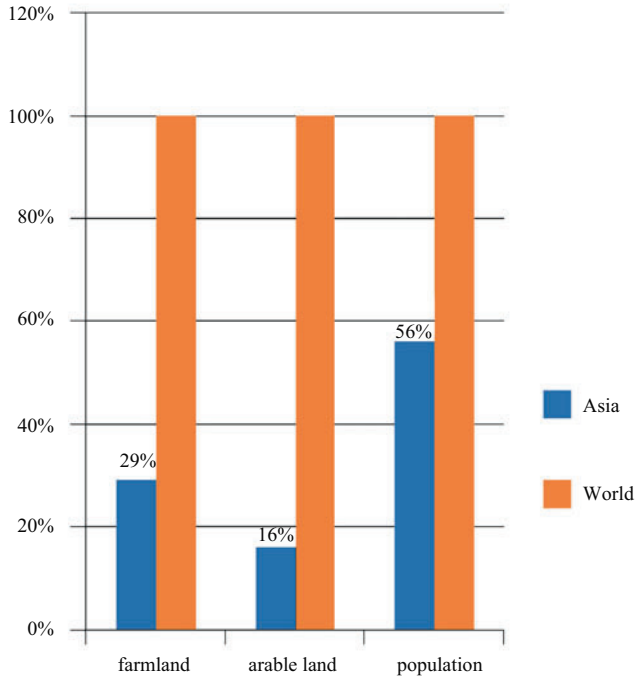

Figure 4.4 Asian population and land cultivation

India and China are the world's two largest developing countries in the world. Agricultural industry has always occupied an important position in the GDP of Asian countries like India and China. In over 30 years between 1950 and 1951 and from 1983 to 1984, the average annual growth rate of agricultural

production was 3%, with the output increased by 1.31 times from the early 1950s to the early 1980s. Agricultural output has always been the largest source of India's GNP, accounting for about 65% of the net industrial output. India's agricultural output ranks second in the world. In 2007, agriculture, forestry, aquaculture and other related industries made up 16.6% of the GNP, and absorbed 60% of the work force(CIA, 2007). Although the proportion in GDP is declining year by year, the primary industry is still the biggest branch of India's economy, playing a significant role in socioeconomic development. Since the implementation of reform and opening up policy, the share of rural population and agricultural output in national population and GNP were dropped, but there are still over half of the national population live in rural areas. In 1997 and 2004, the proportion of rural population in overall population was 70.1% and 58.2% respectively. Nevertheless, the share of agriculture in industrial and agricultural production was 18.1% and 16.2% respectively.

Since the beginning of opening up (1978 in China, 1991 in India), both of them accomplished great economic achievements and are rising as major powers. While looking into a bright future, they should notice that the journey to rise will not be smooth, and they will encounter common difficulties in economic security. Food security is of great concern in particular. After the founding of the two countries, they both suffered famines that incurred severe social or even political consequences. Leaders of the two countries are making every effort to make them prosperous. India started the "Green Revolution" in 1960s and realized grain self-sufficiency later, turning from the former "country of famine" into an important grain exporting country. China made even more phenomenal progress in grain production. However, the food security situation in India and China is not optimistic. On the one hand, the accelerated industrialization engrossed large amounts of farmland, and land losses of the two will exceed the growth rate of land productivity, further pulled down the grain output. On the other hand, as the population increases and people's lives improved, the rising indirect grain consumption demands more food; therefore, there are still gaps between supply and demand. Given that the population in China and India accounts for 40% of the world, they can not resort to the world market for insufficient food like small countries, because it will definitely inflict huge pressure on food supply and demand in the world market and cause volatility of international grain prices. China and India must solve the problem of food security on their own.

As the most densely populated country in the world, the per capita arable land area of Japan falls far short of countries in US and European countries. After the Second World War, agriculture's position in the overall economy has been declining. The arable land in rural areas was shrinking. Along with the development of the secondary and tertiary industries in cities, agricultural workforce left fast and accelerated the aging process, resulted in heavy dependence on grain import. In the early 1950s, agricultural population accounted for over1/3 of the total nationals, and reached its peak to 1.6 million in 1955, made

up to about 40% of the entire employed people. The agricultural output was 1/6 of its GDP, and over half of the national consumption is on food and drink. After 1950s, the share of agriculture in Japan's GNP began to decline. In 1960s, the employed population in agriculture reduced by 40% and the yield by 50%. The proportion of diet consumption in the final consumption was lowered to only 1/4 and the agricultural output 1.8%. People worked in the primary industry make up 6.2% of the overall employed population. After 1980s, Japan imported more and more agricultural produces year on year. Grain self-sufficiency rate fell year by year: from 82% in 1960 to 37% in 1973, and to 32% in 1983.

In Rep. of Korea, the labor force fully engaged in agriculture dropped to 20.7% in 1988 from 58.8% in 1956. The tendency of industry emptiness and aging was evident. In 1991, the agricultural output accounted for 8.1% of the GNP in Rep. of Korea, and it further fell to 2.6% in 2006, which indicating the declining position of agricultural industry in national economy. In 2009, the grain self-sufficiency rate was only 25.3%, and it was only 5% after deduction the proportion of rice.

The West Asia region is the largest oil exporting area where agricultural industry also holds important position in many countries. In the whole region, agricultural population accounted for 39% of the total national in West Asia (except for Bahrain, Qatar, and Oman due to the lack of information) in 1985, but people worked in agricultural economic activities made up 47% of the employed population. All countries in this region relied on corn imports to some extent. The farming land in West Asia mainly located in non-oil exporting countries, and the per capita arable land in oil-exporting countries was only 63.5% of that in non-oil exporting nations. The net grain import volume in oil-exporting nations was 71% of that in West Asia. As for the per capita net grain import, the oil-exporting countries imported 3 times more than the non-oil exporting countries did.

Relying on oil export or highly developed economy, some countries and regions in West Asia and Japan and Rep. of Korea temporarily resolved the grain problem through imports, but in the long term, oil might be depleted and the economy volatile, countries as developed as Japan and other advanced regions also face food and agricultural problems.

Agricultural development and food security are the most important factors hindering the sustainable development in Asia. Two-thirds of the malnourished people live in 7 countries: India, China, Democratic Republic of Congo, Bangladesh, Indonesia, Pakistan and Ethiopia. Except for Congo and Ethiopia, others are all Asian countries. According to FAO, some southeastern countries like Thailand and Vietnam have made progress in reducing hunger. The Philippines once realized rice self-sufficiency after 1966, but in 2008, the rice supply still had 10% gap. By the end of April of the same year, President Arroyo announced the allocation of 1 billion U.S. dollars for rehabilitation of agriculture. She said "we must work hard to feed ourselves". The South and Central Asia experienced setbacks in food self-sufficiency. DPR. of Korea even

has more severe problems.

More serious situation may be yet to come. The population growth might result in tension between supply and demand. The latest report on population forecast released by the United Nations Population Division in March, 11th, 2009 stated that the global population will be increased to 7 billion in 2012 from the current 6.8 billion, and to over 9 billion in 2050. According to this report, the incremental population is mainly from developing countries. It is expected that in 2050, population in developing countries will reach 7.9 billion in 2050 from 5.6 billion in 2009. The population in developed nations is estimated to change little, from the current 1.23 billion to 1.28 billion.

China used 7% of the world's arable land to feed 1/5 of the global population and realized food self-sufficiency in a nation with 1.3 billion people, which is remarkable even incredible to many people. However, is this miracle sustainable? In 1995, Lester R. Brown, head of Worldwatch Institute made astonishing remarks, "Who will Feed China?" He said that before 2030, China will import more food to feed its rising population. China's problems are those of Asia. Asia has 456, 000, 000 hectares of cultivated land, accounting for 29% of the world's total. However, its arable land is less than 16% of the entire arable area, but the people in Asia accounts for 56% of the world population.

The sustainable development in Asia relies on the sustainability of energy, resources, and the environment, and even more on sustainable development of agriculture. People are fundamentals for a nation; foods are fundamentals to people. A prosperous agricultural industry is the way to long-term stability. Moreover, the primary industry is also related to energy, resources, and the environment.

4.3.3 Agricultural industry has ever-weakening foundation

The agricultural industry in Asia today is as important as it was in 10 thousand years ago when it was born. However, its foundation is getting weak.

The first one is the shortage of cultivated land. The land that can be reclaimed worldwide has been basically cultivated, so it is impossible to increase land by a large scale through reclamation just as in the past. The multiple crop index is quite high, and the utilization rate of per unit area has reached its limit. The excessive cultivation of land resulted in over reliance on fertilizer and declined self-repairing capacity of soil. The quality of soil is dropping for the lack of nutrition. Statistics show that the basic soil fertility in China is declining compared to 1980s. The middle-and-low-yield land that made up 60% of all arable land has the problem of poor nutrition in general. Most arable lands have insufficient nitrogen; 1/2 of them lack phosphor; 1/2 to 2/3 of them lack potassium, and a large share of them has scarce secondary elements and microelements(Jin et al., 2006). The oil, coal and mine, and natural gas resources used to produce fertilizer and farm power are running short. Most Asian countries need to import oil and natural gas to fuel ever-increasing vehicles to cope with its expanding industrialization. Apart from damaging the environment, those resources

are not renewable. The reduction of output caused by environmental damages is irreversible; to make it worse, the reduction of farmland incurred by industrial development and cities advancement is also irreversible. In the future, land and the means of production will not increase; on the contrary, it is going to decrease continuously. China's average loss of arable land is 1, 333, 333 hectares, with per capita farm land stand at 0.08 hectares, which is far less than the average level of 35% in the world. In 2015, China's urban population will for the first time exceed that of the rural areas. In 2030, China's population will reach its peak of 1.6 billion and the food problem will be more outstanding.

The second problem is land erosion. The forest in Asia has gradually vanished due to deforestation in several thousand years. Other problems include the extreme shortage of wood supply, dangerous water and soil loss, and the uncontrolled amount of runoff exacerbated floods and silted mud. With increased population pressure and greater demand for timber as the economy further develops, more slope and forests have been destroyed and caused disastrous consequences. In China and India, most primary forests have been damaged, and the reforested areas cannot make up for the over-logging. The floods in central China in 1954, 1991, and 1998 resulted from continuous deforestation. In flood-prone Bangladesh and Assam of India, deforestation also aggravated floods in terms of the scale, frequency, damages and mortality. Southeast Asia has the most important tropical forests in the world, and they are deemed as key factors to maintain climate stability in the world, but since 1950s, they have been cut by large amounts to sustain local economy or export for foreign exchanges and importing goods. At present, the logging technique using chain saw and logging trucks engendered severe consequences. Due to the impacts of modernization especially the rising population, some ancient agricultural nationalities began to be influenced. The ethnic minorities in northern mountainous region of Vietnam used to conduct uncultivated farming pattern featuring slash and burn method. But now the uncultivated period is getting ever shorter, caused damages to vegetation, soil erosion, and low productivity, and even affected the ecological environment of the whole river basin(Le and Tuan, 2004).

The third one is water shortage. The application of high-yielding techniques greatly improved the effectiveness of artificial irrigation. The original farming tools like scoop and water tankers used for drought relief and drainage of water and many techniques were substituted by modern water pump. The development of large-scale irrigation projects has made great achievements, with irrigated area reaching 74 million hectares. This is the fundamental guarantee of the "Green Revolution" in India, but its dependence on the water pump increased demand for electricity and imposed huge pressure on groundwater sources. The excessive pumping of underground water caused dropping of underground water level. By the end of 1974 and early 1975, a drought of once-in-a-century hit southern India and wiped out all achievements in productivity after the "Green Revolution" (Institute of World History, CASS, 1981). In 1980s, canals funded by the government have dried up. In India, 15% of the grain is ir-

rigated by over-pumped well water. When the wells dry up, 175 million Indians have to rely on over-pumped underground water.

Climate change and environment degradation made many countries have less water available. This issue is especially severe in North China and Northwest China. In the past half a century, people in these regions fought against drought all the time, because the precipitation was less than 70% to 90% of the normal level and serous decline of underground water level due to over exploitation. Since 1960s, the aquifer in Northern China Plain has fallen from 10 m to 50 m. will last only 20-40 years, at most, under current usage (Maidment, 2009). In 2009, 15 provinces and cities in northern China were hit hard by droughts that were unprecedented in 50 years. The Yellow River and other important water systems are facing the crisis of drying up. In spring in 2010, a rarely seen drought occurred in China's southwest region.

The similar situation also happened in other countries and regions in Asia. Saudi abandonment of self-sufficiency in wheat after a major aquifer was nearly exhausted; in other parts of the country aquifers, some very deep, are also drying up. Since a survey of its ground water resources in 1984, the country has probably used up half of its water reserves. Around Quetta in Pakistan water tables are falling at the rate of 3.5 m per year, while around Islamabad and Rawalpindi the loss ranged between 1 and 2 m per year from 1982 to 2000. In Iran, over-pumping of aquifers amounts to 5 billion tons of water per year. In Yemen the water table is falling by about 2 m annually. Around the capital, San'a, water supplies are drying up; drilling more than one kilometre deep failed to find water, and it may be necessary to move the capital to a site with more water. Israel is depleting both its major aquifers, one of which it shares with Palestinians(Watson, 2009a).

The fourth one is the reduction of germplasm resources. The commodity economy emphasizes too much on outputs and neglects other functions except for improving yields. Given that yields are often negatively correlated, many varieties with superior quality have been excluded from cultivation and then gradually reduced. Sorghum in North China has been one of the major crops in North China. However, since 1970s, as a staple in China, it has been wiped out of the historic stage. Glutinous rice had once played an important role in rice cultivation in Asia, but due to the impact of the market economy, the planting area and species reduced rapidly.

Except for crop species and varieties, the household livestock also declined. In 1990s, India has more than 1 million camels, but in 2005, there were only less than 500, 000. Known as "ship of the desert", camels are means of transportation and also sources of milk, fur, bones and meat. Camel dung is a kind of fertilizer. However, these uses have been replaced by modern modes of transportation, which incurred the sharp decline of camels. In China main land, before 1980s, every producing team of a village with about 200 people had over 10 cows, and a normal household with 5 people raised 2 or 3 pigs each year. After the 1980s, only a limited number of ordinary farmers are feeding scattered

chicken. Other animals were barely raised. In Taiwan, few farmers have cattle.

Apart from the security of agriculture and crop, traditional culture and even public health are also at stake. Traditional crops and species are not only a source of food, but provide subsidiary products. For example, native breed rapeseed is oil rich; also, removing its flowering stalk not only serves people a palatable vegetable, but also promotes its branching and seeding. The introduction of high yielding rapeseed has eliminated the native breed. Decreased crop species may ultimately led to the loss of human health. Modern high yielding crops usually have low quality, for example, hybrid rice was commented as "the grain is no good for humans, the bran no good for pigs and the straw no good for cattle". In respect of nutrition, many traditional crops are vitamin-richer than modern breeds. In East Asia, people believe that medicines and foods share the same origin, which means they have the same function. Some crops have special health functions. Muslim culture has the same idea. Some major diseases of modern times, like cancer, coronary heart diseases and deficiency diseases are rarely seen in ancient times. To some extent it's because in ancient time there were more species and cultivars of crops.

Fifth, rural labor force is flowing outward. As modernization has destroyed traditional values, young people regard farming as dirty, tiring and not money-making. At the same time, the giant gap between urban and rural development make them yearn for cosmopolitan life. As a result, large labor force has been transferring from rural areas to cities and non-agricultural industries, leaving the number of farmers shrinking. Therefore, in modern societies, with the population irreversibly growing, labor force engaged in agricultural decrease all the time, most of them old people, women and children who are unfit for work. Prevailing rural population ageing will undermine Asia's sustainability.

In 1961, Japan entered a stage of rapid economic development. Rural areas suffered labor loss of about a million each year and large numbers of young people (among them, males under 19 accounted for 67% and females 75%) flooded into cities, leaving farming work to their grandparents and mothers. In mid 1990s, among 2.7 million Japanese farmers, old men (above 65) accounted for 19%, middle-aged and old women accounted for 36%, and they are joined by about 2000 young people each year. Subsequently, land utilization in Japan is low and only 18% of the farmers are young people.

From 1980 to 2005, rural labor in Rep. of Korea dropped sharply from 10.82 million to 3.43 million. The percentage of rural labor in total population correspondently decreased from 28.9% to 7.3% in this period. At the same time, the number of the elderly in rural areas increased significantly, indicating accelerated ageing. Reports forecast that by 2020, only 4.7% of the total population will be agricultural labor. As young people are unwilling to live in the countryside, the problem of ageing population will be more prominent by then. Also, with the nationwide birth rate dropping, Rep. of Korea will face a tendency of population decline.

From 1978 to 2008, continued transfer of rural labor force in China, particularly young workers and high-quality labor force left more and more old and weak labor force behind, and issues of left-behind women and children rose sharply. According to a survey conducted in September 2007, in Shenshan and Chounaoliang Villages of Dongsheng District, Erdos City, Inner Mongolia, because most young labors left their hometown for work, local residents aged over 60 accounted 45% and 70% of the total population(Jiang, 2008). With rapid development of industrialization and urbanization, China has entered the most active period of migration. In the next 30 years, about 300 million rural labors will transfer to urban areas, forming a population pattern of 500 million urban population, 500 million migrant population and 500 million rural population. Decreasing rural population has highlighted the aging of agricultural population. Therefore, labor-intensive work has been replaced by more extensive ways of farming. In early 2009, some elderly farmers in Jishui County, Jiangxi Province, China, used the slash and burn approach to weed, causing forest fires and leading to disasters, but there were not enough people to extinguish the fires, for strong workers all out in town.

Sixth, the pressure from western countries increased. Economic globalization, particularly WTO (Figure 4.5) accession has led to bigger western pressures on agriculture in Asia. Agricultural tariff cuts, reduction of government subsidies and increased imports will surely drag down prices of agricultural products, weakening local competitiveness and directly reducing farmers' income. After China's entry into WTO, though agriculture needed more protection, there was not much space for protection and it became more difficult to implement national protection policies. Trade liberalization will lead to substantially increased dependence on foreign trade, resulting in heavier impact of international market changes and fluctuations on agriculture, therefore significantly increasing agricultural dependence on international markets. Difficulties in solving rural social and economic problems, as well as food and agriculture security issues will rise consequently.

Figure 4.5 WTO logo

In order to cope with external pressure, people now hope to integrate agricultural structure adjustment with market economy, even with the WTO, and arrange agricultural activities according to the market. The promotion of the so-called "company plus farmer" and "order farming" all serves the purpose of in-

creasing agricultural production and enriching the farmers. However, the temporary gain does not change the long-term poverty, market-oriented agriculture may not be able to form a sound structure. There are many historical examples of this. For example, sugar cane, mulberry, tobacco, opium poppy (opium) have higher market value than food crops, because of which the land for growing food crops was once severely squeezed. But the cultivation of these crops didn't essentially enrich the farmers. On the contrary, because of the homogeneity of the crops and unreasonable agricultural industrial structure, the farmers became over-reliance on market and couldn't escape exploitation from merchants, and the fertility of the land deteriorated. After the globalization of trade in rice, a number of modern rice exporting countries, such as Burma, Java, Bangladesh, Indochina "benefited initially in the specialization of export-oriented rice production," but "ultimately suffered from the specialization in exporting to the West." Each of these areas has had their own "market era", but with the integration of market and enhanced market competition brought by technological innovation, each region in turn saw the demise of their market era. (Caclanis, 2001).

How to deal with the pressure brought to Asian agriculture by economic globalization? How to improve the competitiveness of Asian agriculture? Are specialization, mechanization and large-scale agriculture the only ways out? Is the adjustment of agricultural structure a panacea? Historical experience shows that market orientation will always lead to the trend of homogeneity. The homogenous agriculture structure is often the most unstable. As an old saying goes: "five different kinds of grains need to grow in the same time so as to prevent disaster." The then so-called disaster is more of a natural disaster. It now seems to include social and economic risks.

5 Retrospect and Prospect

5.1 Challenges for the development of Asian agriculture

Most of the problems that Asian agriculture faces today are those met by yesterday because the problems faced by both ancient agriculture and modern agriculture all merely involve the heaven, the earth and the people. In ancient agriculture, the influence of such natural factors as the heaven (climate) and the earth (soil) is stronger, whereas in modern agriculture, with the advance of science and technology and rise of level of the productive forces, the factor of people gets more influential. For instance, the wide application of chemical fertilizer, agricultural chemicals and machinery has to a great extent influenced the harvest. However, some fundamental problems that agriculture faces do not change accordingly; lack of land resources, decrease of land capability, flood and drought as well as insect damage and crop smothering caused by animals and plants still remain the main problems that beset agricultural development. At such a moment, a retrospect to the problems faced by the development of traditional Asian agriculture and their solutions will be enlightening for and drew lesson from by the agricultural practice of today.

5.1.1 Natural disasters

Agricultural natural disasters consist of climate damage and biohazard. Among the disasters caused climate, flood and drought are the most catastrophic. Most of Asian areas are affected by monsoon climate, the abnormal activities of which are directly connected with floods and droughts. Generally speaking, in the years of a strong monsoon, floods tend to come; and in those of a weak monsoon, droughts are inclined to happen. In addition, in the areas far from the sea, droughts are severe and frequent. North China and Northwest India, which are located on the border of major monsoon climatic zones, are easily influenced by droughts. Some disasters even spread over the most parts of Asia, for example Indian Deccan Famine of 1630-1632, where nearly 2 million people died; in the same period, a great famine also

occurred in Northwest China and it finally led to the perish of Ming Dynasty (1644). Among biohazards, locust plague is one of the most serious. Stem borers plague is a second one. Still, there are disasters of animals and birds. Weed is one of the main agricultural disasters of Asia, especially in the high-temperature and high-moist East Asian areas including South China, Korea and Japan; if weeding being not well done, there would be little harvest. Thus, intertillage weeding becomes an agriculture feature of East Asia.

China is called the Land of Famine. According to the record of *Spring and Autumn*, Chinese earliest annals, among 242 years there were only 2 years of harvest, other years had either floods and droughts or grasshopper disasters. All kinds of natural disasters almost happened all the time. Indian agriculture depends much on climate. Natural disasters such as flood and drought cause that the output of agricultural products varies greatly year by year; reduction of output happens every two or three years and catastrophic famine occurs every few years (Anonymous, 2010c). The most prominent and severe problem is precipitation deficit, and this is especially critical in the dry or nearly dry areas such as the upstream area of Ganges, Punjab, Rajasthan, middle India and Deccan Plateau. In addition, Indian agriculture also faces bird damages, wild animal damages and plant diseases and insect pests. Mice and monkeys (the latter is a sacred symbol of traditional Hinduism and consequently protected) do very much harm to crops and stored grains; as the storage is easy and simple, one fifth of stored grains are ruined or ate by insects in some areas.

5.1.2 Shortage of arable land

Land is the most fundamental production goods for agriculture. Affected by the factors of level of the productive forces and agricultural structure, as early as in Shang Dynasty 3000 years ago, parts of China faced the comparative shortage of arable land. With the rise of population, the contradiction between man and earth reached its peak after 1000 years; then land cannot feed the population on it, and in some areas people started to control population consciously. However, the population expansion was not controlled. The speed of farmland expansion could not catch up that of population growth. The result is the decrease of per capita area of farmland. In 1381 the per capita area of farmland of China is 0.97 hectare, in 1662-1722 it decreased to 0.36 hectare, in 1753 to 0.26 hectare and in 1821-1850 to only 0.11 hectare. In the condition of vast population and limited farmland, in order to prevent the death from contesting for land with the living, Chinese leader including Chairman Mao signed to advocate “carrying out cremation, leaving farmland”, but the shortage of arable land did not change. At present, the agricultural acreage of China ranks No. 4 in the world, but its per capita area of farmland is merely 0.08 per capita area of farmland, being 1/3 of the world average and less than that of Bangladesh. Bangladesh has the highest population density among the countries with an area of above 2500 square kilometers; its area is 147, 570 square kilometers, and in

1997 its population was 12.503 million.

Shortage of arable land, system of inheritance to sons by average and disparities in natural conditions of different blocks led to land fragmentation; the land was divided into strips and blocks, and per capital area was small and dispersive. Fragmentation makes plantation inconvenient; and also the borders (ridges) of strips and blocks aggravate the shortage of land, for they themselves occupy some areas of land. The system of fragmental farmlands plays the role of shaping Chinese history(Wan, 2005).

The situation in China represents the trend of many Asian countries. According to an official statistic in 1734, the farmland of a typical Japanese peasant household was less than 1 hectare. In late 19th century and early 20 century, the scale of an East Asian farm on average was 1-3 hectares, but about 70% of Japanese farms were only half a hectare or even less. In late 19th century of industrialized Japan, 90% of farms were only 1 hectare or less than 1 hectare. In contrast, the scale of a French farm in 1882 reached 14 hectares on average(Arrighi et al., 2006). From late 20th century to early 21st century the per capital farmland of Rep. of Korea takes a trend of falling; in 1970 it is 0.0731 hectare, in 1980 it is 0.0576 hectares, in 1990 it is 0.0492 hectares, in 2000 it is 0.0399 hectares and in 2004 it is 0.0382 hectares.

The condition of shortage of arable land is comparatively better in India. However, with the development of Indian population, its per capita farmland decreased from 0.33 hectare in 1950 to 0.2 hectare in 1980. Moreover, India also faced the problem of fragmentation. Land policy and family property controversy caused that the land of each peasant house was small and fragmental. In the years 1961-1962, 73% of farms in Tanjore were less than 2 hectares, 15% were between 2 and 4 hectares and 12% are over 4 hectares. As farmland is concerned, the farms of less than 2 hectares occupied 26% of arable land, the farms between 2 and 4 hectares occupied 22% and the farms of over 4 hectares occupied 42%(Institute of World History, CASS, 1981).

5.1.3 Decrease of land capacity

The rise of land use rate inevitably brings the risk of land capacity decrease; this is a objective fact, as well as a problem that bothers world agriculture, and the perish of many ancient civilizations has something to do with it. These not only include the Roman Empire and ancient Maya civilization but also some ancient civilizations in Asian history.

The collapse of Harappa civilization of ancient India was caused by the decline of agriculture. As it was located in a drought area, irrigation was a requirement for agricultural development. The Indian people made irrigation possible by building dams blocking a river, which increased the area where the flood flew. This kind of irrigation used for a long period led to the land salinization, which obstructed the development of agriculture and strength of the civilization. The conqueror Aryan from north were not farmers, and they destroyed the dams for irrigation, which marked the end of grain production(Kosambi, 1966) From 1750 BC, some town along Indus

were destroyed and buried in mud and sands for long periods.

The decline of ancient Babylonian civilization was caused by the same reason. Deforestation, excessive reclamation and wars led to the results that the forests in upstream Tigris and Euphrates were damaged, water loss and soil erosion were severe, and thus Mesopotamia Plain silted up constantly, flood occurred, riverways and irrigation canals were blocked up, and plus climate deterioration, fertile farms finally became barren land due to desert storm, desertification and salinization.

Chinese traditional agriculture also faces the problem of land capacity decrease. In the Warring States Period (475 BC-221 BC), people had fully understood the influence of land capacity decrease on plant growth. During the reign of Emperor Wen of Han Dynasty (202 BC-157 BC), the farmland did not lessen, the population did not grow and the farmland per capital grew, but reduction in products occurred for several successive years and food was in serious shortage; agricultural decline led by land capacity decrease was obvious. In Song Dynasty (960-1279), people found that "all land becomes poor in capacity after planting for three or five successive years." For the recent 1000 years, maintaining land capacity has been the main direction of Chinese agricultural technique.

5.1.4 Labor shortage

As Asia has a large population, why there is labor shortage? This has something to do with the agricultural structure of Asia. In Asian agriculture, grains are mainly planted, and meanwhile in order to gain clothing materials, a large number of fibers including mulberry, cotton and flax are planted; the grains plantation adopts intensive cultivation, so lots of labors are in demand. In addition, if we assume that the labors for traditional grains plantation of the East and the West are equal, the labors needed for the East and the West are decided by sericultural industry, cotton-flax industry and animal husbandry. Usually, the labors for paddy field are as five times as those for dry land. The populous Asian areas are mainly rice cropping areas. As for East Asia, the rice cropping areas are often sericultural areas at the same time, and sericultural industry needs more labors than paddy fields, the ratio about being 100: 5. On the other hand, animal husbandry needs less labor than dry land agriculture, the ratio being 1: 100 or 1: 200. We can see that the agriculture combing rice and mulberry needs much more labor than that combining dry land plantation and animal husbandry. Moreover, the Chinese traditional agriculture adopts intensive cultivation, more labor is invested to produce more land capacity, so the need for labor exceeds the theoretical evaluation and consequently the labor is insufficient. Labor shortage becomes even more serious in busy farming seasons. This is one of the dynamic forces of population growth in Asian society.

5.1.5 Inferior quality

For traditional agriculture, the quantity of labor is usually more important than the quality of labor; the role of labor with superior quality in traditional

agriculture is not obvious. Nevertheless, a good harvest of agriculture can not be separated from the advance of labor quality and its command of relevant knowledge. Furthermore, the quality and knowledge of labor of Chinese traditional agriculture earn a certain respect, and even a saying goes, "intelligence is more powerful than force." However, as far as agriculture is concerned, the emphasis on physical effort is far beyond that on intelligence. The Chinese farm labor of thousands of years do not know how to read or only know a little; they entirely depend on practical experiences accumulated during long periods, richer from generation to generation, but all the time staying at the level of perceptual knowledge. There are few literates engaged in farming. That is "literates do not farm, and farmers are not literate."

The quality of Chinese agricultural labor has been improved for recent years, but still has disparities with Japan, Europe and America. There are only 4 agricultural experts among 10 thousand population (rural population), but there are 18 in Japan and in America there one college graduate among 70 agricultural labor on average(Liu, 2006a). 50% of Japanese farmers graduate from senior high schools or colleges and most agricultural administrative staff are graduates, but on the contrary only 0.1% of Chinese young farmers have college degree, over 40% only have diplomas of primary schools and about 30% are illiterates or semiliterates.[1] In 1989, there were 18.8 graduates among every ten thousand people, and 1.2 were graduates from agricultural colleges (6.38%); but in Japan there were 205 graduates among every ten thousand people (1986), and 53 were graduates from agricultural colleges (25.85%). As for the educational level of Japanese farmers (1987), 5.8% graduated from colleges, 74.8 from senior high schools, 19.4% from junior high schools, and as Japan had popularized compulsory education, no farmer without graduating from junior high schools. The educational level of Chinese farmers in 1987 was lower than that in 1978; in 1978 farmers graduated from junior high schools take 6.1% and those from junior high schools take 1.2%, but in 1987 they decreased separately to 3.56% and 0.024% (one reason is that a high ratio of students were out of school). According to a statistics of 1990, there were still 0.2 billion illiterates and semiliterates, and most of them were in rural areas.

The situation in China also happens in India. Low literacy rate and little knowledge of modern technologies are two of the reasons why the productive forces of Indian agriculture is low.

5.1.6 Animal labor shortage

Under the circumstance of arable land shortage, people use the existing land for grains production as much as possible to feed the people, so the

1 According to the results of 2000 the Fifth Population Census published by National Bureau of Statistics of China on March 23, 2001, the illiteracy rate of China is 6.72%, that is to say, among the people above 15 years old, 85.07 million people are illiterates. Compared with 15.88% of 1990, this is much better. As per the same data, there are 69, 622 people who do not get diplomas of junior high school and 3611 graduates among every 100 thousand Chinese people.

land for animal husbandry becomes less and less, which leads to the shrink of stockbreeding. Since animal force was used in agriculture, agriculture depended on stockbreeding more and more, and thus stockbreeding became a matter vital to national well-being and the people's livelihood. However, due to the shrink of animal husbandry, animal labor is often insufficient. Then various methods of replacing animal labor with human power appeared in history. In the light of the statement of ancient people, one farm cattle can be equal to the human power of 7-10 persons, so the shortage of one cattle will need to be replaced by at least 7 laborers, and this led to the growth of population. Then the growth of population in turn burdened the agriculture and land. This was a vicious circle.

The shortage of animal labor also existed in Japanese agriculture. In late 17th century, the potential of exploring new territorial resources had been exhausted, and the population pressure on existing land became heavier. The using of horses to plow and transport was reducing, the pressure of population on land make the possible of livestock-raising smaller and smaller (Arrighi et al., 2006).

The Green Revolution emerged in the 1960s further accelerate the shrink of animal husbandry. Before the Green Revolution in 1952, on Brahmin Street in Tanjore, India, almost every Brahmin house and many non-Brahmin houses kept milk cows, at least a pair of bulls or water buffalos. When it comes to the twelve big landowners and rich farmers, each owned at least twenty to twenty-five milk cows; each of small holders and cottiers owned four to six milk cows. After the Green Revolution in 1976, only seventeen of the thirty-eight houses on Brahmin Street had milk cows, and most of them only had two to four beef cattle and only one house had twenty cattle. Old and unwished cattle were sold to butchers in the county cattle market. About forty-five non-Brahmin houses and "untouchable" houses fed farm cattle, each house owning two, whereas each house of twenty-one non-Brahmin houses and "untouchable" houses owned one or several milk cows and goats of the same number. Most men of the untouchable now drink milk in tea houses, but in the family, only the babies whose mothers die or babies who cannot be breast-fed can drink milk(Institute of World History, CASS, 1981).

In some southern areas of China of the People's Commune Period before the 1980s, the production team raised about a dozen of farm cattle through collective efforts and each family fed 2 or 3 pigs. However, after the reform and opening-up, only a limited number of chickens are raised, while other domestic animals are rarely seen. People will use human power to plow in the traditional manner, or employ others to do it with tractors.

5.1.7 Social factors

There are many social factors that affect agriculture; speaking of Asia, the state and government play the leading role. From ancient times, the Chinese governments put agriculture as the most important of their jobs, emphasizing

and encouraging agriculture. To arouse the enthusiasm of farmers' agricultural production and to meet the demands of farmers' agricultural production were highlights of governmental jobs. The major measures include: light tax, relieving the people with governmental grains in famine years, stabilizing commodity prices, and if circumstances permitting, supplying farmers with necessary production goods including land, farm implements, farm animals and seeds. However, if the government did not do enough, it had negative influences. Wrong policies, would burden the farmers and the production could not go on, especially in certain periods when the government took more from farmers for the sake of itself. Chinese agriculture continuously develops in thousands of years, but the circumstances of farmers are not much improved in general. The Chinese farmers have been all the time striving for the basic needs for eating and clothing.

Researches have shown that the famines of India during British colonial domination were not only related to uneven precipitation, but also to the British economic and administrative policies. From 1857, these policies resulted in that the local farmlands were raped to be plantations owned by foreigners, the internal trades were restrained, and heavy taxed were levied on Indians to support British expedition in Afghanistan. For instance, during the second Anglo-Afghan War, the measurement of inflation elevated food price and exported food to Britain in large quantities. The first Bengal famine in 1770 carried off the life of one quarter or one third of the population there. At that time East India Company raise taxes, aggravating the famine. From 1865 to 1866, serious drought attacked Orissa, but the British officers did nothing. In fact, every province of Britain-controlled India then including Burma has plus grain, the surplus of the year reached 5.16 million tons. At the time, the rice and other grains exported from India reached 1 million tons per year(Anonymous, 2010c).

The Bengal Famine in 1943 was related to rice shortage. However, the grain "supplied that year" was only lower than the last 5 years by 5% and higher than that of 1941 by 13%, and there was no famine in 1941. Therefore, the Indian economist Amartya Sen believes, the disastrous Bengal Famine was not a result of grain shortage, but of the change of "exchange entitlement." The causes of the change included demand, interest, speculation and coemption, as well as government administration, army and national defend. The improper policies of British colonial government during the famine are widely noticed and criticized (Sen, 2004).

Similarly, the famine in China in 1959-1961 that resulted in death of thousands of population was called "three years' natural disasters", but most people believe that the famine is caused by "natural disaster by 30% but by people by 70%." The "Great Leap Movement" started in 1958 was the direct cause of the famine.

5.2 Main achievements and experiences of Asian traditional agriculture

Asian agriculture grows up and develops while addressing unfavorable natural conditions and social factors. Asian agriculture acquires gloriously achievements, feeding the world's largest population as well as making Asian civilization durable.

Asian culture is based upon its high-efficiency agriculture. The earliest civilization of Asia appeared on an agricultural base in a big valley, and today agriculture remains to be the dominant industry and major source of products in almost all Asian monsoon areas except Japan. Laying stress on the agriculture and restraining the trade is a basic national policy for many Asian countries. Industry and commerce develop in various degrees, but industry and commerce never equal to agriculture except in a few countries. It is agricultural fortune that supported the empires of all generations and the splendid culture of traditional monsoon Asia, and it is agricultural fortune that ensured a higher living standard of Asian people in general than other places in the world.

Asian agriculture not only provides the Asian people with grains, but also meets other material demands and spiritual demands in many aspects, such as textile raw materials, building materials, fuel and domestic animal feed. From the order of the seven matters of living of Chinese people, "firewood, rice, oil, salt, sauce, vinegar and tea", the fuel matter is sometimes more urgent than the grain matter, and the fuel matter in a large sense depends on agriculture. Straw of crops can be used as fuel as well as used to feed domestic animals. If systematic planning is made in land use, some lands that are not suitable for crop plantation can be used to plant fuel wood, so as to solve the problem of fuel supply. Even the feces of cattle can be used as fuel.

The achievements and experiences of traditional Asian agriculture can be put in the following aspects.

5.2.1 Simple but practical farm implements

Asian philosophers had known the importance of instrument early. Confucius says, "A workman must sharpen his tools if he is to do his work well." (*The Analects*) The Indian book *Parashara* (400 BC) also says, "Any implement that is not sufficiently strong or is not manufactured as prescribed measurements, will at the time of farming operations, obstruct the work at every step." Chinese agronomist in Southern Song Dynasty Fu Chen has similar view, "If the instrument is not sharpened, the work cannot be well done; if the instrument is sharpen but not prepared, the work cannot be done." "If the instrument is applicable, prepare it in advance, and then it will work in time. If an instrument is not precise, a job cannot be done. This should be remembered." (*Agricultural Book of Fu Chen: Sprouts Nurture*)

Many agricultural techniques and instruments invented and improved in Chinese history elevated the labor capacity. The mold board iron plough is one of the most advanced traditional ploughs in the world. The multi-tube seed drill that accomplishes ditching, sowing and earth covering at one stroke is a brilliant invention, which not only uplift sowing efficiency and quality, but also make convenient the future field management, as well as opens the way to the future inventions of animal cultivation and fertilization. The plough and multi-tube seed drill had been perfected in the periods of Qin Dynasty and Han Dynasty (221 BC-220 AD), and the two instruments were introduced to Europe in the 18th century and exerted great influence on European technologies of agricultural instruments and farming, marking the start of western revolution of agricultural technology.

The agricultural revolution of the Muslim world from the 8th century to the 11th century developed a mature irrigation system, making use of dam, reservoir and water raising machines including norias and watermills. People tried to enlarge the arable areas using these techniques. Noria and chainpump (also known as dragon-bone water lift in China, see Figure 3.1) were improved and used together with fly wheels and widely spread. At the same period, this set of irrigation instruments was widely used in China as well, and it was still used in early modern times.

However, the Asian agricultural instruments did not change for a long time in history. Traditional Asian farmer did not seek the best instruments, but only wanted them practical. Therefore, many advance agricultural instruments were not used in a larger scope after they are invented.

5.2.2 Land utilization according to local circumstances

In the circumstance of arable land shortage, enlarging farmland becomes the major way of developing agriculture. Many ways of land utilization occurred in history including warping irrigation, diked field (polder land), terrace field, artificial floating field, stone mulch field, etc. Almost all these methods are used in Chinese history.

Using water with mud and sands richly containing organic to irrigate is called “warping irrigation” in history. Many rivers in northern areas of China contain a lot of sands, and after summer rainstorm, torrent with mud and sands rushes down from the mountain, bringing some troubles for river training and irrigation. Warping irrigation is to lead torrent with mud and sands to the farm, fulfilling the three purposes of irrigation, fertilization and flood prevention. This method of irrigation and land utilization was first used in the Warring states periond (475 BC-221 BC), but it was not widely used until the 11th century. In early modern times, this technique was still used in North China. From the 1960s to the 1980s, Shandong China has a special investment to utilize sediment of the Yellow River to improve waterlogged lowland and salt lick of 124, 000 hectares, and had 33, 333 hectares grow rice.

What similar to warping irrigation is runoff farming spreading in arid regions and semiarid regions of the world. It is an agricultural form of irrigating by collecting rainfall from inclined slopes or areas out of crop. Runoff farming dates back to 9000 years ago in Jordan; in 4500 BC, simple facilities of runoff farming also appeared in Mesopotamia. Middle East has an undisputedly important role in developing runoff farming. A lot of archaeological materials are found in Jordan, Israel, Palestine, Syria, Iraq, etc.

Negev of Israel is a typical model of runoff farming. From the 10th century BC to 638 AD when it was conquered by Arabs, Negev people managed runoff farming all the time; they adopted two methods of collecting and utilizing rain water to separately develop and use the rain water of small divides and large divides (reaching 10,000 hectares). In 1958 and 1959, scientific research workers rebuilt two water collecting farms in this area, one near Shivtah and the other near Avda. The two experiments seem to show the potential of runoff farming in Negev.

Since 1964, Jordan has built many earth dams to promote the penetration of collected water for the sake of improving pastures. From 1985 to 1988, the Ministry of Agriculture and Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD) jointly built a contour farmland to improve pastures in the Balama area. In 1987 College of Agriculture of University of Jordan built some dams to store flood for irrigation. In history, stored flood was used to irrigate sorghum in southern Saudi Arabia. Today, about 35, 000 hectares of farmlands are still irrigated with stored flood. In 1987 the Dei-Atiye community of Syria built a rain water collecting engineering to irrigate woods and crops of 130 hectares. Currently International Center for Agricultural Research in the Dry Areas (ICARDA) has started work of advancing technique on water resource acquisition.

Runoff farming is also widely developed in India. Since 1975, International Research Center for Semiarid tropics in Hyderabad has started many research programs on runoff farming. At present, India ranks No.1 in area of runoff farming, and Pakistan ranks No.2 with an area of 1,500,000 hectares.

Runoff farming has contributed much for arid areas and semiarid areas. It enlarges farmland, pastures and forests; prevents desertification through planting trees and grass; and saves irrigation cost and especially in areas short of water, reduces the use of ground water.

Diked field (also known as polder land), namely reclaiming farmland from water is a major method of enlarging farmland area in land of rivers and lakes. Small-scale diked field draws lessons from pitting field to address flood. it is noteworthy that many costal countries of Asia also adopt reclaiming farmland from sea to enlarge land area; this method of land utilization is called silt field.

Terrace refers to building dams and leveling earth on sloping fields of mountains and hills, many anomalous semi-lune pieces of field with different heights are thus built, and they connect one another up and down like ladders; the terrace has the function of preventing water loss and soil erosion. This manner of utilizing land is widely used in Asia and the world. Famous terrace

landscapes in China include Hani Terrace in Honghe Yunnan, Longji Terrace in Guangxi, Ziquejie Terrace in Hunan, Mingyue Mountain Terrace in Yichun, Jiangxi and terrace in Hongtong County and Zhaocheng of Shanxi.

In 1995, 5 terraces in Province of Ifugao, Philippines, were listed as world heritage sites by UN Educational, Scientific and Cultural Organization (UNESCO). The ancient rice terraces of Ifugao are the only reserved and original plateau-mountain agricultural ecosystem in Philippines, having a history of more than 2000 years. Terrace management is performed through management customs of traditional tribes. Every layer of the terrace is covered with forest; the public forest on the top conserve about 264 plant varieties, most of which are endemic species. The terrace is a part of the mountain ecosystems; as the rain water filter system, it is in saturated condition all the year. The rice production, especially that on the mountains over 1000 m height above sea-level benefits from the biothythm technique in harmony with local climate change, cultural activities and hydrologic management. Besides grain production, Ifugao terraces protect the agricultural biodiversity and natural landscape. Meanwhile, the aesthetic value promotes the development of local tourism.

In 2010 Hani rice terrace in Honghe Prefecture, Yunnan Province was listed as protective pilots of Globally Important Agricultural Heritage Systems (GIAHS).

The most delicate one is artificial floating field (Figure 5.1). Artificial floating field, also known as zizania field in Chinese, is a kind of artificial farm-land floating on water. It has a history of over one thousand years in China. In Aztecs, a place near Mexico City, North America, there existed a kind of floating land similar to that of China.

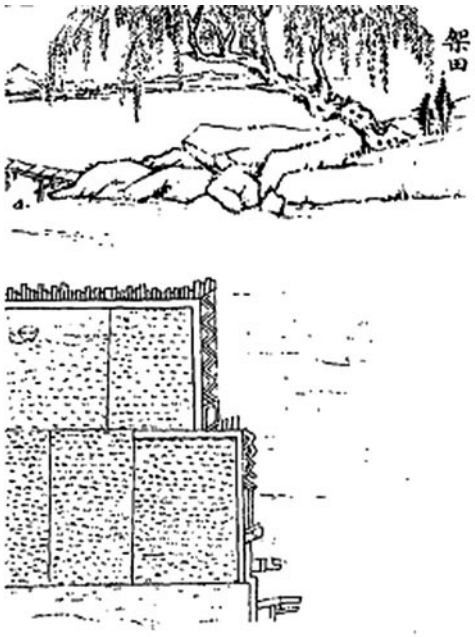

Figure 5.1 Artificial floating fields
Source: *Agricultural Book* of Zhen Wang (1300) of Chinese Yuan Dynasty

The "floating farming boat" displayed in the Chinese Shipping Room of 2010 Shanghai World Expo in China is similar to the ancient instruments of artificial floating field. The "floating farming boat" "integrates seawater desalination, vegetable and fruit plantation, fowl and fish farming and food processing, ensuring that people living on the sea can eat fresh and nutritious food." In the ship there is the fowl raising zone, where fowls can be fed and let them lay eggs, and there is the breeding zone, where fowl can be bred. Here seawater desalination also can be done and the desalinated sea water be used to raise fresh water fish, and vegetables can be planted through the method of soilless culture. The food produced can be processed through highly automatic production line and then stored. The "floating farming boat" can be seen as the modern artificial floating field on water.

Stone mulch field is an anti-drought culture method created in arid area of Northwest China. Cobbles from the river are used to pave on the land with a height of 11 or 12 cm; when sowing, sow the seeds under the cobbles and then cover them with the cobbles, and the crop will out of the cobbles from cracks. Paving cobbles on the arid land can save water and preserve soil moisture and uplift efficiency of water application; it plays the role of heat insulation and warm preservation; it can relieve salt accumulation and prevent soil salinization; it can reduce surface runoff and conserve water and soil; it can reduce nutrient loss, preserve soil fertility, inhibit weeds and relieve insect pest. During the first 10 years of stone mulch lands, the production can be higher by 30%-50% than ordinary farmland, and the improving yield effects of stone mulch lands can reach 30 years. Stone mulch field, the unique agriculture of water saving and zero tillage, is a great invention of the people in the northwest, and it is distributed in Qinghai and Gansu; it roots in the 17th century and thus has a history of over 400 years.

Mulberry fish pond is a comprehensive way of land utilization, and it appeared in Yangtze River delta and Pearl River Delta in Ming Dynasty and Qing Dynasty (1368-1911). The depressions are dug to become ponds, and the mud dug out is put around the ponds as foundation beds to grow mulberry. Fish is cultivated in the ponds and mulberry leaves are used to feed silkworms, the silkworm feces then is used to feed fish, and the mud in the ponds can be fetched up to be fertilizer of the mulberries. This cyclic utilization gains an economic benefit of "two-fold and harvest of ten times", and it is appraised by UN Food and Agriculture Organization (FAO).

Rice-fish system, namely fish farming in rice paddy, is a typical production way of ecological agriculture; in the system rice and fish live together, and the function of the system is perfected through internal coordination system of natural ecology. The system can ensure the rice harvest, as well as makes the best of water, pests and worms to raise fish. All waste energies of rice are comprehensively used to improve productivity effect, little or no higher effective and lower toxic pesticide is used, and natural pest prevention is taken as the foundation to produce high-quality fish and rice. This system is not only a way of production but also a unique farming culture. In June 2005, the rice-fish system of Longxian

Village, Fangshan Town, Qingtian County, Zhejiang Province, China was honored as protection site of rice-fish system of World Agricultural Cultural Heritage.

Similar to fish farming in rice paddy, duck breeding in rice paddy has a long history in Asian rice cultivation areas. The ducks swim in the paddy of transplanted rice; they eat various plantlets, weeds and sick leaves and catch all kinds of worms and locusts, thus reducing and preventing insect pest; its excretion can enrich soil fertility. Meanwhile the waves lifted when the ducks swim can supply sufficient oxygen, and the feathers of ducks stimulate the rice, protecting the healthy growth of the rice. The activities of ducks enrich the ventilation and light and decrease moisture in the field, preventing and reducing rice blast. The grown ducks are another revenue source of the rural families. Many things are achieved at one stroke. In history, Chinese farmers adopted the way of duck breeding in rice paddy to prevent locust and brackish-water crab, achieving harvest of both rice and ducks.

As a typical model of modern ecological agriculture, duck breeding in rice paddy is widely noticed by countries in East Asia and Southeast Asia. Early in the 1990s, such developed countries as Japan and Rep. of Korea popularized it in large area. The duck breeding in rice paddy of Takao Furuno, a rice farmer in Fukuoka, Japan has been concerned both in Japan and world wide (Roberts, 2009). There is a village in Rep. of Korea of duck breeding in rice paddy, where nuisanceless organic rice and ducks are produced applying the technique of duck breeding in rice paddy. Also in Rep. of Korea, there is a "river snail farming method", which uses river snails to clean up weeds in rice paddies, and the weeding efficiency reaches as high as 98.6%. Like duck breeding in rice paddy, this is an organic and ecological method based on biological ethology, and it is a high-efficiency futuristic agricultural method that is environment-friendly and will increase revenue of farmers (Choi, 2010).

In the 16th century, the farmers in the south of the lower reaches of the Yangtze River in China started to build pen and shed on the pond to raise sheep and pigs, and the feces of them were thrown into the pond to feed grass carps and the feces of grass carps can feed chubs. The pond silt is again used to serve as fertilizer for planting mulberries or rice in most circumstances. This method is still used by residents in the mountainous areas of North Vietnam; they build barns with bamboos next to ponds. The animal wastes are put into ponds to increase the output. Fruit trees such as mandarins are planted around the pond, and some weeds are planted to be supplied as baits for fish. This represents an effective usage of space and labor, and will increase steady revenue(Le and Tuan, 2004).

After the 1970s, a circular complex agricultural model called "four-dimensional agriculture" appeared in Japan. The four-dimensional agriculture includes rice, mushroom, cattle and earthworm. This circular complex agriculture takes rice as its fundamental production, the straws and hulls after harvest are used to cultivate mushroom, the bed charge after mushroom harvest will be used to raise cattle, and the cattle feces then will be used to raise earthworms or serve as organic fertilizer for rice(Li, 1991).

The traditional complex agricultural model of ecological cycle represents the direction of agricultural development in the future. The futurist Toffler has similar description about the design of future agriculture. Interestingly, Toffler calls the future society "Gandhi plus satellite", which indicates some connection between tradition and future.

5.2.3 Lifeline of agriculture: water conservancy construction

In Asia the key to the success of agriculture lies in irrigation, especially so for dryland agriculture. In 4th century BC Indian Parashara said, "What hope of harvest can that foolish farmer have who has not made arrangements for preserving water for the crop during Ashwin (October) and Kartika (November)?"In China a farming proverb goes "March for growing mulberry, June for digging ponds", which ridicules those foolish farmers who waited until June when water is mostly needed to dig ponds. Irrigation has been the key to agriculture and the lifeline to the livelyhood of farmers. The Sumerians, the founders of the Mesopotamia civilization, established irrigation agriculture. During the Islamic Agricultural Revolution, the Muslims inherited and made anew the ancient irrigation system of the fallen dynasty. In addition, new technologies for water fetching, water diversion, water storage and lifting emerged, and all available devices were ingeniously put together for the purpose of irrigation(Anonymous, 2009). Irrigation drove the development of agriculture in West Asia. In 1962 an Israeli farmer invented the highly efficient dripping irrigation, kicking off a revolution in irrigation. About 2000 years ago in the Han Dynasty China, a water-saving irrigation technology was also developed. Earthenware pots filled with water were buried in the farmland where irrigation is needed. By osmosis, the water in the pot traveled to the roots of the crops. Therefore irrigating the crops, reducing evaporation and saving water were done at the same time.

Irrigation depends on water conservation facilities. Asian countries made remarkable achievement in water conservancy construction in history. Dujianyan water conservancy project in China and the countless Karez wells in Xinjiang, Middle and West Asia are undisputably the most impressive.

Dujiangyan, built in 256 BC, sits on the Min River in the west of Chengdu Plain of China. It is the most ancient and only preserved non-dam water conservancy project in the world. Thanks to the scientific design, rational layout, clever construction and the commitment to water issues on the part of governments of consequent dynasties, Dujiangyan has survived 2000 plus years and continues to function. Bing Li, the Qin Dynasty governor for Sichuan, supervised the construction of Dujiangyan. Governments on all levels from the consequent generations participated in the maintainance of Dujiangyan. In 228, Liang Zhuge, the prime minister of Shu Kingdom, assembled 1200 soldiers to guard Dujiangyan and for the first time in history appointed full-time officials to manage it. The Dujiangyan project that is more than 2000 years of age is one of the best and most important examples of sustainable development.

A Karez or qanats well is a water conservancy system that combines a underdrain and a shaft. It utilizes the underground water streams in arid and semi-arid areas. Karez wells are laid out along the slop of the ground, with shafts for the positioning of the underdrain, the excavation of earth, ventilation during the construction of the well and inspection and maintenance after the construction is done. The underdrain is the main part of a Karez well. The first segment of the underdrain gathers water, the rest segment carries the water.It also includes the dragon's mouth, the visible channel, the flood dyke and other ancillary parts. The so-called dragon's mouth is the water outlet of the underdrain, the visible channel is what comes after the mouth, and the flood dyke is a small embanked pond at the end of the channel. Karez wells have many unique advantages, such as no need for water lifting equipments, simple building and maintenance technics, good quality of water, stable water supply, reduced evaporation, sand invasion-proof, convenient and efficient in providing water. Karez wells dot Xinjiang, Middle and West Asia. Iran is the first country to apply for the World's Important Agricultural Heritage Pilot Project for Karez wells.

5.2.4 Intensive agricultural technologies

Because of limits such as the scarcity of arable land, traditional East Asian agriculture was lead down to a path that sought to expand arable land in every possible way, relied heavily on manure and labour and focused on improve the unit output, or in short, the intensive agricultural model. In a harsh natural environment with underdeveloped water facilities, the Chinese people improved the soil quality by deep ploughing, collected more rainwater, cleared the weeds, applied a sensible farming arrangement, resulting in full utilization of farmland, in some cases 200% or even 300% land use ration, records such as "multiple harvests in a year", "thirteen harvests in two years" and the several-fold increase in per unit output. What is even more impressive is that while securing high output, Chinese people developed multiple sources of manure, maintained high fertility of the soil and a stable yield of crops. Dryland farming techniques, which were initially rules of experience in North China and later defined in agriculture classics such as "The Essential Arts For People's Welfare" (Figure 5.2), were introduced to neighbouring nations such as Korea and Japan. Dryland farming, together with paddy field farming which came later, became the shared trait of traditional East Asian agriculture.

While India's traditional agricultural technology in general is more crude compared to that of China, but the ancient Indian people shared some common understanding about agriculture with their Chinese comtemporaries. Parashara (400 BC), the Indian writer said: "Farms yield gold if properly managed but lead to poverty if neglected." He stressed soil management, seed health, Water gathering, animal management and tool manufacture and maintenance(Nene, 2009). India and China have many identical or similar agricultural techniques. Take seed treatment as an example. Before sowing,

the barley, beans, sesame were broken, and mixed with rotten meat, then together with seeds, they were spread into the soil. This could help the seeds sprout and accelerate the growth of the tender shoots. China also had similar techniques. Around the 10th century, China and India have substantially the same rice growing techniques. In 10th century Surapala wrote in Vrikshay-ureda emphasizing the importance of seed selection, seed pre-treatment, the use of right soil, intercropping, rational close planting, balanced nutrition, optimization of water use, timely weeding, the use of herbal products and dead animal waste in preventing crop disease, timely harvest and the drying and storage of seeds.

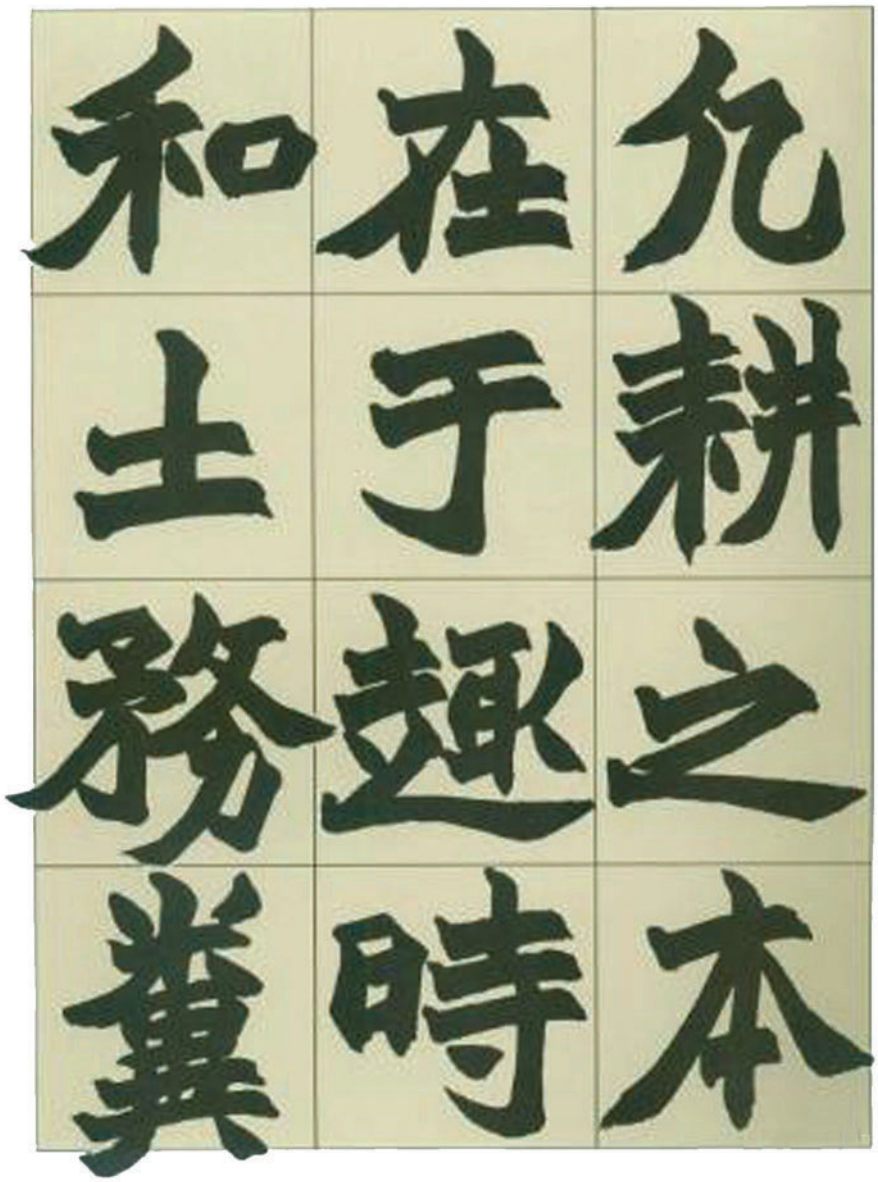

Figure 5.2 Calligraphy extract of maxims in ancient agricultural classics

5.2.5 The strategic choice that favors agriculture and grain crops

The key to the success of traditional Asian agriculture in supporting the largest population in the world lies in the fact that Asia's agriculture focuses on producing grains. With the same land mass, grain production is able to support more people than animal farming. It seems that the ancient Chinese had long realized this, thus there goes sayings such as "a hundred mu of farm land for grain production, five mu for other crops and animal farming", which shows that it is paramount to secure grain supply, anything else takes a second place. The Chinese history tells us that the commitment to agriculture was always seen with the focus on grain production.

Emphasis on agriculture and grain production is a shared tradition in Asian countries. In the early 1950s, farming and animal husbandry contributed 97.8% to the total agriculture national income, forestry 1.4% and fishing 0.8%. In the early 1980s, farming still took up 89.2%, animal husbandry 7% and fishing only 1.5%.The occupational composition of population tells the same story. In the early 1980s, only four million out of a total of 192 million agriculture labor worked in forestry and fishing, which means at least 95% agriculture labor worked in farming and animal husbandry. Within the farming sector, food crops are the main agriculture produce, cash crops are relatively underdeveloped. In the last three decades, food crops contributed 60% to 70% of India's farming industry, while the various, high value yielding cash crops only took up the remaining 30% to 40% percent. In 1970, grain made up 55.9% of Rep. of Korea's total agriculture output, while animal farming only contributed 4.2% (Gao, 2001).

The Asian diet is largely grain-based, with small amount of meat. People who live on the river sides or alone the coast, especially those who live in rice producing areas look to fish as the main source of protein, while inner land residents take beans and dairy products for protein supplement.

5.2.6 Biodiversity in agriculture

The commitment to food crops doesn't confine Asian agriculture to one or two species of food crops. On the contrary, in order to guard off natural disasters and to meet the various different needs of the people, traditional agriculture developed a variety of agriculture species. Research on "*Rig Veda*", "*Ramayana*", "*Mahabharata*" and other ancient literature shows that from the Bronze Age India has been cultivating more than 80 different crops. Even today the terraces in the Himalayas still have a good variety of crops such as millet, amaranth, pigeon pea, black bean, chickpea, oars, beans, soybean, Adzuki bean, cowpea, millet.

Biodiversity first and foremost is to meet the diversified needs of people. In the self-sufficient economy, many human needs are met by agriculture, the more underdeveloped the markets, the higher degree of self-sufficiency, and the more apparent the agricultural biodiversity. In market conditions,

agricultural biodiversity is maintained only as a means to respond to natural disasters. Han Dynasty China (202 BC-9 AD) decreed that "five different kinds of grains need to grow in the same time so as to prevent disasters". In light of this old decree, in the early days of Northern Song Dynasty (960-1127) officials in South China's rice-growing areas called on the people to grow dryland crops such as millet, wheat and beans, while their counterparts in North China's dryland areas called on the people to plant rice on the riversides.

"Variety-cropping" doesn't only apply to different crops, but also different breeds of the same crop. Traditional agriculture has long noted that different characteristics of selected varieties of crops help the crops to survive in different natural conditions. Sixth century Chinese agriculture classic "*qi min yao shu,* Essential Arts For The Welfare of The People" noted several millet varieties: 14 breeds are drought-proof and pest-free, 24 wind-resistant and sparrow-free, another 14 hydrophilous. The various breeds of rice is a even better example. Some rice breeds grow well during drought, some in flooding, some in low temperature, some in salty soil, some in fertile soil, some in arid soil, some in fertile, wet and windy fields, some with insects and animals. *Shou Shi Tongkao* (published in 1742), a Chinese agricultural book documented 3429 rice breeds.

In accordance with variety-cropping, various different kinds of crops and breeds were developed, moreover, other crops were introduced from abroad to empower the crops in their battle with natural disasters. In history China continuously introduced agriculture species from outside, and many had exerted huge impact on China's agricultural development, for example, Wheat, alfalfa, grapes, flax, lettuce, spinach, watermelon, Champa rice, cotton, pepper, tomato, corn, sweet potato, potato and peanut.

Different combinations of crops and breeds gave rise to different growing patterns such as mixed-cropping, rotational cropping, inter-cropping, and also contributed to the forming of interdependent biomes. For instance, in the South China of Song Dynasty ramie were planted under mulberry trees, because fertilizer that goes to ramie also helps the growing of mulberry trees, it is like killing two birds with one stone. Mulberry has deep roots, and ramie shallow roots, therefore they don't hinder each other's from taking in nutrients. Other examples are the combination of food crops, cotton, beans and vegetables in Qing Dynasty Hebei Province and the inter-cropping of corn and green beans in modern North China. Up to today some minority people such as the Hani People still maintain the tradition of variety-cropping. American agricultural historian Gras (1935) said: "China is an interesting case for agricultural historians···Chinese people grow more than two crops on a piece of farm land; they make use of every inch of the land to grow crops. Their farms are like fish scales···which is a smart farming regimen, as a result, the country will never be exhausted."

The Islamic Agricultural Revolution around 11th century also to certain

extent owes its emergence to the rotational cropping of different crops and different breeds of the same crop. During the said revolution, a large number of new crops, including fruits and vegetables, such as sugar cane, rice, citrus, apricots, cotton, artichokes, eggplant, saffron and the related cultivation methods were introduced to the Islamic world.The introduction of new crops and the strengthening of irrigation brought into being a complex and multifaceted farming regimen, which enabled the utilization of all sorts of soils, and consequently they now had three or more harvest where they once only could expect one harvest. Some parts of Yemen saw two harvests of wheat in a year. The same is true with rice production in Iraq. The improvement in the land use ration and agricultural productivity owed many thanks to the introduction of new crops and the improvement in breeding(FSTC Research Team, 2002).

5.2.7 The development of competitive industries

On the one hand the traditional Chinese agriculture had a firm grasp on food crops, on the other it never forgot to develop competitive industries in line with the local conditions to meet the market need. As early as in the Han Dynasty China had developed specialized production centers. In the 11th century Song Dynasty China four villages including Shishui Village in Zhangming County, Mianzhou City (now part of Sichuan Province) were famous for monkshood production. There were 3466 hectares of farm land in these areas, out of which a half grew rice, three tenth for soybeans and millets and two tenth for monkshoods. Monkshood production answered to the need of the market, therefore growing monkshood became a value-added labor intensive industry for these areas. In a culture where "authenticity" was valued, every place had its local specialties.

The "one village, one product" movement that started in 1970s Japan was very similar. It encouraged all places to capitalize on its unique conditions and produce "quality products", securing a place in the international market. This economic pattern that features the capitalization on local competitive conditions, self-dependance, all-round rural development was followed widely by countries and regions in the world.

To evade one's weakness and capitalize on one's strength is also the experience of the success of Israeli agriculture. Israel pursued food and non-staple food self-sufficiency in the 1970s. Food crops took up huge land mass with the 1969-1970 average at 138.7 thousand hectares, about 42.6% of its total arable land, but only with 200 thousand tons of produce. Therefore the country was heavily dependent on imported staple food. This agricultural pattern didn't fit Israel which was a desert nation with arid land and little water. Since the 1970s, it started to cut down the grain-growing area, and by 1985 only 93 thousand hectares of farm land grew grains, a cut by 32.6% to the 1969-1970 average. The newly vacant land went to the cultivation of horticultural crops, the foreign exchange earned by the export of which went to the import of staple food. In 1970 the trade deficit for agricultural produce was 25.9 million dollars, however, in

1984 it shrank to 5.65 million(Chang, 1990).

5.2.8 Few is more with intensive management

Full and reasonable use of land, is the main way to increase agricultural production. Centuries of human agricultural activities followed the two rules, the first, expanding farming area and increasing per unit yield; the second, intensive management. The two worked in synergy, but were not always given the same priority in different times and regions.

The natural limit on the expansion of arable lands left China with no choice but intensive management in order to increase per unit yield and produce as much agricultural produce as possible. The 5th century BC Chinese think Li Kui pointed out the principle of "put the land potential into full play", emphasizing the importance of using every inch of farm land to the best of its potential. The 12th century Song Dynasty agriculture expert Fu Chen went further to say that "the success of farming doesn't lie in the size of farm land but in the proper management of the land one owns." Concerning the size of farm land, there are agricultural proverbs passed down from history, such as "few but good is better than many but ill", "many isn't always better than few", "small but manageable is better than large but wasted".

In ancient China farm lands were left to rest occasionally or regularly, which made the land fertile enough to produce crops year after year. Later multiple-harvest cropping was introduced to increase production.2000 years ago, North China had seen agricultural patterns that featured three harvests in a two-year period.1000 years ago in rice-growing South China rice and wheat were both harvested in the same year and rice was harvested twice in a year. 600 years ago in the Linnan region in South China, crops were harvested three times in a year.300 years ago with the development of inter-cropping, mixed-cropping and under-cropping, production increased immensely. The famous British demographer Thomas Malthus (1766-1834) once said "China's farm land in most cases can support a second harvest. That's because the Chinese people can make the best use of the local conditions. They take soils from other places and mixed them into the farm land to improve the soil, they fertilize the soil and irrigate the field. They apply all cunning and smart agricultural techniques." (He and Liu, 2001)

The agricultural path that China took was also the common path for other Asian countries. In contrast, the West took the path of farm land expansion. Up to the 18th century, the western land use pattern was generally not very efficient. In addition to the 1/3 or 1/2 of farm land that was made to rest, there were lots of public lawn and wasteland. It was calculated that before the 13th century, in the agriculturally developed Britain, farm land was no more than 20% of the total land area, Germany and France less than 15%, and in densely populated areas such as South France and Spain the ratio was about 20% to 25% (Bloch, 1966). After the 18th century the land in the West was put into more efficient use. Wasteland and land that was put to rest were reduced and farmland

expanded, exceeding 30% of the total land mass.While the permanent grazing land in France and Germany was about 1/4 of the total land mass, in Britain it was more than half.

5.2.9 Heavy manure in maintaining soil fertility

Asia's population distribution is not even, the bulk of the population live in Asia's monsoon area, the rest in one of the world's most sparsely populated regions (see Figure 5.3). The moutainous and hilly areas of monsoon Asia including Southeast Asia, the west region of China, Korea and a fairly large part of Japan are sparsely populated, while the low land areas of Asia accommodate more than half the world's population. And records show that it has been so in the early days of recorded history. But no signs of soil deterioration manifested, perhaps because the Asians were good at fertilizing the soil.

Figure 5.3 Distribution of population density in Asia

In 8th century Indian agriculture classic Kashyapiyakrishisukti pointed out that "Land is intended to receive excellence in every age." In 12th century Song Dynasty agronomist Fu Chen put it in a cut and clear way, saying: "If the fields were added new fertile soil and dealt with manure, it would be more fertile, its product capacity would be maitained, and no exhausion would happen!"

The combination of using the field and maintaining it, keeping it strong and fertile, is a outstanding achievement of Asian agriculture. In the early 1900s, American agronomist F. H. King made a tour to East Asia. He was very appreciative of China, Korea and Japan. The three countries maintained the fertility of their farm land and supported the high density population for two, three or even four thousand years, which is a "remarkable agricultural success" (King, 1911). German agronomist W. Wagner who spent some time living in China said that "China is densely populated and the land has been producing crops for thousands of years without signs of deterioration. This must attribute to the fact that Chinese farmers are meticulous with fertilization. Without even the slightest of doubt, Chinese farms not only collect manure around one's own house, they also go long ways to the cities in search of manure. They would go any length to find all sorts of stinky things. They knew thousands of years ago that those things had fertilizing capacities" (Wagner, 1936).

Multiple manure sources and heavy manure application are keys to stable and high agriculture output.Chinese people found a variety of manure sources including green manure, grass manure (green manure made in the nature), ash manure(burned mud ash), sludge manure (pond scum) and the like. Green manure was made out of Chinese milk vetch, vetch, yellow clover, radish, all kinds of leguminous crops, duckweed, water lettuce and the like. Some of the manure making techniques were recommended by the FAO to third world countries. This is an acknowledgement of traditional Chinese fertilizer technology. However, in today's deteriorating environment, what's worth of our attention is that lots of garbage from urban areas are utilized as manure in the country side(Cheng, 1212). This not only expanded the fertilizer source, but also solved the problem of urban sanitation, waste to treasure, a great step in achieving a virtuous circle of urban and rural areas.

The practice of traditional agriculture in Asia is consistent with the founder of modern agricultural chemistry, great German chemist J. Liebig who proposed the "compensation theory". He believes that China and Japan's traditional agriculture is based on such a principle, which ordains that nutrients taken from the soil should be return to it in the form of agricultural waste, so as to maintain the fertility of the land and raise the production. The agriculture that suits the need of population expansion is a "example of reasonable agriculture" (Dong, 2007).

Indian history also has records of deep ploughing and fertilizing that served the purpose of maintaining the fertility of the land. Most notable is the use of a liquid fertilizer named *kunapa*(Ayangarya, 2004). There was a liquid organic fertilizer called *kunapajala*, which used animal remains and waste from deer, pigs, fish, sheep and other animals. The animal remains and waste were mixed with water and fermented to make the fertilizer. Chaff was also added in the process of making the fertilizer(Nene, 2009-01-03). The ancient Indian literature Surpala's *Vrikshyayurveda* also noted other substances that were used as fertilizer ingredients, such as milk and dairy products, cattle feces and urine, animal fat, lime, brick powder, buffalo horn, other horn, shells, fish powder,

honey, horse hair, lotus mud, bone marrow as well as iris and other plants.

The Muslims also scored huge success in the Muslim Agriculture Revolution. A variety of fertilizers were used according to a well-advanced methodology; whilst a maximum amount of moisture in the soil was preserved. Soil rehabilitation was constantly cared for, and preserving the deep beds of cropped land from erosion.The love for nature and leisurable lifestyle helped the Muslim world achieve ecological balance, which was not based on theory but learned from traditional knowledge from many great civilizations(FSTC Research Team, 2002).

5.2.10 Low-cost but highly effective bio-mechanism in disaster prevention

Warding off natural disasters with the traits of crops and animals is also a key to the success of Asian traditional agriculture. Pests are not a common problem among rice-growing traditional peoples such as the Hani People in China's Yunnan Province, and other agricultural disasters are also relatively few. Main approaches in preventing natural disasters are as follows:

First, agricultural bio-diversity in fighting disaster. The Han Dynasty Chinese people came to know that "five different kinds of grains need to grow in the same time so as to prevent disasters", because this pattern helped to improve bio-diversity, even when one grain was inflicted, there were still others to take up the space left vacant. Therefore, there were no serious disasters. The Japanese people are still applying this strategy(Zhao, 1995).

Second, grow crops according to soil conditions. Biodiversity reflects the diversity of natural conditions. Farming in modern days requires the environment to adapt to the needs of the seeds, such as fertilization, irrigation; but farming by traditional ways requires the seeds to adapt to the environment. Different environments are suitable for different crops, and different crops also have different needs for the environment. Farming according to the natural condition of the environment on the one hand allows all sorts of different environments to support growing crops, on the other hand reduces the changes done to the environment. Ancient Indian scholar Kautilya (321 BC-296 BC) mentioned examples of using wilderness such as growing calabashes on the river side when the flood receded, which is still in use in India today. In north-central Vietnam, people with small farms do not plant rice between September and December. Seasonal rains might destroy the rice. So instead, they plant lotus seeds on raised beds. Farmers in the Philippines are showing new interest in crops like winged beans, string beans, arrowroot and cassava. These traditional crops can survive the fierce storms that often strike the islands.Traditional agriculture developed breeds of crops with slightly different traits to fit into different natural environments. Even in the same farmland, different crops were planted each year or every two years, so as to keep the land fertile.

Third, protect and raise the enemies of pests so as to prevent natural disasters. Since ancient times, people in some Asian countries have been pro-

tecting natural enemies of pests, such as frogs and certain birds. The Chinese people express their understanding of the food chain in sayings such as "the big fish eats small fish, small fish shrimps, and shrimps mud", "the mantis stalks the cicada, unaware of the oriole behind." And they used the pests' natural enemies to fight pests. An ancient Chinese botanical book recorded raising Oecophylla smaragdina in controlling citrus pests.In East and Southeast Asian Countries people raise ducks in rice-growing fields, which not only improves land use ration, but also helps in controlling pests and clearing weeds. As early as after the 16th century Chinese farmers in the South had realized that raising ducks in the rice fields could help reduce locusts and amphibious crabs.

Fourth, allelopathy in controlling weeds and pests. Ancient Indian people had some knowledge about pests, and they even invented an organic pesticide. Organic substances such as animal fats, butter, hemp, horse hair, horns, milk, cow dung, honey, licorice and Madhuca were used in controlling pests. The traditional Chinese people thought lots of organic substance had medicinal value and used them widely in prevention and cure of human and animal diseases, thus the herbal medicine tradition was developed in China. Some medicinal plants such as monkshood and wormwood also can be used to control pests. Sesame was widely used as pioneer crops for land reclamation and weeds control. Sesame was also grown together with soy beans so as to ward off pests. The ancient people also discovered that growing Stemona japonica in gardens helped keeping away most pests. When introduced to East Asia from the New World, tobacco was used to keep away a pest known as rice borer. Since Ming Dynasty cotton and rice have been grown rotationally, this reduces pests and improves the soil fertility. Till today farmers in Yunnan Plateau still grow different breeds of cotton in the same field in order to control pests.

5.2.11 The indispensable role of the government

Agriculture lies at the root of Asian culture. Asian countries, under the influence of the farming culture, all take agricultural development as the basic national policy. Many rulers in history took the understanding of agriculture as the first step toward ruling the people. Reduce the burden on peasants has always been affirmed by history. Governments also worked to provide necessary conditions for agricultural production. In East Asian history some dynasties adopted land systems to give peasants lands or the right to use lands so as to encourage agricultural production. When it got to modern times, revolutions and movements took "land to the tiller" as a goal. After World War II, China, Japan and other countries implemented land reform and in one way or another achieved the goal of "land to the tiller", boosting the incentive on the farmer's part. The Chinese rural reform in the past 30 years also started from land contract. The Governments have played a fundamental role in responding to natural disasters. Ancient Chinese governments were actively involved in disaster relief, price stabilization, restoration and reconstruction. When it came to agriculture, the governments also provided seeds, farm animals, farming

tools so that production could be resumed in a short time. The governments in Chinese history sometimes gave official positions and honorable titles to farmers who produced outstanding amount of grains as incentive and rewards for farmers.

Government's role in water management is particularly evident. Water management is the foundation of oriental despotism. The Sumerian city-states in Mesopotamia were established on the basis of irrigated agriculture. The Chinese Governments' role in water management in history was impossible to ignore. Xia Yu, the legendary king of Ancient China, was famous for water management, which says a lot about the relationship between politics and water management. In Chinese history, many of the large-scale water conservancy projects such as Zhengguo channel, Dujiangyan, the Grand Canal, Huang-huai-hai Rivers comprehensive management, Sanmenxia Gorge, the Three Gorges were all carried out by the governments. During the Muslim Revolution Period, the Muslim governments also built large irrigation networks in order to meet the need of new crops. And in order to ensure the equitable distribution of water resources, the government took up ownership of water resources(Watson, 2009b). The ancient Indian literature *Kashyapiyakrishisukti* (700-800) also looked at water management as the king's responsibility. The Chola Kingdom in South India from 9th century to 12th century was known as "theocratic and irrigation kingdom". Putting the government in charge of irrigation projects was the economic foundation of Chola Kingdom(Institute of World History, CASS, 1981). After the Indian Independent War, small-scale local irrigation networks were established using newly drilled wells, motorized pumps and reservoirs by the government or with the government assistance. Large-scale water conservancy projects include a number of new dams or reservoirs, of which some are famous such as the Bhakra Project on Sutlej River in the Himalayan foothill in the north of Deli, the Tarbela Dam on Indus River in Pakistan and several other dams, the Hirakud Reservoir on Mahanadi River, the dam on Cauvery River in the south of Madras and other small scale dams. The Israeli Irrigation Revolution took place after the 1960s was also led by the government.

Modern Japan has the highest levels of agricultural support and protection in the world, and one of the most sophisticated systems, which created favorable conditions for Japan's agricultural development. The Japanese government began to promote agricultural mutual insurance after 1929, and rolled out a livestock insurance law. In 1939 the first comprehensive agricultural insurance was born, and agricultural insurance law was adopted, which marked the official start of agricultural mutual insurance endeavor. In December 1947 the "Agricultural Disaster Compensation Law" was released, kicking off the post-war agricultural insurance course. Later, Japan expanded the agricultural disaster compensation law, integrating agricultural insurance and livestock insurance. And changes were made according to the development of agriculture. More services now could be provided by agriculture insurance and more could be insured. A relatively comprehensive mutual aid agricultural insurance system

came into being. After World War II, the Japanese government attached great importance to agricultural mechanization, sponsored and supported the development of agricultural mechanization. In 1953 the government introduced the "Agricultural Mechanization Promotion Law" (modified in June 1965), which was supposed to promote the application of agricultural machinery by introducing high-performance agricultural machinery in pilot research programs, establish a quality control and experiment system and also to secure the necessary funding. In Japan the government doesn't tax agriculture. On the contrary, it finances agriculture. Government funding on agriculture usually goes to agricultural infrastructure building, agricultural technology promotion and personnel training, agricultural loans and agricultural insurance, and supporting the evolvement of agricultural federations. The government also offers subsidy agriculture, rice production and the purchase of agricultural machinery. The subsidy for purchasing paddy field agricultural machinery started in 1964, lasted for 40 years, and was terminated in 2004.For more than 40 years, the farmers had been enthusiastic about agricultural machinery. The high government subsidy varied from 10% to 50%. The subsidy was particularly high when it comes to the purchase of advanced, high price machines, which boosted the development of agricultural mechanization(Li, 2006).

In Japan and Rep. of Korea the governments exercise heavy protection on agriculture. 63% of a Japanese farmer's income comes from the government on average, and 66% for a farmer of Rep. of Korea(Zhang, 2004). The New Rural Campaign in Rep. of Korea in the 1970s was also led by the government. President Chung-hee Park led the campaign and its slogan was "diligent, self-help, cooperation", the farmers were encouraged to participate in agricultural production and rural construction at their own will. In 1970 the government of Rep. of Korea subsidized 35 thousand villages with 300 bags of cement for each village. In 1972 it gave 500 bags of cement and one ton steel bars to each of the 16 thousand model villages out of 35 thousand villages. The government also invested a lot in training government officials in rural areas, improving seeds, cultivating high value-added cash crops, promoting plastic greenhouse, rural financial market development and logistics system modernization and other areas. The campaign changed the backward outlook of rural areas once and for all(Liu, 2006b).

After the Independence War, the Indian government, out of concerns for food security, accentuated the special role of agriculture in the Five Year Plan, and supported agricultural development in irrigation, technology and loans. The per unit yield has been soaring since the 1950s. After the Green Revolution; the government began to subsidize agriculture. In order to achieve the "White Revolution", the Indian government formulated a series of policies and measures. The government provided milk cows for free in the hope that dairy industry could make the pillar of Indian agriculture. In order to put independent farmers into a unified plan, India established the National Dairy Development Board (NDDB), promoting dairy industry development in the whole nation. In

accordance with the Cooperatives Act of Union, the government established village, regional and state level cooperatives which played important roles in "Operation Flood". Meanwhile the government invested nearly 60 billion rupees, setting up more than 200 milk processing plants and ancillary equipments over the country. The Government also gave special subsidies for low-income families so that more people can share the fruits of "White Revolution".

In West Asian countries, Saudi Arabia is the one that has scored the most outstanding advances in agriculture. Agricultural Progress in Saudi Arabia owes everything to the role its government played. In order to support agriculture, the Saudi government does not only offer farmers short, medium and long-term preferential loans, but also provides them with agricultural means of production at a favorable price, for example, fertilizer, young stock, motors, pumps at half price, 30% discount for dairy equipment. The government also provides incentives for the production of all sorts of crops, and purchases agricultural produce at high price. For example, the procurement price for wheat is 1000 dollars per ton, several folds of the average price in the international market. In addition, the government also established a number of large-scale water resources development projects and agricultural settlement areas. The unparalleled long-term investment has brought progress in agriculture. Poultry, vegetable, dairy products have achieved self-sufficiency, although the grain self-sufficiency rate in 1985 was still only 26.45% (Chang, 1990).

5.2.12 Urban agriculture that leads the trend

Cities are inseparable from agricultural civilization. Although in ancient Asia city walls separated the inner city and the countryside, agriculture was omnipresent on both sides of the walls. The existence of urban agriculture not only squeezes the urban construction land space, but also to some extent meets the city's need for vegetables, grains and other agricultural produce. More importantly, the city's political, economic and cultural advantages are able to exert heavy impact on agricultural development. Cities enrich the content of agriculture. Flowers, vegetables and other horticultural produce that urban people need in their lives were first cultivated in the cities and then later spread to the countryside. Cities also abound in the most excellent agricultural experts and the most advanced technologies. The experts play an important role in the invention, promotion, introduction of agricultural technologies. City is the birthplace and experimental field of technological advances in agriculture. Many advanced agricultural technology, crop breeds are first developed in the cities and later gradually spread from cities to rural areas.

In the 1930s' Japan the term "Urban Agriculture" had already been in existence. In the late 1950s and early 1960s some American economists started to research on urban agriculture. The term Urban Agriculture or Agriculture in City Countryside that they crafted initially means agricultural activities in urban areas. That is, using rural landscape, ecological and environmental resources, together with animal husbandry and fishery production, agricultural business

activities, rural culture and farm life, to provide people with opportunities to travel, enjoy themselves, experience agriculture and learn about rural areas. Obviously, urban agriculture integrates agricultural production, rural lifestyle, and agricultural ecology. This is the future direction of agricultural development.

5.2.13 The all-benefiting cultural exchange

The peaceful and inward-looking farming culture made Asian people earth-bound and uneasy with change, which to certain extent hindered cultural exchange. But historically, there existed broad and close ties among Asian countries and between Asia and the world. The Silk Road and Maritime Silk Road are bridges for cultural exchange between the West and the East in which the Arabian merchants played a rather important role. Exchanges between China and neighboring countries were even more frequent.

Without cultural exchange and learning from each other, the modern day agriculture would be totally different. The exchange of different crops and animals in the cultural exchange led to revolutionary change in the history of agriculture. In the history of Asian agricultural exchange, wheat, soybean, cotton, Champa rice, tea, and crops from the new world such as corn, sweet potato, potato, peanut, red pepper and related agricultural technologies all played important roles. Before the 20th century, overseas Chinese in Southeast Asia had already made tremendous contributions to agriculture development in that region(Xie, 1991). The agricultural progress in the Muslim world owed thanks to the use of agricultural technology that were adapted to meet local needs, and magnificent cultural integration of scientific knowledge from Near East to Maghreb and Andalusia since ancient times(Anonymous, 2009).Cultural exchanges contributed to the overall development of Asia.

5.3 Historical application

5.3.1 The choice of a development path that suits Asia

After World War II, the developed nations began to enter modern agriculture phase so that they could accumulate more wealth, conquer and manipulate nature without restrain, and achieve high level of agriculture modernization. A economic pattern of “high input, high output, high energy consumption, high pollution” was gradually developed. Many Asian developing countries, out of the concern for their own survival and development, followed the example of developed countries, turning forests into farmland on a large scale, logging without restrain, farming extensively with low yield, and as a result, they also saw soil erosion, desertification, salinization on a large scale. Since the United Nations General Assembly on Environment and Development in 1992, countries in the world began to think about sustainable development, searching for

a development path that coordinates the economy, the society, the environment and resources, protecting the interest of both our generation and future generations. What we want to make a point of is that in formulating sustainable development strategies for Asia, in addition to considering the population, energy, resources and environment, we also need to consider the history and culture of Asia. Re-evaluate the inherent values in Asian culture to make up for the shortcomings of western culture became a new choice for Asia.

Traditional culture is not some old garment one can throw away at will, for it is deep in our blood. Although Asian agriculture has went through thousands of years of evolution, some fundamental issues stayed the same such as the conflict between human being and land, the basic natural condition of drought and flood, the need in improving food production to meet the growing needs of the population, the need to better people's life, and "the historical theme of achieving the change from patriarchal small farmers' idyll to modern agriculture rhapsody stays the same" (Qin and Su, 1996). Before these fundamental issues are changed, the traditional and effective ways in solving these problems will continue to play their role.

Asian agriculture is a unique product of the unique natural and cultural environment of Asia, essentially different from western agriculture that was introduced to Asia in its course of modernization. Although in modern times, Asia has tried to copy the western experience in agriculture, the result was not successful as expected. The reason is that western agriculture is not compatible with Asian natural conditions and cultural heritage. Asian traditional agriculture follows the rule of adaptation to local conditions, as shown in sayings such as "different soil, different farming" and "agricultural activities according to local conditions". Even after the introduction of western agriculture, some Asian scholars still firmly believe in the value of traditional agriculture. Modernization of Asian agriculture is not westernization of agriculture, because the European and the United States' experience is not suitable for Asia. Agricultural modernization in Asia must be consistent with the Asian actual situation.

Learn and draw experience and lessons from western agriculture, but take a development path that suits Asian natural conditions and cultural traditions is perhaps the inevitable choice for Asia. The future direction of Asian agricultural development lies not in the West, but in its own agricultural tradition. Asian agriculture is a product of its own natural environment. Only the agriculture that suits the environment survives. The real "international competitiveness" can be improved only when an objective understanding of development in the right historical perspective and a keen awareness of one's own position are in place. To ignore the differences in the environment and the grounds for agriculture, and follow the western model unconditionally would be a huge mistake(Lee, 2004).

Living our life with the help of tools and techniques invented by ourselves is far better than relying on things other people invented for their own purposes. Science has no boundaries, but the choice of technology has to consider the

impact of different cultures. Modern western agronomy came into being for the need of the West. Western technology transfer may have an internationalistic and humanitarian side, but it may also become a means of imperialism and colonialism. Being wary of western technology is justified, of course, including the controversial transgenic technology.

5.3.2 Respect the traditional culture and values of Asia

The places that have the most rich agricultural and biological resources are usually around where they were domesticated. Because they have been there for a very long time, which enables them to go through natural and artificial selections and survive. The places where people have the most agricultural experience would be the cradles of agriculture where civilization evolved for a very long time without interruption. The agriculture industries of those regions went through long-term natural and artificial selection just like the crops they produce. Following the rule of "survival of the fittest", the agriculture industries of those regions became adapt to different natural and social conditions, and continued to prosper, some after thousands of years still in good shape(Luo, 2007).

We should respect Asian cultures and Asian traditional knowledge, because they were developed in Asia, survived thousands of years and were derived from numerous observations and empirical research. Asia's cultural and historical experience, past and present, adds up to more than half of the total human experience.It played an important role in fine-tuning the relationship between human beings and that between human beings and nature. Asia has long history and the Asian people have the tradition of respecting history. Without knowing its past, we wouldn't be able to understand its present, let alone its future.

5.3.3 Explore and protect Asian traditional culture

Asian culture can serve as guide and reference to sustainable development. Meanwhile it also has its own sustainable development problem, therefore we need to explore and protect Asian culture. Traditional culture manifests itself in both living relics and cultural relics unexcavated, in ancient literature that was passed down from time and also cultural legacies that continue to function today.

In the 1950s or even earlier, some Asian countries such as China, Japan and India, began to sort out and study their traditional agricultural heritage, focusing on the literature of agricultural history and trying to make the past serve the present. The work should continue.

In 2002, The FAO launched a "Globally Important Agricultural Heritage (GIAHS) Dynamic conservation and adaptive management" project, aimed at establishing a global level protection system for the agricultural landscape and biological and cultural diversity, and making it receive worldwide recognition and become the bases for local sustainability management. To date, eight systems in eight countries worldwide have been included in

GIAHS protection pilot program, of which four are in Asia including the rice-fish symbiotic system in Qingtian City of China's Zhejiang Province, the rice-growing terrace system in Philippines, the rice-growing terrace system of the Hani People in Yunnan Province, the Wan Nian rice-growing cultural system in Jiangxi Province.In fact, Asia abounds in potential agricultural heritages, of which some are very notable such as the mulberry and fish pond system in China's Yangtze River Delta and Pearl River Delta region, and the Karez Well hydraulic systems in China's Xinjiang, Middle East and West Asia. In the future we should continue to strengthen the research and protection on Asia traditional culture, mobilize multi-disciplinary power to protect Asian traditional culture, especially local knowledge, to discover, organize and use it, and pay particular attention to the protection of biological, especially agricultural biodiversity .

Protect germplasm resources, restore the cultivation of traditional crops. local germplasm resources survived a long-term process of natural and artificial selection. They are not only good for food, but also meet other needs, such as need of production, life(straw sandals, straw ropes), folkways, religion, culture, health care. It also has strong resistance to climatic disaster and pests. Some varieties of traditional crops are convenient to eat and are edible both raw and cooked. Restoration of these crops can provide a way to reduce food shortages, hunger and malnutrition, and support rural development. Growing strong resistance varieties boosts agricultural production without doing much to change the environment. This is particularly important for developing nations in Asia. Now there are still lots of land in South and Southeast Asia, where the natural conditions are suitable for growing rice, but unable to produce rice because of toxic soil, or lack of nutrition (salty, alkaline, iron toxic, zinc deficiency, etc.).

In the conservation of agricultural biodiversity, we should pay particular attention to the protection of local germplasm resources which are an important part of agricultural biodiversity. They all existed in the same environment for several hundred or even several thousand years. They are important agricultural heritage surviving severe natural and artificial selection. Some nutraceuticals, as health foods, play important role in curing lifestyle-related diseases, therefore deserve more attention and protection.

In terms of broad cultural heritage, Asia needs to do more. In 1972 UNESCO adopted the "Convention on the Protection of World Cultural and Natural Heritage". Currently, nearly 120 places from Asia have entered the World Heritage List. In the November of 1998 UN passed a resolution to establish the United Nations Human Oral and Intangible Cultural Heritage Award, aiming to promote excellent works of that represent the oral and intangible heritage. China is stepping up work and has included more than 1000 items in its national intangible cultural heritage list.

It might be highly useful to create an internet data bank of agricultural strategies which have proved successful in the past or at present in Asia and

perhaps elsewhere. Entries should of course include detailed information about the nature of each strategy, the problems it addresses, how successful it has been and under what circumstances, its likely costs and benefits, and so forth. Scholars, researchers, bureaucrats, agro-businesses and farmers might all contribute to the data bank and they might all use it. Comments on each entry might be invited from all these groups. In this way knowledge of successful practices could be shared widely and quickly.

5.3.4 Inherit and carry forward the excellent tradition of Asian agriculture

Review the value of traditional agriculture. Asian agriculture took a different path with western agriculture, and in the history of agricultural activities some unique traditions were established. To a very large extent, Asian traditional agriculture has a lot in common with Sustainable Agriculture and Conservation Agriculture. The sustainability of traditional agriculture has two aspects, ecological soundness and labor-intensive farming. As the sustainability and labor-intensive nature of agriculture worked hand in hand effectively, Asian agriculture has lasted for thousands of years without decline, and successfully supported a growing population's growing need for agricultural products (Ke et al., 1995).

In 1957, Chairman Mao said: "I believe China's agriculture will have to rely on intensive cultivation." In 1958 he summed up the meaning of intensive cultivation in "soil, fertilizer, water, seed, density, protection, management and tools", which was known as the "eight-word constitution of agriculture". Later the worldwide "green revolution" seemed to put more weight on the role of seeds, while somewhat neglecting "density, protection, management, tools". A concurrent "crop management revolution" is needed, especially in view of nonsubstantial increases in per hectare yields even after the "green revolution" (Nene, 2005).

Traditional agriculture in Asia centers around grain cultivation. The hugely vegetarian Asian diet succeeded in feeding the gigantic Asian population. Asia's religious teachings about not killing living creatures reflect on its vegetarian diet. While improving the lives of the people of Asia, grain production continues to be the main direction of agriculture. Western scientists have recently accused Asia of greenhouse gas methane emissions from rice fields, and asked Asia to cut down on rice cultivation, which went against the Asian tradition. Asia's agriculture in the future will still focus on rice and wheat, with beans and other food crops as supplement.

5.3.5 On agricultural mechanization

In Asian agricultural history the improvement of farming tools doesn't seem to be the major problem. In Han Dynasty China there was an attempt of mechanization, but no major development after that. As early as in the 1920s a Chinese scholar had noted the problems mechanization might cause. He feared

that mechanization would bring about the problem of rich-poor polarization. He thought that in China "clothing, housing, utensils have all been changing since Qin Dynasty, but farming tools alone remained unchanged for thousands of years. There must be a good reason that they can't be changed or shouldn't be changed. It is definitely not out of the respect for tradition."[1] Traditional farming has its own value. With increasing depletion of oil and other resources, the environmental problems caused by mechanization has attracted lots of attention today, but the traditional farming tools still work just fine. Some Thai farmers who have abandoned tractor for water buffalo said that water buffalo only fed on grass, were convenient and environmental friendly to use, with no gas emission, and the dung can be used as fertilizer, so they were far more better than gas swallowing tractors.

For agriculture that relies on human and animal power, every one calorie input produces five to ten calorie output in the form of food, but for mechanized modern agriculture five to ten calorie of oil only produces one calorie in food form. Japanese scholars believe that "the possibility of the agriculture system that uses water buffalo which feed on plants that take in solar energy can't be ignored." (Tamura, 1980) Mechanization is a sign of agricultural modernization, and even the only choice for agriculture, but from the perspective of sustainable development, there are still many problems to be solved.

5.3.6 The role of religion in building a harmonious society and protecting the environment

In the final analysis all the environmental problems we face today are results of the human behavior pattern of excessive exploitation. And the way we behave is determined by the way we think. So, what ways of human thinking have led to over-exploitation of natural resources? This may be attributed to the thought pattern that separates subject and object. In the modern industrialized society, this way of thinking dominates the human mind and has misled mankind in the relationship with nature, thus today's disastrous consequences. Therefore, as long as human beings do not change this way of thinking, the behavior pattern led by such thinking will not change. Give mankind one hundred Earth, with this way of thinking and behavior they would destroy it for one hundred times, and forever be in the deep waters of environmental problems.

Resisting malignant consumption is the key to sustainable development. And it takes a revolution in values in the entire society. Lester R. Brown, the head of Worldwatch Institute once said: "As the source and guardian of values, religion plays an important role in the transition to a sustainable society." In this transition, Asian countries should pay attention to the role of Buddhism. Buddhism as a form of culture, it has sucked in two thousand years of world and unworldly wisdom. Its teachings about thrifty and non-violence can also help

1 1920 Annals of Guiping County. Vol. XXIX: Consume Goods

to resist material desires. Acknowledgement of the fact that the impact of Buddhism as a system of thought will be quite long-standing in Asia, and proper guidance to its development, will to certain extent exert desired impact on sustainable development (Ouyang, 1997).

5.3.7 Building a conservation-minded society

Thrifty is the traditional virtue of the Asian people. "The global environmental degradation is mainly due to unsustainable consumption and production patterns." If we really want to achieve sustainable development, we must never forget the lesson of "Thrifty and abstinence". Thrifty should be held as important as food security, natural disaster control and sustainable development.

The development of modern agriculture must be based on resource conservation and efficient use of resources. Agricultural waste and forestry waste must be recycled, so does the livestock waste. A comprehensive recycling mechanism must be established. And we should develop recycling agriculture vigorously.Agricultural development should find more help from bio-engineering technology.The trend for agriculture development should be ecological, green and organic.Government should guide and support the development of sustainable agriculture.Governments should also promote the use of conservation technologies in agriculture and conserve more resources, so that agriculture would have more potential for sustainable development.

5.3.8 Government's role as regulator

For thousands of years, Asian governments have been playing an important role in agricultural development, the Chinese government's performance in particular is most remarkable.The Chinese government played a major role in adjusting land policy, easing the burden on peasants, organizing agricultural production, stabilizing food prices and many other aspects. The Government also adopted the policy of offering government positions to those who excelled in grain production, so as to provide incentives for agricultural production.After the founding of new China, the government always put paramount weight on the development of agriculture.After the entry into the new century, the Chinese government has made a point by focusing on rural areas, agriculture and farmers in the No. 1 Document of the central government and the CPC central committee for seven consecutive years, offering financing and preferential policy to agriculture development.

The Japanese government relies on legislation to protect agriculture. According to the needs of the various periods of agricultural development, the economic legislation wrote all kinds of policies, objectives and economic measures into the law. The laws are made to have continuity and flexible to change. The agriculture protection stressed by the Japanese government is not isolated, scattered articles, but a complete protection system that integrates preferential financial policies, financial support, agricultural insurance, trade protection and

others, a system that has a variety of ways and means of protection that suites various needs of agricultural protection.

In modern times the governments of the world mainly relies on the invisible hand of the market to strengthen the protection of agriculture. In face of global competition, the governments now need to play an increasingly important role. Therefore the obsolete view that "All government intervention is evil and the free market is omnipotent" should be discarded. The world now is closely nit in the global market, therefore governments, in the hope of protecting their own people, should respond to the market and be willing to trespass old rules.

Agricultural policy of Rep. of Korea under the WTO system is worthy of our attention. To mitigate the impact of WTO rules on its own agriculture, improve the international competitiveness of its agriculture and protect the interests of its farmers, the government of Rep. of Korea amended and issued a series of agricultural support policies, which helped to achieve the transition of priority from increasing agricultural production and maintaining agricultural price stability to improving agriculture competitiveness, expanding the scale of investment and financing for agriculture, providing farmers with neutral direct subsidies within the limits of WTO rules and encouraging domestic agriculture industry to compete in the international arena.

However, while stepping up government efforts to support agriculture, the government should also make room for the market to play its full role. The Indian government's inability to handle the relation between the two rendered the Indian agricultural industry with low productivity. The World Bank believes that high government subsidy keeps investment from entering the agricultural industry, which severely pulled back agricultural productivity. Excessive administrative control drives up cost, increases price risk, resulting in the investors' low sense of certainty for the future market. The government's excessive intervention in labor, land and credit severely handicapped the market mechanism. The infrastructure and the service industry that agricultural development needs direly were neglected (The World Bank, 2009).

The important issue is to truly benefit the farmers that their absolute income and relative income both grow. Governments in guiding agricultural development must take full account of the capacity of farmers, should not put more burden on them, and encourage farmers to express initiative and creativity. Low grain price hurts the farmers. Concerning the agriculture subsidy that is in the immediate interest of farmers, some scholars suggested that governments should "purchase grains at high price, and sell at low price", so as to give farmers incentives and stabilize the price.

The Government can also play its part in sorting out, studying and preserving Asia's traditional culture. The Chinese National Heritage Board's Compass Project during the Eleventh Five-Year Period is a good example.The Compass Project takes on the great inventions of Ancient China as the research subject, draws on inter-disciplinary and cross-sectoral strength, and relies on

modern science and technology. The purpose is to sort out and study ancient Chinese inventions in fields such as agriculture, medicine, diagnosis and treatment equipment, water conservancy, transportation facilities and traffic tools, materials and processing, textiles and tools. The project also includes museum theory, research and demonstration of technology.

5.3.9 Expand the functions of agriculture

Multifunctionality of agriculture refers to the fact in addition to meeting the need of human and livestock for food and fiber, agriculture also has societal, cultural and ecological functions. The tourism side of agriculture was enhanced after industrialization. Other important non-monetary contributions of agriculture are that it provides housing and landscape views, preserves soil and water, manages waters, reduces carbon emissions and preserves biodiversity. Today people are more aware of agriculture as a way of life, a heritage, a cultural identity, as well as the old contract with nature which is priceless.

Multifunctionality of agriculture has gradually become a important issue for many countries and regions. Japan and Rep. of Korea are the first countries that gave attention to agricultural multifunctionality research and construction, and has also achieved great theoretical achievements and rich experience(Cao and Xu, 2006). Since the 1980s, Japan, Rep. of Korea and some other countries and regions stepped up effort in developing green agriculture organic agriculture, and on this basis, they also proposed the multifunctionality of agriculture, meaning that agriculture not only secures for food security, but also plays an important part in ensuring steady economic growth in rural areas, preserving biological and cultural diversity, and supporting the development of a variety of other industries. Therefore, commitment to agricultural multifunctionality and support of agricultural development goes a long way to boost the sustainable development of agriculture and national economy.

Traditional farming culture has some promising application in expanding the functions of agriculture. All the tangible and intangible cultural elements that shot off from traditional agriculture are something we can capitalize on for purpose of agricultural multifunctionality. Although traditional agriculture took food, clothing and subsistence for the goal, its functions far exceeded its goals. As an ancient Chinese scholar said, “Agriculture is more than agricultural activities. It is a form of education in itself.” Asian traditional society forged a connection between agriculture and personal development, household management and the advancement of humanity. For the imperial rulers, agriculture is also a good way to learn about people’s life. “Know the difficulty in farming so as to know what the people live on.” In this sense, the rulers of ancient China had long realized what Nobel laureate, economist Theodore Schultz (1902-1998) dubbed as “The Poor’s Economics” in 1979. For the wealthy, agriculture have always provided them with leisure and fun. Exploring the cultural heritage of traditional

agriculture not only serves to provide the basis for preserving agriculture, but also promotes local tourism, and local economic development.

Expanding agricultural function relies on the adoption of the new concept of Grand Agriculture. Agriculture, a healthy lifestyle for people and sustainable development of mankind need to be integrated.

5.3.10 Human resources and agriculture transformation

Modern Agriculture with high mechanization has lower demand for labour. How to solve the problem of rural surplus labor? Taking into account the Asian farmers' attachment to their home and land, it would be a good idea to enable them to leave farming but not their homeland during the agricultural transformation. Agricultural transformation is to simply convert agricultural production to food production, and extend field production to the entire process of agricultural produce processing, storage and marketing. This will inevitably increase the demand for agricultural labor.

It is natural to achieve this transformation. Traditional society defines agriculture as a means of subsistence. It is not a simple field production process. It is also a means of life necessity production (although food is the No.1 life necessity).It is a entire process from agricultural produce production to food production. Taking the processing of agricultural products (otherwise known as the second agriculture, or the second battle field) as the natural extension of field production (the first agriculture or the first battle field), integrating agricultural production, processing and marketing, and using agricultural and forestry wastes and marginal land to grow energy plants as raw materials for bio-energy and bio-based products (the third agriculture or third battle field), would be a good way to put rural surplus labour into effective use during slack seasons. It also can reduce the living expenses of farmers, improve employment and increase income for farmers.

Integrating the three agriculture battlefield into one enables the first agricultural surplus labor to transfer to the second and third agriculture by hundreds of millions. The labour now can be relocated to the nearby small and medium size cities and towns that take bio-industry as the main body of rural economy. This "soft" transfer of labour force can also undergo interior adjustment in accordance with the new development. So it works to effectively suppress the surging flood of migrant workers and alleviate the population pressure in major cities (Shi, 2006).

In order to meet the needs of agricultural transformation, the agriculture practioners need to improve their competitiveness, so that they update their skills from production type to management type. And they can become new farmers who have the knowledge, understand technology, excel in management. In the 1950s Schultz found that human capital investment return rate was much higher than other investments. School education is essential in human capital investment. China has proposed "Putting people first and investing in people" as the strategic choice to improve population quality and to establish a

"human resources super-power". The strategic goals to be attained by 2020 are to basically modernize education; shape a learning society; and turn China into a country rich in human resources.

Transformation of agriculture needs the farmers to be organized. Emphasis on the collective is one of the characteristics of Asian culture. Japan Agricultural Association is an excellent creation in the management of small-scale farmers in the history of world agricultural modernization, and also an outstanding way in help small farmers develop modern agriculture. The agricultural associations not only increased the farmers' income, but also provided strong support in building a professional, communal and up-to-scale modern Japanese agriculture (Zhuang, 2008).

5.3.11 Acclamation for new agricultural revolution

The future development of agriculture still needs fertilizers, irrigation and pesticides. When applying new technologies, we must pay attention to integrate technical content with social, economic and cultural background so as to develop sustainable agriculture. For example, when promoting high-yielding breeds, we need to avoid simplification of breeds so as to preserve biodiversity and maintain the richness of the gene pool; the development of irrigation needs to avoid salinization; we need to keep certain chemical compounds(such as pesticides) from doing harm to the environment; we need to promote the diversity of farming regimen and comprehensive pest control; attention must be given to soil conservation, integration of farming and animal husbandry and good water management(Liu, 1997).

Modern ecological agriculture, or sustainable agriculture has a lot in common with traditional agriculture. But the modern ecological agriculture is not a simple restoration of traditional agriculture. It is a form of modern agriculture that follows the principal of organic agriculture and utilize modern technology, turning the closed traditional agriculture into a open, modern and ecological one. Modern organic ecological agriculture is a high-tech empowered development of the traditional organic agriculture, and in a sense the product of the synergy of organic and inorganic technologies. In other words, modern ecological agriculture or sustainable agriculture while emphasizing the use of solar energy, does not unconditionally object to the use of oil, but seeks to minimize oil input, environmental pollution and to restore as much as possible the use of organic fertilizers. Modern ecological agriculture or sustainable agriculture is a continuation and development of traditional agriculture.

5.3.12 Establish new urban-rural relations

Urban-rural relations have shaped history. Since time immemorial, cities have been at the center of economic, technological, cultural and institutional revolutions. In ancient Asia, many cities were inhabited by crowds of farm laborers. On the one hand, these laborers provided some food

to cities; on the other hand, cities contributed to agricultural development as a result of their advantages in politics, economy, culture, technology and population. With urban-rural exchange of personnel, information, capital and materials, advanced farming technologies were spread from cities to surrounding areas.

Urban-rural materials exchange is worth paying special attention to. Primary products come from rural areas to urban areas so that city dwellers have their daily necessities. In a traditional society, urban house refuse was transported to the countryside and used as agricultural fertilizers. Thus, a virtuous circle was formed between urban and rural areas. This relationship in ancient Asia was a violent contrast to the one in modern western capitalist countries. Within this new context, it is urgent to find out how to inherit and carry forward the tradition of utilizing industrial and house refuse, and rebuild a material circular passageway covering agricultural and industrial production and urban-rural living, so that we can sustain our development.

City development always needs farming land and inevitably caused agricultural losses. However, history tells us these losses can be compensated by urban agricultural development and technological innovation. In this era when urbanization is accelerating, one possible solution to urban-rural land shortage will be, reducing urban-rural differences and eventually achieving urban-rural integration.

5.3.13 Strengthen cultural exchange, promote Asian development

Cultural exchange played important role in Asia development in history. In an increasingly globalized, networked today, the exchanges within Asian countries and between Asia and the world are growing more intense every day. Such exchanges now exert deep cultural impact such as on food system, diet and even the retail market. It is expected that cultural exchange will contribute even more to the sustainable development of Asia. Japan can share its unique mechanical system of rice cultivation with its rice-growing neighbors. Israel could transfer its water-saving irrigation technology to other countries. China can carry on "Hybrid Rice Diplomacy" with countries in need such as countries in Southeast Asia and Africa. The dialogue between Asian countries that face similar food and agricultural problems is paramount without any doubt. The exchange and cooperation on the bases of shared experience and technology platform will bring about new solutions that respond to local conditions. Similarly, inter-regional exchange of agricultural experts can also benefit agricultural development.

Globalization promotes cultural exchange, but the unequal exchange will have a negative impact and may even lead to the demise of traditional culture. Globalization continues to change people's diet and way of life. People's food consumption patterns become increasingly identical, as shown in fewer types of

food, dependency on rice, wheat and other the staple food, higher consumption of meat, dairy products, edible oil, salt and sugar, and low intake of dietary fiber. The homogenization of cultures will be a major element that affects sustainable development. While absorbing imported culture, we must also localized it to meet the local needs.

We must adhere to the globalization of agriculture, but the diversity and continuity brought about by the special nature of agriculture of each country and of different stages of development should be taken into account. The future of agriculture in Asia can not be dominated by commercial or political concerns.

Asian culture must develop in its exchange with other cultures.

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