

Principles in the Indigenous Agricultural Techniques and Management in Sri Lanka: A Historical-Comparative Analysis

The purpose of this Ph.D. thesis is to provide an alternative perspective on technological change in agriculture in the 20th century and to examine the historical significance of the traditional or indigenous agricultural techniques, which have been developed over the centuries by the local people in Sri Lanka and entirely neglected in the technological revolution (Green Revolution) in agriculture since the 1960s, to understand the sustainable principles of those techniques to address the contemporary agricultural problems in Sri Lanka. Thus, this thesis attempts to link again the indigenous agricultural techniques to address contemporary agricultural problems. It newly establishes a dialog between farm-level agricultural techniques in the past and present, opening a new discourse in the field of agricultural technological history. In this connection, the thesis, first, critically reviewed the historical origin of the technological revolution in the agriculture in the Third World countries—from a global perspective and a country-specific perspective, which, in this case, is Sri Lanka. Second, the study analyzed the field survey data by applying a historical-comparative approach. In this chapter, an attempt is made to provide a concise overall summary of the philosophical development of the technological change in the agriculture in the Third World countries during the colonial and post-colonial period. Key findings of the analysis of both sections—the critical review and the historical-comparative studies—are provided, along with a discussion of the remaining issues to be addressed in the future for further development of new knowledge in the field of agricultural history.

The philosophical development of technological revolution in agriculture goes back to the period of the emergence of the ethnocentric capitalist system in the 15th century in Europe. Europe moved to capitalism from proto-capitalism with the population explosion in the 15th century. This movement has expanded the European markets in the world, first, with the agricultural revolution and thereby the industrial revolutions in the region, and second, via imperialism in Asia, Africa, and Latin America in order to balance the demand and supply. However, the US-led Western countries had to change the mode or way of maintenance of the capitalist system in the world for the benefit of Western economic prosperity owing to the collapse of the European economy due to the World War II and the threat of communist ideology to the capitalist system during the Cold War period. In this connection, some complementary outcomes were needed for Third World countries because of the threat of communist ideology. Thus, the Western attention essentially focused on agriculture in the Third World countries due to their strategic importance for the Western-led capitalist development in the world. Specifically, the Western world viewed agriculture in the Third World countries as static, normatively consistent, or structurally homogenous and recognized those factors as growth-retarding factors in the world capitalist system. Particularly, the subsistence nature of agriculture in the Third World countries was recognized as the core issue of low farm productivity, which obviously led to imminent global starvation with a population explosion. Thus, the US-led Western industrialized nations put forward a technological package or the Western scientific advances in agriculture to the Third World countries, particularly in the period of the post-colonial world, in order to face the challenges of the population-food race based on the theoretical foundation established by the Malthus in 1798.

It is noteworthy to refer to the fact that the Western technological package, mostly referred as the Green Revolution (GR), was central to make revolutionary change in agriculture in the world in the 20th century in terms of technology and therefore social and cultural practices. It is without a doubt that the GR averted hunger for thousands of people by increasing farm productivity in the country. However, researchers in the world have recognized that the GR was not a panacea for solving the problems facing the agrarian structures in the Third World countries. This is mainly due to the cited health, environment, and farm management problems, in addition to problems of the disappearance of indigenous crop varieties in association with modern technology. The social and cultural polarizations influencing the

GR were critical to the Third World countries. Despite the high rate of growth of productivity of specific crops, such as rice, food insecurity is still one of the acute problems in the Third World countries. These facts have, today, established the rationality of the overall philosophy of the technological revolution or the Western scientific advances in agriculture in addressing the food problem, particularly in the Third World countries.

Thus, this Ph.D. thesis attempted to open a new historical discourse on technological transformation in the Third World countries that occurred in the 20th century in Sri Lanka. Sri Lanka was selected for this because Sri Lanka is the one of typical countries in the Asia that has undertaken the Western technological package (the technological package of the GR) since the early 1960s.

The theoretical justification of the technological change in agriculture (the population-food race) in the 19th and 20th centuries is questioned in the second chapter of the thesis because it obscured the reality that underlies the technological change in agriculture in the developing countries. It critically reviews both primary and secondary historical sources in deriving the basic argument of the thesis or testing the research hypothesis, which is the existing theoretical underpinning (the population-food race) is not sufficient enough to interpret the technological change in agriculture that occurred in the post-colonial world. The following are the concluding points of the second chapter. First, the technological change was a large attempt to promote ethnocentric capitalist imperialism in the post-colonial world by converting agrarian structure of the Third World countries from independent agrarian structures to dependent agrarian structures. Second, on a minor scale, the US geopolitical and military concerns were recognized as supporting concerns in smoothly promoting this new economic imperialism in the post-colonial world, particularly as tools against communist imperialism. The ethnocentric evolution of capitalist agriculture from Europe to the tropical and sub-tropical regions in the world confirmed the need for the maintenance of capitalist imperialism in order to maintain the Western countries economic prosperity. The emergence of communist imperialism in the 19th century provided some challenging theoretical insights into the exploitation of resources by one part of the world from another by challenging the ethnocentric capitalist system. This made the Western world redefine colonial-based imperialism and transform it into a new form in the post-colonial world. Therefore, the US geopolitical and military concerns in the post-colonial world were the defensive concerns of the economic imperialism. Third, the study also demonstrates the inadequacy of the theoretical foundation (the population-food race) in interpreting the technological change in agriculture in the Third World countries. The reason is that the suggested technological package has led to an aggravation of the food problem in these countries. This paper views this problem in association with global cooperate capital in terms of agricultural input and output markets and changed agrarian structures in the Third World countries. The review of historical information of this study supports the facts that technological change is the revolutionary attempt by Western countries to promote economic imperialism in the post-colonial world. Thus, visible factors, such as the population-food race, are not closely related to the reality; rather, invisible factors, such as geopolitical and military concerns of the US foreign policy, global cooperate capital, a global institutional setup, etc., provide supporting evidence for a new form of imperialism—economic imperialism—in the post-colonial world.

The third chapter critically reviews the historical origin of the agricultural transformation that occurred during the colonial and post-colonial period in Sri Lanka. The study found that the partial change of agrarian structures during the colonial period and the technological change during the post-colonial period corresponded to the global objectives of the industrialized nations in promoting the capitalist agricultural system throughout the world. Specifically, the neglect of indigenous techniques during the colonial period was reported due to the specific attention of the colonial empires in promoting the commercial agriculture—tea, rubber, and coconut, and other minor export crops, such as pepper, coffee, cinnamon, etc—enhance the economic prosperity of industrialized nations. The technological change

since the 1960s in Sri Lanka has been based on the theoretical underpinning—the population-food race—that is similar to in other Third World countries.

The focus of the fourth chapter was to allow the researchers to demonstrate that the neglect of indigenous techniques in the technological change in agriculture in the 20th century is the key reason for the long-term failure of the GR technology in Sri Lanka. This study addressed the fallacy of the main justifications that underlie GR technology by evaluating long-term consequences of the technological package of the GR in Sri Lanka. First, the study proved the fallacy of grounded rationality of the basic justifications of the introduction of GR technology in Sri Lanka—the fear of the Malthusian famine. The historical data of the farmers revealed that the predicted future food problem is no longer a valid justification for the introduction of GR technology in Sri Lanka, which entirely displaces the indigenous agrarian structures. This was proven by the diversified and poly-culture agriculture techniques in the indigenous agriculture, as these techniques supported higher productivity in terms of crop land. Specifically, the critique of the low yield is not rational for indigenous agriculture because the indigenous techniques do not focus on specific crops or practice a monoculture system as the focus of modern agriculture. Instead, they focus on a diverse range of crops and livestock (mixed farming) that provide a different range of agricultural production for a specific land space. This specific technological difference indicates that the modern yield comparison between the indigenous and modern agriculture by taking into account a specific crop, such as rice or maize, is not a viable indicator. Second, the indigenous agrarian structures also contributed to the food security of agricultural households via a diversified, poly-culture and mixed farming approach. The farmers' historical data revealed that there were many types of cereals that were substituted for rice. The relative importance of those crops was that they were free from chemical inputs, which attributed to the nutritional and medicinal properties. In addition, they helped farmers to maintain a household dietary balance throughout the year. This indicates that the technological change in agriculture in the 1960s in Sri Lanka was based on the common justifications established in developing countries, such as Mexico and India. Those justifications were false with regard to the indigenous agriculture in Sri Lanka because the indigenous agriculture was capable of facing future challenges in the food supply in a sustainable way. Third, the study results concluded that GR technology led to the marginalization and displacement of farmers on their own lands and thus increased social inequality. Moreover, the change of technology was expected to generate an economic surplus, which supports the capital accumulation in agrarian structures. The study results indicated the increased social and economic disparities among the farmers across a half-century. It indicates problems of modern technology in deriving equitable benefits to the farmers, particularly through the capital accumulation process, leading to questions of the distributional effects of technological change. Specifically, the study results provide historical lessons on how to maintain social equity through indigenous farming techniques. Moreover, the social and cultural values attached to the indigenous technology of Sri Lanka have not been completely recognized in the technological change created by the GR, as it has basically assumed that agriculture is a purely technical process. Thus, the technological change has led to a gradual erosion of the historical identity of the country producing the agriculture. The social capital assets and mutual labor exchange systems used in indigenous agriculture have become impractical due to the technological change. Specifically, those norms, values, and practices are unique to the agrarian structures, and no violence or conflict is related to the agricultural activities. This provides some contradictory evidence to the agricultural transformation that occurred in Europe and America from the 18th to the 20th centuries because the agricultural transformation in those regions was the process of technological evolution based on their indigenous technology and thus reflected their historical identity. Fourth, the separation of agriculture from nature was reported in the historical experience of the interviewed farmers. The indigenous techniques in agriculture correspond to the natural features of the region, including the rainfall patterns, soil conditions, temperature, and humidity, and they are dependent on the local resources. The study found that cultivation based on rainfall patterns and the lunar calendar, as well as other indigenous techniques, provides highly

sustainable alternatives to the modern, highly external, input-based techniques. Indeed, decision making based on rainfall patterns and the lunar calendar prevents possible risks in agriculture in terms of pests, disease, flood, drought, etc. These techniques are not harmful to the environment and thus can maintain the long-term production sustainability. These techniques were also not linear and uniform over all of the regions of the country. These characteristics were the basic foundation of the independence of the indigenous agrarian structures, which was later transformed and became dependent on Western techniques. This may also concern part of the agricultural transformation in linking the multi-national companies (MNCs) with the agriculture of developing countries. The study concludes that the neglect of sustainable principles of the indigenous agrarian structures in the technological change decreased their potential to farm to produce the greatest yield possible. Thus, this historical-comparative evidence demonstrates the fallacy of the Western ideology on the indigenous agricultural technique, which was considered as a primitive technology in developing countries, in Sri Lanka. It is acceptable that agrarian structures, particularly the technology in these structures, would change according to the changing needs and future challenges of the country. Such a change would be an evolutionary change and based on the innovative and sustainable principles of indigenous agrarian structures and social, economic, cultural, and agro-climatic heterogeneity of the specific region or country, as it helps to maintain the long-term sustainability of the agriculture in Sri Lanka.

The fifth chapter attempted to identify indigenous techniques in rice farming applied by farmers at each stage of cultivation, with the aim of identifying the sustainable principles of those techniques. The study demonstrated that indigenous techniques in rice farming correspond with the natural features of the region, including the rainfall patterns, soil conditions, temperature, and humidity, and are dependent on the local resources. Cultivation based on rainfall patterns and the lunar calendar and the adopted techniques of soil fertility management, seed selection, seed treatment, water management, and pest and disease control provide highly sustainable alternatives to the modern, highly external, input-based techniques. However, the main argument against indigenous techniques is the relatively low yield, which is eventually associated with the country's food security, even though the production costs are significantly lower in comparison to modern techniques. Thus, further research should be conducted on the unique conditions of and the technology adopted by progressive farmers who record high yields to identify yield-enhancing techniques in different regions. Indeed, these indigenous techniques are not harmful to the environment and thus can help to maintain the long-term production sustainability of rice farming. This study suggests that the strategies designed to tackle the problems of modern rice farming should take into account the characteristics of the indigenous rice farming techniques in Sri Lanka.

The sixth chapter identified the characteristics and significance of the indigenous rice farming technology, which was developed based on the extensive experience of the local people in Sri Lanka and has been tested over long periods of time. The study findings indicate the potential of the indigenous technology to address problems that originated from the technology package of the Green Revolution. The characteristics of the indigenous technology revealed that the techniques it employs are adaptable to the natural features of the region, as many of these techniques are specifically related to local resources. Based on the farmers' experience and information related to the environment, as well as decision making based on the lunar cycle and dependency on rainfall patterns in the region, the farmers can establish the conditions necessary for improved rice plant growth. These techniques also have the ability to improve the seed fertility rate and rice plant tolerance to potential diseases. The study further showed that these techniques do not have adverse environmental effects, and they generate the expected outcome. The empirical results indicated the significance of the indigenous technology in terms of farm management. This study further emphasized that the Green Revolution has resulted in a six-fold increase in the input cost of rice farming under the modern technology compared to the indigenous technology. An income analysis indicated a surplus in the net income of rice farmers using the indigenous technology, whereas a deficit in net income was recorded for farmers using the modern technology. Moreover, the analysis of

rice yields supported the existing potential for further enhancing rice yields using the indigenous technology. Marketing issues due to the non-existence of a segmented market for indigenous rice, lack of extension facilities with regard to the indigenous technology, low productivity discourse, debt problem among the modern farmers, lack of government support with regard to the indigenous technology, and lack of quality seeds are the main limitations in the dissemination of this technology among the farmers in Sri Lanka. Thus, this study suggests that technological development in the rice sector should be undertaken based on the historical evaluation of the characteristics of the indigenous techniques in the region and the indigenous knowledge of the local people.

The seventh chapter identified what lessons that can be learned from the ancient *Chena* cultivation techniques to address the contemporary agricultural problems. First, the study found that the usage of agrochemicals from farming can be avoided with proper understanding of the relation of nature with agriculture. Particularly, changes of direction of the sunrays, the lunar calendar, and the rainy calendar in the region provide ample evidence on the natural growth of crops. The adopted poly-culture crop technique minimizes pests and controls disease. In this connection, the cultivation of specific crop varieties was an important characteristic of the techniques. Second, ancient techniques result in higher net returns in farming due to the low cost of production and the maximization of crop land productivity. Third, the concern of food safety and farmer safety of agricultural practices can be addressed by the traditional technology. As revealed, the ancient *Chena* cultivation technology shows how to avoid using agrochemicals when farming. Also, the use of the poly-culture cropping technique and diversification practices provide many kinds of foods. This obviously affects the household dietary intake, and there is therefore high support for securing the household nutritional condition and balance. Also, the technique of using indigenous varieties specifically in farming provide important solutions to modern health problems because indigenous varieties have many kinds of medicinal properties used for cancer, diabetes, kidney problems, etc. Thus, we can see that there are existing solutions for the health problems associated with the modern technique in agriculture in Sri Lanka. Fourth, the rain water utilization technique for crop plant growth provides another important solution to the contemporary water shortage problem in farming. The ancient *Chena* is entirely dependent on the rain. As described in the analysis, the farmers traditionally know about the yearly rainy calendar in the region. A pattern of crop planting occurs by taking into account each step of the rainfall pattern and the length of the life cycle of each crop. Moreover, the water utilization for each crop in the *Chena* is done by assessing the suitable land for each crop by taking into account several environmental indicators. This indicates that indigenous farmers apply a diversified water utilization technique in order to sustain the *Chena* farming in each season. This is quite different from the modern water management techniques because the modern technique in water management is unique to the region and all crop varieties, and it does not adequately take into account the rainfall pattern in the region.

These findings are novel in the field of agricultural historical science. Thus, this thesis acknowledges the sustainable principles of indigenous agricultural techniques and management in each country.