

## **Externalities in Agriculture**

**Prof. P. Abeygunawardena, PhD**

### **Organic Farmer**

When agriculture was begun in Sri Lanka can be debated. The legend has it that when Prince Wijaya arrived in Thambapanni, he saw Kuweni was weaving cotton to make her cloths. There is ample evidence to show that thousands of years ago large tanks and other irrigation structures were established by the ancient kings. Kala Wewa, Giant Tank, Yodha Ela and Parakrma Samudra were built many centuries ago and are still serving their original purpose of supplying water for irrigation and other essential purposes to thousands or if not millions of people in the dry zone of Sri Lanka. Sri Lanka was known as granary of the Eastern world. The agricultural methods, practices, seeds and fertilizers were natural and chemical free. Since then, the way we grow paddy and other dry land agriculture practices such as Chena cultivation have under gone many changes. Such changes began during colonial administration when they introduced rehabilitation of ancient irrigation structures and new schemes like Kagama, Minneriya, Hingurakgoda commencing from Liyangastota.

Drastic changes to our agriculture systems started happening on the ground since mid-1960s primarily due to three main factors: new or high yielding seeds, irrigation water, and chemical fertilizers. Those changes started in relation to grain production. Subsequently, other crops, animal husbandry and almost all segments of agriculture were subjected to similar changes. In crop based agriculture this was considered as the green revolution and in the dairy industry it was considered as white revolution. Therefore, for purposes of agriculture I consider the pre-mid1960s as past, mid-60s to current date as the present and beyond 2020 as the future. In the next section of this essay, I consider essential features of each of those agriculture systems and practices and make some observations about how our future agriculture is going to be.

Tea was introduced to Sri Lanka in 1820 or approximately one hundred and fifty years ago. It is amazing to think that any agricultural industry could have survived for such a long time without undergoing major changes. The way Sri Lankans grow tea, pluck tea leaves and process them into ready-to-drink black tea has not undergone any major changes since the introduction of the tea plant to Sri Lanka. If at all, any changes that we talk about with regard the tea industry relates to increasing output, expansion of cultivated land, and extension and improvement of tea quality. Coconut and rubber subsectors have also faced similar situations but unlike rice based seasonal agriculture; the plantation sectors have not undergone such drastic changes over the years. Therefore it is trend analysis of past, present and future of these two sectors that have to be discussed with different parameters in mind. Perhaps, gain or staple food sector has to be discussed with food security at

the center of focus while plantation sector has to be analyzed concerning their ability to generate foreign exchange earnings for the country.

### **Staple Food Production Sector**

Pre mid 60s our staple food sector used mostly traditional seeds, labor intensive production methods and primitive tools and implements for day to day farming activities. Farmers used to cultivate traditional or native varieties and maintained their own seeds season after season. The agriculture inputs were very much natural and no chemical fertilizers or agrochemicals were used or even available. Yields per unit of land were low and most of the varieties the farmers used to grow were less or not very responsive to fertilizers. They were tall, and vegetative growth was substantial and often subjected to water or wind lodging. In grain plants the number of grains per panicle was low and grain was smaller resulting in low volume output. Though certain specific aroma or flavor had been found in those traditional varieties, in general, output volumes were lower. There had been some occasions where high yields were reported in new fields but further observation determined that those varieties were low yielding. Some of those varieties were reasonably adapted to the climate and its seasonal variations. Some of those traditional varieties were found to be in fact too sensitive to the day light length and so on. Average paddy output per ha of land during this period was about one metric ton or less.

During the 1940s Sri Lankan agriculture research program was able to come up with a set of high yielding varieties namely "H" series. The more successful ones were H 4 and H 8 which were not water lodging. Although it was reported that more than 500 varieties of traditional paddy varieties were listed in the literature, there had been many redundancies and also the same variety was referred to in different locations under different names. However, it is safe to conclude that there would have been hundreds of paddy varieties cultivated in traditional ways in Sri Lanka in the past. Average paddy yield was between one and a half to two metric ton per ha and by the mid-sixties Sri Lankan population was about eight million and what we produced was simply not enough to feed the entire population. Other food crop yields per ha were also low. A food crisis was unfolding after the World War I and various steps had been taken to overcome it. For example, the promotion of irrigation schemes, rehabilitation of them, cooperative movement, price controls on rice, introduction of rice ration books, price subsidies for rice, guaranteed price scheme for paddy, and many other schemes. In fact the crisis was getting worse after the World War II and during 1953 a major social uprising caused by request for cheaper rice made the entire political system unstable. The Paddy Land Act of 1958 was introduced with many other programs but they all were inadequate to fully resolve it.

During the mid-sixties introduction of IR 8 and mini-kit system lead by CGIAR system started taking control over Sri Lankan agriculture as well as the world agriculture. This is the period I consider as the end of past agriculture system and

emergence of the present agriculture system in Sri Lanka. The present agriculture system has not undergone a smooth transition. Whenever there was an issue the government came forward with a reasonably well funded support package. Among them (i) continuation of guaranteed paddy price scheme, (ii) large scale irrigation system development and (iii) research and development program for high yielding varieties. Moreover, subsidy scheme for promotion of the application of chemical fertilizers and the Paddy Land Act that enabled tiller to be rewarded better than what was received in the past contributed positively towards increasing paddy production across the country. This high input high output package was referred to as the green revolution in grain production. The average paddy production increased year by year and by the early 1970s, average paddy output per ha was about 2.8 to 3.0 metric tons per ha. This was almost 50% to 75% incremental increase over a five to six year time period. By the mid-1980s average paddy output increased over 4.0 metric tons per ha. This trend came to a plateau around year 2000 to present date without a drastic change in yield levels.

The green revolution paradigm dominated Sri Lankan agriculture for more than five decades. However in a short span of time from mid to late 1970, and again late 1980's there had been a major food crisis in the world. There again in 2007 - 2008 food scarcity caused poor people to stage riots or violent actions in search of food. Pre 1960s such events were almost day to day across the world especially in Asia and Africa. For example, the Bengali food crisis in 1940s was considered a major human catastrophe. Except for such drastic events, most of the time during that half a century period the world has had a modest amount of food needed to reduce acute malnutrition, and extreme hunger. Not only in Sri Lanka but almost every part of Asia food production increased to such a level that the regional food trade made the Asian region relatively self-sufficient in food grains. It was a major conclusion that Sri Lankan agriculturalists boasted how the successful green revolution effectively eliminated starvation from day to day policy discussions.

Africa still continued to suffer due to lack of food and wide spread starvation. One of the research reports related to Texas agriculture noted the following: "The case of Ethiopia is one of the most instructive in Africa. Not only are its recurrent famines good examples of how politics turn drought into starvation, but a comparison of the famines of the early 1970s with those of the 1980s shows how the ideology of the state has meant little for the mass of the people. In the 1970s the government of Ethiopia was Western oriented and backed by the United States --and it starved the people. In the 1980s a new government of Ethiopia proclaimed itself "socialist" and was Soviet backed --and it too starved the people. "Ethiopia: Catastrophic Drought," *Africa Research Bulletin*, February 15 - March 14, 1983. (6761-6762)<sup>1</sup>

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<sup>1</sup> *Food Crises of the 1970s and 1980s*

<http://la.utexas.edu/users/hcleaver/357L/357lsect4biblio.html> To appreciate the degree to which the 1970s and 1980s have been decades of crisis in world food supplies and prices,

In the meantime, agriculture researchers found that the yield increasing potential in grain subsector was reaching its limits. High yielding varieties and incremental dosage of fertilizers and other agro-chemicals did not generate usual incremental outputs. In the early 1990s for example researchers also started asking how green the green revolution actually was given the resultant deforestation, soil erosion, water pollution, water scarcity and environmental degradation associated with the green revolution; becoming a massive problem.

Younger people are environmentally more conscience, everywhere across the world. They started demanding a different type of food packet/basket versus what was popular in 1970s or 80s. They have been less concerned about the grain quantity they receive onto their plates and began asking more about nutrient and health value in their food packet. Greater awareness of increased cancer rates, kidney disease, disturbances to the endocrine system, and obesity has taken its toll. In 2015, Sri Lanka for example declared Wasa Wisa Nethi Govithena (Agriculture without Poisons) as its major agriculture program or policy. In 2017, during the annual Budget Speech the Finance Minister stated that “...unsustainable agricultural practices adopted over time have resulted in low productivity, degradation of the soil, compromising the quality of water and water sources. Clearly, a paradigm shift is needed to transit into more eco-friendly agriculture practices. This will not only benefit our environment, but also open new export markets, given the increasing awareness and the price, especially the developed markets are willing to pay for produce from ethical farming and eco-friendly practices.”

### **The Future of Sri Lankan Agriculture**

In the past, Sri Lankan agriculture has not always taken a smooth growth trajectory as it has traveled through many lands on a challenging path, sometimes in steep decline and other occasion's a rapid ascent. The future will not be an exception. Within the agriculture sector there have been drastic changes to improve productivity. A heavy input and high output model considered as the green revolution dominated the last five decades of agriculture growth. Other newer developments such as gene modifications, hybrid technologies, tissue culture and hydroponic systems had taken over the task of increasing food supply to the world. Those changes initially demonstrated positive results, but at the same time they also started showing negative results due to excessive use of inputs, and resultant nasty outcomes from chemicals, pesticides, growth hormones etc. Drastic changes and damages to pristine ecosystems, soil erosion, polluted waters, carcinogenic additives in day to day food items and adverse health impacts due to high input high output agriculture model are not kept secrets anymore. Starting from the present endowment, generating food for much higher population of people with better food safety standards and maintenance of environmental quality are the major challenges of future agriculture in time to come.

In environmental economics externalities have been defined as the transactions that have not been able to taken into account markets. They can be positive or negative. Eroded soils from an upland farm is a negative externality to tourists use such a water stream for recreation. Residues of agrochemicals or washed of fertilizers can be externalities to the next door farm. Dust storms can cause even intercontinental impacts that needs to be measured in millions of dollars. Invasive species, land clearing, road development many such agricultural activities have caused in significant economic and financial impacts sometimes have not been able to internalize in our day to day market transactions.

Has ever there been a serious effort to calculate such gains or losses and incorporate them into agricultural growth or development figures or statistics? For example recent case of California court passed a judgment asking Monsanto to pay USD 296 million compensation to a weedicide applicator. How often such health issues have been seriously debated?

I argue that the present crisis in the food sector is an inevitable outcome of reckless spoliation of natural resources of the world. Poorly coordinated and selfish activities at the local level and subsequently at the global level made this crisis almost unmanageable. One agriculture company owner overpowered another agricultural company owner, competing for limited inputs. They also add various chemicals, sugar and other additives without much care for the consumer in the process of food processing. What we have observed in the last five decades is not competitive agriculture or food industry, but a cut-throat “war” by various players. Regulators all over the world have also become part of the problem where instead of being part of the solution, they failed to look at how the industry as a whole guide for win-win solutions. At the same time, world-wide consumers have changed their consumption patterns and are demanding healthier foods. This is the consumer shift underway in the world market today that both the agriculture and food sectors failed to fully grasp. We also have not been able to address externalities and their impact in agriculture and food sector even partially.

This is the paradigm shift stressed in the budget speech 2017 and which needs to happen without further delay. In a way, this is not a new paradigm. Our food crops initially grown as any other plant or tree can be realized without use of heavy artificial agrochemicals or fertilizers. Our ancestors grew and processed their food crops naturally, according to nature. Under the new paradigm, our food and agriculture sector needs to embrace going back to food production and processing to their natural ways and convert the food production business into to a health industry. A healthy food product simply cannot contain chemical residues nor can it contain heavy metals. No Diuron, Glyphosate, DDT or POPs.

Sri Lanka needs to organically and naturally convert over our agriculture production and processing industries wherever possible without further delay. This will be a bold initiative and will require major adjustments in the sector while reaping the

benefits and will take several years to be realized. We can no longer continue to do business as usual. Recognition as high quality producers is insufficient for us to thrive in this business. As much as we produce high quality food we must also make sure our foods are healthy to eat. It must be profitable to farmers and food processors and affordable to average consumers. There must be adequate quantities available in the market to feed the hungry mouths. Such paradigm shift requires resolve and addressing several key issues discussed below:

### **What is this new agriculture?**

As of today, there is no clear understanding about organic and natural foods in the world. Producers are not fully aware as to what specific requirements that they need to follow in producing organic or natural foods. To some, it is just another type of agriculture where the crops are cultivated without any fertilizer or agro-chemical applications. To others, it is agriculture production without fertilizers. However, such narrow definitions or conditions or requirements are incorrect or incomplete. Organic tea cultivation for example requires fertilizer applications. However, they must be natural fertilizers. Artificial and harmful chemicals cannot be applied in organic agriculture. Sometimes buyers know what they want to buy but many sellers are not aware of what it is they are selling. Therefore, there is a felt need to recognize organic food as a specialty category of food wherever possible and applicable.

In a country like Sri Lanka, there is no organized organic food marketing system available for consumers to buy their daily needs. Organic food buyers will have to search for organic food producers or sellers. This is time consuming and creates a problem of information flow among the key stakeholders in the organic food trade. This often leads to organic food producers facing serious cash flow problems. Also organic food buyers often end up not being able to buy genuine organic food on time in the market and as a result, the organic food market remains largely underdeveloped.

It can be strongly argued that organic food production and promotion can be achieved through regular market mechanisms. Allow the market to regulate the organic food industry and any specific barriers that exist in the market must be removed by the regulatory body (of the government). Moreover, government regulatory bodies can intervene whenever there are incidents of wanton harm to the organic integrity, as such incidents may bring disrepute to the organic food industry. For example, if any producer or food processing factory or seller's food is detected with chemicals, pesticide residues, heavy metals or any other harmful materials that are not supposed to be mixed with food, the regulatory body must remove such producer/seller from using the organic status label in his/her products, despite what form of certificates they produce to show their integrity.

As much as those who damage the integrity of organic food markets should be penalized, in parallel there must be a program to reward those who safeguard the

integrity of the organic food industry. In any country, relevant regulatory agency officials of government and semi government institutions should be made aware of the nature and mechanisms of the organic food industry and exposure to how international organic food markets operate. Their lack of understanding of the organic sector related matters makes it extremely difficult for producers, processors, and packers to function harmoniously and in a mutually respectable manner. This is an essential requirement for new agriculture to be commercially viable.

The trust between the consumer and the producer is critical for an organic market to properly develop and function in any country. Often organic consumers are far removed from the organic food producer. However, the consumer should be able to learn everything what s/he wants to know about organic food production and processing methods and standards, what inputs are used or not used, etc. The certification body in this context has an important role to play in making sure that consumer preferences are reflected in their certification process. Consumers can visit production farms, processing factories and packing plants, if needed. If any producer or processor violates the trust formed on them by the consumer, it is recognized that the consumer can opt to move away from the offending producer/processor that was unable to maintain a trusting relationship. Through consumer associations, brokers, certification bodies and a direct relationship with the producer and consumer, organic food markets can thrive.

Organic and/or natural food brings a whole array of environmental and health benefits. Organic food does not require artificial or chemical fertilizers, pesticides, herbicides or any other growth hormones. Therefore, organic food does not contain residues of any such harmful chemicals, or Lead, Arsenic, Cadmium or similar heavy metal in it. It does not harm or spoil the land or soil resources that nurture crops and water bodies which drain from such agricultural lands. It protects and enhances biodiversity; organic food has much lower Carbon emissions than its counterpart of non-organic foods. Hence Carbon footprint of organic food is relatively smaller.

#### **New world system of agriculture**

The success of the green revolution paradigm of agriculture had a lot to do with the world order of agriculture and is a fact that whether one likes it or not. For example, CGIAR system, FAO, and various other world bodies that support agriculture include bilateral and multilateral groupings/agencies. The success was an outcome of all those activities. It is mandatory to establish a new world system if the new paradigm is going to help bring us in a more positive direction. This new world system minimally must focus on organic and natural agriculture development, promotion and regulation. It can be an apex body consisting of country specific organic agriculture bodies collectively formed into a new world system of organic agriculture. This new world system of organic agriculture should look after organic

food production, sales and promotion activities of the world commencing from country specific manner.

Such new organic world system must be able to find adequate resources to undertake its specified tasks. This body should promote organic agri-business in the world. It should protect organic food consumer and assist organic food producers and processors. It also can sponsor organic agriculture education, promote award ceremonies nationally and internationally coordinate with country specific organic agriculture research and other relevant research bodies, private sector research and development systems etc. It also can promote (i) organic food production, (ii) organic fertilizers, (iii) organic food processing methods and techniques, (iv) organic food sales, marketing and trade, (v) value added products for organic products and (vi) organic food consumer research, waste disposal activities in anywhere in the world.

### **The way forward**

The new agriculture paradigm demands much more than what was demanded by previous agriculture or development models. It has to be artificial/chemical free, achieve higher output with greater nutritional values and more so, it must be healthier and affordable. The composition of the food basket has to be acceptable to new generations. Research will have to multi-sectoral and interdisciplinary. Coordination of those activities, and in particular some of the conflicting goals will be extremely difficult but necessary.

These proposals do not work if various players of the game do not function prudently. It is a must to establish a transparent, respectful and trustworthy organic agriculture and food sector if we are to harness the significant benefits from this newly emerging trend. Required social changes are inevitable. The society must be democratic or pluralistic, and must be free from corruption. Any form of discrimination will not be tolerated. Businesses will have to be socially responsible and environmentally sustainable. Practicing farmers must be empowered, rewarded and made responsible for their product quality. A certification system must be allowed to function in private hands. If any government agency wants to establish its own certificate system they are free to do so. However, it should be done in a competitive basis with the private sector accrediting agencies. All players in the organic agriculture and food industry must work for the sake of serving the trustworthiness and integrity of organic agriculture across the country. Trust and transparency is the basis of success and the consumer is the ultimate judge in the organic food sector. All others must help and nurture such a system to emerge and prosper.

One can argue that this kind of society we are talking about will involve a new kind of people to make this happen. For the new agriculture paradigm to be successful we need people willing to make decisions and sacrifices at every level of society for



the betterment of society. The resultant improved environment, lands and oceans will be very different from what we witness today.

Most of the agriculture functions performed today relies heavily on chemicals. In the new agriculture economy, production will be greatly enhanced through microorganisms. Most of the plant growth and food processing will be carried out by microorganisms. Farmers today who worry every moment about the health and nutrition of their soil will work with soils that are rich and alive in every aspect. Naturally balance insect populations can co-exist within our new agriculture. Farmers will begin to care for all species of flora and fauna living in our agriculture system with the same care and concern they provide for their cattle or poultry today. The lithosphere, biosphere and aerosphere all will be in harmony. These changes are going to start in Sri Lankan agriculture from around 2020 to about 2100. No longer can externalities be ignored in agriculture. They must be addressed properly and taken into account in our profit and loss assessments.

The microbiological revolution will dominate the new paradigm of agriculture. One can argue this is risky. Yes, the industrial revolution with all its innovations also brought us the atomic bomb and other forms of nuclear hazards. The Green revolution also brought us polluted rivers, lakes, depleted soils and contaminated foods across the planet. The great computer and information technology revolution also brought with it computer hacking and viruses. Even a smart school child can hack into a website of a company's CEO and create havoc. So, it's assumed under the microbiological revolution that there exist similar risks and challenges that will require great awareness. Is this simply too big a risk for human kind to face and if so, what is the way out? In my humble opinion, the green revolution paradigm cannot feed the world safely and meet world population expectations. As a result, a new paradigm for agriculture development is an imperative. The risks will have to be carefully weighed and proper safety systems designed and built in. Moving forward with enough care, love and attention is our only way forward.