Agriculture has undergone many ‘revolutions’ throughout history, since its advent some 8 to 10,000 years ago. But it is during the last century that agriculture has perhaps seen the most radical changes, due to the rapid spread of new technologies and the far-reaching nature of their impact upon social, economic and ecological systems.

Two guiding themes may be said to have dominated this period of agricultural and rural development. One has been the need for increased food production to meet the needs of growing populations. Governments have intervened to modernise traditional agricultural systems, by encouraging the adoption of modern varieties of crops and modern breeds of livestock, together with associated packages of external inputs (like chemical fertiliser, pesticides, antibiotics, credit and machinery). In addition, they have supported new infrastructure, such as irrigation schemes, roads and markets, guaranteed prices and markets for agricultural produce, as well as a range of related policies.

The other theme has been the desire to prevent the degradation of natural resources. To conserve natural resources, governments have adopted policies, set up
institutions and structures, and generally encouraged the adoption of conservation measures. They have established grazing management schemes to control degradation of the soil. They have excluded people from forests and bio-diversity rich areas to protect flora and fauna.

Going by the record of these two themes, it would appear that agricultural and rural development has been remarkably ‘successful’. Although often seen as mutually exclusive, both have been approached by the same process of modernisation. The approach is firmly rooted in and driven by the enlightenment tradition of positivist science.\(^2\) Scientists and planners first name the problem that needs solving. Rational solutions are proposed and technologies developed. Technologies that have been tried in controlled environments are then let loose on society.

The Modernisation of Agriculture
The Story of the Green Revolution

The Green Revolution drove widespread shifts in the agricultural sector from subsistence and low external-input agriculture to mono-cropping with high-yielding varieties (HYVs). This agricultural paradigm required the adoption of a ‘package’ of inputs, including irrigation, chemical pesticides and fertiliser, and hybrid seeds bred for disease resistance and high yield. Participating farmers often had access to credit and agro-processing facilities, transport and roads, machinery, marketing infrastructure and government price supports.

By the 1970s, Green Revolution farming had replaced the traditional farming practice of millions of developing country farmers. By the 1990s, almost 75% of Asian rice areas were sown with these new varieties. Overall, it is estimated that 40% of all farmers in developing countries were using Green
Revolution seeds by this time, with the greatest use found in Asia, followed by Latin America.³

The rapid spread of Green Revolution agriculture throughout most countries of the South was accompanied by a rapid rise in pesticide use. This was because the HYVs were more susceptible to pest outbreaks. Promising increases of yield were thus offset by rising costs associated with increased use of chemical inputs. According to one study, in the Central Plains of Thailand, yields went up only 6.5%, while fertilizer use rose 24% and pesticides jumped up 53%. In west Java, profits associated with a 23% yield increase were virtually cancelled by 65% and 69% increases in fertilizers and pesticides respectively.⁴

Synthetic fertilisers, pesticides and herbicides are made from non-renewable raw materials such as mineral oil and natural gas, or from minerals that are depleting, such as phosphate and potassium. As the price of petroleum increases, so does the cost of external inputs and machinery, forcing small farmers who are dependent on these inputs, into debt. The production of agro-chemicals is also an important source of greenhouse gas (GHG) emissions. Industrial, chemical-intensive agriculture has also degraded soils and destroyed resources that are critical to storing carbon, such as forests and other vegetation.

The rise in use of chemical inputs has also had adverse environmental and health impacts on farm workers and consumers. A substantial portion of pesticide residues ends up in the environment, causing pollution and bio-diversity decline. The extensive use of pesticides has also resulted in pesticide resistance in pests, and adverse effects on beneficial natural predators and parasites.⁵
The Green Revolution also brought about a shift from diversity to monocultures. When farmers opted to plant the HYV hybrid seeds, many traditional local varieties were abandoned and became extinct.

Other costs of the Green Revolution, often underestimated, included the financial costs of building huge dams for irrigation, the financial costs of the energy required in the construction and operation of such projects, the health costs of a steadily affected population due to chemical contamination of food, the costs involved in soil losses from increasingly degraded soils, genetic erosion and the drainage of groundwater aquifers. Green Revolution farming systems also required substantial irrigation, putting further strain on the world’s limited water resources.

Traditionally, local farming communities were close-knit as seed exchange and farming knowledge were shared freely. The Green Revolution seeds however were hybrids, for which seed saving is undesirable, as the seed from the first generation of hybrid plants does not reliably produce true copies. Therefore, new seed must be purchased for each planting season, and this meant that farmers were no longer preserving and storing seeds for the next season. This trend not only incurs extra costs for the farmers, but has an impact on social cohesiveness too.

**The Gene Revolution and the Erosion of Farmers’ Seed Sovereignty**

Until the 1930s, farmers worldwide enjoyed nearly complete sovereignty over their seeds, that is, they decided what seeds to plant, what seeds to save and who else might receive or be allocated their seed as either food or planting
material. Such decisions were made within the overarching norms established by the cultures and communities of which they were members. While these customary arrangements often recognised some degrees of exclusivity in access to genetic resources, they were largely open systems that operated on the bases of reciprocity and gift exchange, rather than the market. Indeed, these customary arrangements usually functioned to stimulate and facilitate – rather than restrict – the wide dissemination of seed. The sharing of seed resulted in the continuous recombination of genetic material, which in turn produced the agronomic resilience that is characteristic of peasant and farmer-developed crop varieties and landraces.

Since the 1930s, farmers’ sovereignty over seeds has been continuously and progressively eroded, while the sovereignty of what is now a “life sciences industry” has been correspondingly enlarged. The development of inbreeding/hybridisation in the 1930s first separated the farmer from the effective reproduction of planting material and created the opening needed for private capital to profit in the seed sector. Seed companies then used their increasing influence to obtain “plant breeding rights”: legislation that conferred exclusive control to them over varieties in crops in which hybridisation was not possible.

Subsequently, the seed industry has pursued both of these routes – technical and social – to further restrict farmers’ access to seed to the confines of an increasingly narrow set of market mechanisms. The structures of science have been used to develop “Terminator” and “Trans-container” technologies, which genetically sterilize seed in order to prevent plant-back by farmers. Both national and international structures of governance – that is, institutions such as the World Trade Organization and the Convention on Biodiversity, as well as national legislatures – have been used for the global elaboration
of a set of Intellectual Property Rights based on the principle of exclusion. By making saving of patented seed illegal, these arrangements are effectively an enclosure of farmers’ practices as well as their seed.\footnote{11}

These technical and social processes of commodification are enabled in important ways by two key features of the organisation of knowledge production and accumulation in the plant sciences:\footnote{12} First, the development of agronomically useful and novel (and therefore patentable) plant varieties has been predicated on access by breeders to the enormous pool of biodiversity that has been produced and reproduced by farmers and indigenous peoples. Systematic appropriation of landraces from farming communities by University and government scientists, their storage in gene banks controlled by governments, corporations and non-governmental organisations and their subsequent use in breeding programmes, is a long standing practice. This bio-prospecting has increasingly been understood as “bio-piracy”, insofar as no or insufficient benefits flow reciprocally to the communities and peoples who freely shared the collected materials as the “common heritage of humankind”.\footnote{13}

Second, the supplanting of classical crop breeding by transgenic methods, the progressive weakening of public research institutions such as Universities, government and international facilities, and the subordination of their work to corporate objectives – has resulted in an overwhelming focus on the development of genetically modified varieties.\footnote{14} After 20 years and billions of dollars of expenditures, GMO cultivars incorporate only two traits (selective pest and herbicide resistance) in only four crops (maize, soy, cotton and canola). The subsequent failure of public science to provide an alternative to this narrow range of patented, corporate seeds has
permitted the global dissemination of crop varieties that do not meet the needs of most farmers, that often cannot be legally saved, that reinforce the expansion of unsustainable monocultures and that contaminate other varieties with proprietary transgenes.¹⁵

Seed sovereignty has been gradually transferred from farmers and their communities to the boardrooms of the five transnational firms known as the “Gene Giants” for their domination of the US $20 billion annual market for seeds. Once freely exchanged according to an ethic of sharing, access to seeds is now ruled by a set of legal mandates based on the principle of exclusion. Once bred by farmers to meet local needs, seeds are now genetically engineered by corporate scientists to the specifications of a globally distributed industrial agriculture, geared not to feeding people but to feeding the corporate bottom line.¹⁶

**More Capitalist Trojan Horses**

The achievement of ‘Food Security’ through trade liberalisation and agricultural reforms – is yet another neo-liberal Capitalist Trojan Horse. Agricultural liberalisation is impoverishing and displacing small producer populations by allowing “dumping” of artificially cheapened (via massive subsidies) Northern food into Southern markets, and by reproducing across the South a new development model of agro-exporting to repay debt. The displacement of local foods by global foods intensifies a colonial pattern of extraction of food resources from South to North. Protections of post-colonial national farm sectors in many countries of the Global South have been dismantled under policies of neo-liberal globalisation, dedicated to the principle of universal free trade and the privatisation of public services.¹⁷
In the context of global warming and Climate Change, the development industry is adopting its own version of adaptation, via ‘Climate Proofing’. A 2008 policy brief for the Commission on Climate Change and Development argued that ‘adaptation’, deemed a necessary and “moral responsibility” by the North towards the South, is “often similar to, or sometimes indistinguishable from, development”. In other words, adaptation, (to be accomplished via insurance schemes, crop rotations, irrigation systems, drought-resistant seeds, sea defences and what not), reproduces conventional development practices.\(^\text{18}\) Climate Proofing represents a new profit frontier, with agro-chemical and bio-technology firms like BASF, Monsanto, Bayer, Syngenta and Dupont filing over 500 patent documents on so-called “Climate-Ready Genes”. Clearly, gene patents threaten farmer sovereignty and shift resources away from farmer-based strategies for Climate Change survival and adaptation.

Yet another nail in the coffin is what is happening today in the name of ‘Energy Security’. The claim to “feed the world” by improving productivity, by enforcing property rights in seeds and other inputs, brings further “accumulation by dispossession”,\(^\text{19}\) rather than supporting farmers’ markets geared to feeding the working poor, a substantial portion of humanity. It parallels a new enclosure of the Commons, driven by a related security concern: Energy supply. Governments are now identifying what they consider, mistakenly, as “idle lands” to be commandeered for agro-fuels production for valuable energy exports.\(^\text{20}\) Given the controversy surrounding the competition between bio-fuel and food crops, proposals are emerging for bio-fuel crops to occupy land deemed marginal. Merging “marginal land” with “abandoned cropland” underlies a number of “bio-energy feasibility studies” that inform policy.\(^\text{21}\)
However, much of this land supports the subsistence needs of local rural populations, such as pasturing livestock, fuel, medicine and building material. The Gaia Foundation notes that common land used for generations may not be titled, that its fragility means it is used sparingly over the years, and that it is often sacred to communities and may be vital to protecting water sources. In addition to displacing communities to more fragile regions, or peri-urban sites, government-sanctioned land acquisition in the name of Energy Security may undermine customary use and ecological practices geared to sustaining landscapes.

While a recent FAO Report emphasises the significance of marginal lands for subsistence functions of the rural poor, primarily women with no property rights, the Gaia Foundation notes:

“It is no coincidence that the livelihoods of communities who do not practice intensive agriculture, and, in particular, of pastoralists and women, are being ignored in the debate. While deforestation for agro-fuels is seen as something to be avoided, the conversion of pasture lands and non-intensively farmed lands in the South is regarded as essential and desirable, if bio-energy is to replace a significant amount of fossil fuels in industrial societies.”  

Contemporary Challenges before Agriculture: A Summing Up

According to Lim Li Ching, Elenita Dano and Hira Jhamtani, while agriculture is still reeling from the mistakes of the past, new challenges are emerging, as discussed below.

1. Climate Change
The most serious challenges facing agriculture are brought by the impacts of Climate Change. The Intergovernmental Panel on Climate Change (IPCC) found that there is abundant evidence that freshwater resources, on which the viability of agriculture depends, are vulnerable and have the potential to be strongly impacted by Climate Change, and that current water management practices may not be sufficient to cope with these impacts. More frequent extreme water conditions, stresses on water availability, droughts and overall changing environmental conditions all pose serious threats to agricultural production. The Food and Agriculture Organization (FAO) projects a reduction in global cereal output due to smaller plantings and/or adverse weather in most of the world’s major producers.

Agriculture itself contributes to Climate Change, with around 10-12% of global anthropogenic Greenhouse Gas emissions annually; mostly methane from livestock raising, biomass burning and wet cultivation practices, and nitrous oxides from the use of synthetic fertilizers. If emissions from the production of synthetic fertilizers and the total food chain from the farm to the consumer are considered, the Greenhouse Gas emissions from all sectors related to agriculture may potentially sum up to 25-30% of all Greenhouse gas emissions.

2. Genetically-Engineered Crops

To adapt to the impacts of Climate Change in agriculture, investments in research and development of Climate-Ready Crops are being directed towards genetically-engineered crop varieties to resist drought
and tolerate flooding and salinity. Major agro-chemical corporations have shifted their investments to the development of so-called ‘Climate-Ready’ genetically engineered crops, and many have already applied for patent claims on commercially viable traits that adapt to the impacts of Climate Change. Climate Change is seen as an opportunity to push genetically-engineered crops as a silver bullet solution, but this will ultimately concentrate corporate power, drive up costs, inhibit independent research, and further undermine the rights of farmers to save and exchange seeds. Moreover, genetically-engineered crops could pose serious risks to the environment and human and animal health.

3. **Bio-fuels**

As a response to the climate and energy crises, bio-fuels are presented as a solution, but their rapid promotion has resulted in unintended negative consequences. The competition for food uses and land for bio-fuel production was identified as a major cause for the recent food crisis. Even the World Bank indicted bio-fuels as directly responsible for the explosion in grain and food prices worldwide and as the factor that forced food prices up by 75%.

Large-scale cultivation of crops for bio-fuels increases competition for agricultural resources, mainly for land and water. Even with the strategy to focus more on non-grain oil crops such as *jatropha*, large-scale production would require agricultural lands to grow these crops in a world where 40% of land is already used up for agriculture.
Some serious questions have also been raised on the mitigation potential of bio-fuels. Thousands of hectares of forests and peatlands are burned every year to give way to the expansion of oil palm plantations. Greater use of fertilisers, particularly nitrogen, releases more nitrous oxide and carbon dioxide into the atmosphere from the manufacturing process of nitrogen fertilisers. In the final analysis, industrial-scale production of bio-fuels depends on fossil fuels to keep the feedstock production and processing plants working, and to keep the trucks and tankers running, to transport the end products to the market.

4. Land Grabs

In the global scramble to ensure national food security and energy security, countries with financial resources have been buying up land in developing countries for offshore food and bio-fuels production. Food import-dependent governments are buying up land across the world to outsource their own food production and escape high market prices, while private investors are eyeing overseas farms as a new source of revenue. Hundreds of thousands of hectares of land have been bought up or leased by oil-producing Gulf countries in many developing countries to grow food and bio-fuels to supply the buyers’ domestic consumption. This has serious implications for the food security and land tenure of local communities.

5. Corporate Concentration

The commercial side of agriculture, namely inputs required in conventional farming, is heavily dominated by corporate interests. A handful of giant
corporations control the seed, agro-chemical and animal pharmaceutical markets globally. The world’s top ten corporations in seed production and marketing have a combined proprietary share of 67% of the markets, 89% of market share in agro-chemicals, and 63% of the market share in animal pharmaceuticals. Monopoly control makes commercial agriculture largely dependent on inputs produced by giant corporate interests who control both the supply and the prices of their products.

The Story of Agriculture: From Liberalism to Neo-Liberalism

It needs to be understood that the shift from Liberalism to Neo-Liberalism in the field of agriculture, has been based on carefully designed strategies and myopic assumptions, with very little thought for repercussions and consequences, both intended and unintended:

According to Jim Handy and Carla Fehr: It is important to recognise that modern agriculture was based on a set of exclusions and enclosures that were fundamental to the emergence and strengthening of Capitalism. Through the 18th and 19th centuries, a set of myths about the supposed benefits of capitalist agriculture were constructed and continually reinforced to help make these exclusions more palatable."

According to Harriet Friedmann, the “dominant tendency” in the contemporary agri-food system “is toward distance and durability, the suppression of particularities of time and place in both agriculture and diets. More rapidly and deeply than before, transnational agri-food capitals disconnect production from consumption and re-link them through buying and selling. They have created an integrated productive sector of the world economy, and peoples of the Third World have
been incorporated or marginalized – often simultaneously – as consumers and producers.” 29

Central to the process of modernisation of agriculture is the assumption that technologies are universally beneficial. During the Green Revolution of the 1960s, it was widely believed by scientists that they would be able to transform agricultural systems without affecting social systems. It was assumed that technologies existed independently of social context. What was not realized is that “technology does not take root when it is cut off from culture and tradition. The transfer of technology requires sophistication: adaptation to region, to unique situations and to custom.” 30

Another assumption of the process of modernisation is the notion that new technologies are better than those of the past and so represent ‘progress’. Such a process is usually depicted as linear, with the new replacing the old, with no co-existence. This linearity is powerful in many disciplines, and usually implies that what has gone before is not as good as what we have now.

The assumption of the universality of technologies has inevitably led to greater standardization. Farmers are made to comply by completely changing “in their own best interests” their age-old practices, to incorporate the new technology. In addition, local institutions are either co-opted or lose power and wither away. The State is acting as if it alone knows best.

As Pretty points out, such universality of approach and technology leads to homogenisation of environments. Where farmers used to grow hundreds of crop varieties, they grow only one or two. Where they used a wide range of biological and physical measures to control soil erosion, they only use a few. Where they used to rely on wild plants for medicine, they
now rely on the market. Modernisation has brought with it the steady erosion of cultural and biological diversity.\textsuperscript{31}

This notion is not new. Modernity has always sought to sweep away the confusion of diverse local practices and pluralistic functions accumulated over the ages, so as to establish a new order. This order brings freedom from the constraints of history, and liberty in the new technologies and practices. One of the slogans of the modernist architect, LeCorbusier, was “by order, bring about freedom”. As Kisho Kurokawa put it, “the nail that sticks out is hammered down”!\textsuperscript{32}

But this loss of diversity and increase in homogeneity has done something to us too. We have lost something important, and probably do not know it. As Berman put it: “The very process of development, even as it transforms the wasteland into a thriving physical and social space, recreates the wasteland inside of the developer himself!”\textsuperscript{33} Modernity does not result in the triumph of rationality; rather it creates an ‘iron cage of bureaucratic rationality from which there is no escape’!\textsuperscript{34} The world so created by this universal modernism is inevitably monotonous. It is associated with “the belief in linear progress, absolute truths, the rational planning of ideal social orders and the standardisation of knowledge and production”.\textsuperscript{35}

To sum up, the modernisation of agriculture is founded on a simple, economic ideology of Nature, which in turn depends on the utilisation of certain technologies in the name of efficiency for the expansion of capital-oriented production. As Wittman points out: “This transformation of agrarian social and ecological conditions has served to disrupt agriculture as a holistic link between human culture and the environment,
producing a chasm, or “metabolic rift”, between humans and nature. Agriculture’s historically relatively closed-loop system (food production and re-incorporation of wastes into the traditional agrarian cycle) is disrupted as producers and consumers are increasingly separated, not just in the division of rural/urban spaces but also further afield through agricultural trade and regional specialization. This process of distancing underlies and fosters the systematic effects of agricultural restructuring and its particular implications for both society and nature.36

As Pretty points out, those concerned with the development of a more sustainable agriculture, if it is to succeed, must not fall into the same traps. They must not make new grandiose claims to have the sole answer. They must be more modest, learning the lessons of modernisation, and so establish a new tradition of science, policy and practice.37 The idea that all groups have a right to speak for themselves, in their own voices, and have their voice accepted as authentic and legitimate, is central to this new tradition.38

The contrast with what is required for a more sustainable agriculture is fundamental. Called ‘Post-modernism’ by some (coming after or contrasting with modernism), it favours heterogeneity and difference as the forces of liberation. What Post-modern traditions have in common is the rejection of ‘meta-narratives’, or large-scale theoretical interpretations, plans or technologies that claim to have universal application.

Post-Modernism and the Case for Sustainable Agriculture: Some Conceptual and Practical Innovations

A host of both conceptual and practical innovations are available, if one is serious in engaging with Sustainable
Agriculture. The following innovations are worthy of careful scrutiny:

✓ **Agro-Ecology**

Agro-Ecology is a scientific discipline that defines, classifies and studies agricultural systems from an ecological and socio-economic perspective. It is also considered the scientific foundation of Sustainable Agriculture, as it provides ecological concepts and principles for the analysis, design and management of productive, resource-conserving agricultural systems. Agro-Ecology integrates indigenous knowledge with modern technical knowledge to arrive at environmentally and socially sensitive approaches to agriculture, encompassing not only production goals, but also social equity and ecological sustainability of the system. In contrast to the conventional agronomic approach that focuses on the spread of packaged uniform technologies, agro-ecology emphasises vital principles such as biodiversity, recycling of nutrients, synergy and interaction among crops, animals and soil, and regeneration and conservation of resources. The particular methods or technologies promoted by agro-ecologists build upon local skills and are adapted to local agro-ecological and socio-economic conditions. The implementation of such agro-ecological principles within the context of a pro-poor, farmer-centred rural development strategy is essential for healthy, equitable, sustainable and productive systems.

The following are the advantages of agro-ecology, according to Altieri, et. al.:

1. It is an alternative path to agricultural productivity or intensification that relies on local farming knowledge and techniques adjusted to different local conditions, management of diverse on-farm resources and inputs, and incorporation of
Continuing Relevance of Swadeshi

2. It offers the only practical way to actually restore agricultural lands that have been degraded by conventional agronomic practices.

3. It offers an environmentally sound and affordable way for small landholders to sustainably intensify production in marginal areas.

4. Finally, it has the potential to reverse the anti-peasant biases inherent in strategies that emphasize purchased inputs and machinery, valuing instead the assets that small farmers already possess, including local knowledge and the low opportunity costs for labour that prevail in the regions where they live.

The science of agro-ecology – the application of ecological concepts and principles to the design and management of sustainable agro-ecosystems – provides a framework to assess the complexity of agro-ecosystems. The idea of agro-ecology is to develop a type of agriculture that does not depend on high chemical and energy inputs. The emphasis is on agricultural systems in which ecological interactions and synergisms between biological components provide the mechanisms for the system to sponsor its own soil fertility, productivity and crop protection. In addition to providing a scientific basis for sustainable and enhanced productivity, agro-ecology promotes the capability of local communities to innovate, evaluate and adapt themselves through farmer-to-farmer research and grassroots extension approaches. Technological approaches emphasising diversity, synergy, recycling and integration, and social processes that value community involvement, point to the fact that human resource development is the cornerstone of any strategy aimed at increasing food production. In short,
agro-ecology can have a significant effect on the region’s food sovereignty.

✓ **Seed Sovereignty**

If true Food Sovereignty is to be achieved, control over genetic resources must be wrested from the corporations and governments that seek to monopolise them, and be restored to, and permanently vested in, social groups and/or institutions with the mandate to sustain them and to facilitate their equitable use. La Via Campesina has recognised this necessity, identifying “seeds as the fourth resource … after land, water and air” and declaring that “sustainability is completely impossible if the right of the peoples to recover, defend, reproduce, exchange, improve and grow their own seed is not recognized. Seeds must be the heritage of the peoples to the service of humankind”. That is, full realisation of food sovereignty must be predicated on the attainment of what we may term “seed sovereignty”.

✓ **Ecological Agriculture**

A conference on “Ecological Agriculture: Mitigating Climate Change, Providing Food Security and Self-Reliance for Rural Livelihoods in Africa” was held in Addis Ababa, Ethiopia on 26-28 November 2008. It was organised by the African Union, the UN Food and Agriculture Organization and the Ministry of Agriculture and Rural Development of Ethiopia, in collaboration with the Institute for Sustainable Development, Ethiopia and the Third World Network. The main conclusions of the conference were as follows:

1. Ecological Agriculture holds significant promise for increasing the productivity of smallholder farmers,
with consequent positive impacts on food security and food self-reliance.

2. As most poor farmers, particularly in degraded lands and in market-marginalised areas, are not able to afford external inputs, Ecological Agriculture offers farmers and their families a real and affordable means to break out of poverty and achieve food security.

3. Ecological Agriculture also provides many other benefits, such as addressing land degradation and reducing the use of polluting chemical inputs, with consequent beneficial health impacts.

4. Ecological Agriculture helps foster agrobiodiversity and other essential environmental services, which improves agro-ecosystem resilience, helping farmers to better face risks and uncertainties. The productivity and diversity of crops also increases incomes and improves rural livelihoods.

5. Ecological Agriculture has high Climate Change mitigation potential; for example, avoiding the use of synthetic fertilisers results in reduced greenhouse gas emissions, particularly nitrous oxide.

6. Ecological Agriculture practices such as using leguminous crops, crop residues, cover crops and agro-forestry enhance soil fertility and lead to the stabilisation of soil organic matter and to a heightened sequestration of carbon dioxide in the soils.

7. Ecological Agriculture assists farmers in adapting to Climate Change by establishing conditions that increase agro-ecosystem resilience to stress.
Increasing an agro-ecosystem’s adaptive capacity allows it to better withstand climate variability, including erratic rain fall and temperature variations and other unexpected events.

8. Drawing on strong local community and farmers’ knowledge and agro-biodiversity, ecological agriculture improves soil quality by enhancing soil structure and its organic matter content, which in turn promotes efficient water use and retains soil moisture. Such conditions simultaneously enhance soil conversation and soil fertility, leading to increased crop yields.

✓ **Strengths of Traditional Farming Systems in an Era of Climate Change**

Over the centuries, generations of farmers and herders have developed complex, diverse and locally adapted agricultural systems, managed with time-tested, ingenious combinations of techniques and practices that lead to community food security and the conservation of natural resources and biodiversity. These microcosms of agricultural heritage can still be found throughout the world, covering some 5 million hectares, and providing a series of ecological and cultural services to humankind, such as the preservation of traditional forms of farming knowledge, local crop and animal varieties and autochthonous forms of socio-cultural organization. These systems represent the accumulated experiences of peasants interacting with their environment using inventive self-reliance, experiential knowledge, and locally available resources. These agro-ecosystems are based on cultivation of a diversity of crops and varieties in time and space that have allowed traditional farmers to avert risks and maximize harvest security in
uncertain and marginal environments, under low levels of technology and with limited environmental impact.

One of the salient features of the traditional farming systems is their high degree of biodiversity, in particular the plant diversity in the form of polycultures and/or agro-forestry patterns. This strategy of minimising risk by planting several species and varieties of crops is more adaptable to weather events, climate variability and change and resistant to adverse effects of pests and diseases, and at the same time, stabilises yields over the long term, promotes diet diversity and maximises returns, even with low levels of technology and limited resources.

Such bio-diverse farms are endowed with nutrient-enriching plants, insect predators, pollinators, nitrogen-fixing and nitrogen-decomposing bacteria, and a variety of other organisms that perform various beneficial ecological functions. By properly assembling a functional biodiversity, it is possible to promote synergy which enhances farm processes such as the activation of soil biology, the recycling of nutrients and the enhancement of biological pest suppression. Although these systems evolved in very different times and geographical areas, they share the following structural and functional commonalities:

1. They combine species and structural diversity in time and space through both vertical and horizontal organisation of crops.

2. The higher biodiversity of plants, microbes and animals inherent to these systems supports production of crops and stock, and mediates a reasonable degree of biological recycling of nutrients.
3. They exploit the full range of micro-environments, which differ in soil, water, temperature, altitude, slope and fertility within a field or region.

4. They maintain cycles of materials and wastes through effective recycling practices.

5. They rely on biological interdependencies that provide some level of biological pest suppression.

6. They rely on local resources, plus human and animal energy, using little modern technology.

7. They rely on local varieties of crops and incorporate wild plants and animals. Production is usually for local consumption.

Recent observations, studies and research suggest that many farmers cope with and even prepare for Climate Change, minimizing crop failure through increased use of drought-tolerant local varieties, water harvesting, extensive planting, mixed cropping, agro-forestry, opportunistic weeding, wild plant gathering and a series of other traditional farming system techniques. This points to the need to re-evaluate indigenous technology as a key source of information on adaptive capacity, centred on the selective, experimental and resilient capabilities of farmers in dealing with Climate Change.

**Sustainable Agriculture as an Option**

It goes without saying that agriculture needs to undergo a radical overhaul to become more sustainable. This is not just because it is important to take care of the environment, but also because sustainability is absolutely necessary for the continuation of the productivity of the agro-ecosystem. Unchecked threats to the environmental sustainability of agriculture threaten agriculture itself.
The IAASTD Report (2008) makes this clear by saying that greater emphasis is needed on safeguarding natural resources and agro-ecological practices, as well as on tapping the wide range of traditional knowledge held by local communities and farmers, which can work in partnership with formal science and technology. It stresses that Sustainable Agriculture that is bio-diversity based, including agro-ecology and organic farming, is resilient, productive, beneficial to poor farmers, and will allow adaptation to Climate Change.

Sustainable agricultural approaches can be in many forms, such as agro-ecology, organic agriculture, ecological agriculture, biological agriculture and the like. According to Pretty and Hine\(^6\), Sustainable Agriculture should:

- Make best use of nature’s goods and services by integrating natural, regenerative processes, e.g., nutrient cycling, nitrogen fixation, soil regeneration and natural enemies of pests;
- Minimise non-renewable inputs (pesticides and fertilisers) that damage the environment or harm human health;
- Rely on the knowledge and skills of farmers, improving their self-reliance;
- Promote and protect social capital - people’s capacities to work together to solve problems;
- Depend on locally-adapted practices to innovate in the face of uncertainty;
- Be multifunctional and contribute to public goods, such as clean water, wildlife, carbon sequestration in soils, flood protection and landscape quality.
Sustainable agricultural practices include:

- Crop rotations that mitigate weed, disease and pest problems; increase available soil nitrogen and reduce the need for synthetic fertilizers; and in conjunction with conservation tillage practices, reduce soil erosion.
- Integrated Pest Management (IPM), which reduces the need for pesticides by crop rotations, scouting, timing of planting and biological pest controls.
- Management systems to improve plant health and crops’ abilities to resist pests and disease.
- Soil conserving tillage.
- Water conservation and water harvesting practices.
- Planting of leguminous crops and use of organic fertiliser or compost to improve soil fertility.

**Rural Social Movements and Sustainable Agriculture**

The development of Sustainable Agriculture requires significant structural changes. This is impossible without social movements that create the political will among decision-makers to dismantle and transform the institutions and regulations that presently hold back sustainable agricultural development. For this reason, many argue that a more radical transformation of agriculture is needed, one guided by the notion that a more radical transformation of agriculture cannot be promoted, without comparable changes in the social, political, cultural and economic areas that conform and determine agriculture.  

Only by changing the export-led, free-trade based, industrial agriculture model of large farms can the downward spiral of poverty, low wages, rural-urban migration, hunger and environmental degradation be halted. Rural social movements
embrace the concept of Food Sovereignty as an alternative to the neo-liberal approach, which puts its faith in an inequitable international trade to solve the world’s food problem. Instead, Food Sovereignty focuses on local autonomy, local markets, local production-consumption cycles, energy and technological sovereignty and farmer-to-farmer networks.

Major changes must be made in policies, institutions and research and development to make sure that agro-ecological alternatives are adopted, made equitably and broadly accessible and multiplied, so that their full benefit for sustainable food security can be realised. Existing subsidies and policy incentives for conventional chemical approaches must be dismantled. Corporate control over the food system must also be challenged. Governments and international public organizations must encourage and support effective partnerships between NGOs, local universities and farmer organizations in order to assist and empower poor farmers to achieve food security, income generation and natural resource conservation.

The need to rapidly foster Sustainable Agriculture requires coalitions among farmers, civil society organizations (including consumers) and research organisations. Moving towards a more socially just, economically viable and environmentally sound agriculture will be the result of the coordinated action of emerging social movements in the rural sector, in alliance with civil society organisations that are committed to supporting the goals of these farmer movements. The expectation is that, through constant political pressure from organised farmers and members of civil society, politicians will be pushed to develop and launch policies conducive to enhancing food sovereignty, preserving the natural resource base and ensuring social equity and economic viability.
Policy Making for Sustainable Agriculture

Jules Pretty is convinced that Sustainable Agriculture can be economically, environmentally and socially viable. There are resource-conserving technologies, local institutional structures and enabling external institutions that are all known to work. It does, however, need coordinated action by national governments to encourage and nurture the transition from modernized systems towards more sustainable alternatives.49

Sustainable Agriculture should not be seen as a set of practices to be fixed in time and space. It implies the capacity to adapt and change, as external and internal conditions change. Yet there is a danger that policy, as it has tended to do in the past, will prescribe the practices that farmers should use, rather than creating the enabling conditions for locally generated and adapted technologies.

Throughout the world, the history of agriculture shows a common pattern. Technical prescriptions are derived from controlled and uniform conditions, supported by limited cases of success, and then applied widely, with little or no regard for diverse local needs and conditions. Differences in receiving environments and livelihoods then often make the technologies unworkable and unacceptable. When they are rejected locally, policies shift to seeking success through the manipulation of social, economic and ecological environments, and eventually through outright enforcement.50

For Sustainable Agriculture to succeed, policy formulation must not repeat the past mistakes of coercion and control. Policies must arise in a new way. They must be
enabling, creating the conditions for Sustainable Development based more on locally available resources, and local skills and knowledge.

The greatest challenge will be the reform of policy processes themselves. These will have to focus more on participation and social mediation, if the contested complexities and uncertainties of sustainability are to be continually addressed.\textsuperscript{51}

**Gandhi, Swadeshi and Sustainable Agriculture**

The contemporary meaning of the Gandhian concept of *swadeshi* is the availability of locally produced consumption goods; self-reliance in agriculture; creation of self-sustaining villages; and augmentation of local production and economy.

All these ideas are very much present in a system of Sustainable Agriculture, which systematically pursues the following goals.\textsuperscript{52}

- A more thorough incorporation of natural processes such as nutrient recycling, nitrogen fixation and pest-predator relationships into agricultural production processes;
- A reduction in the use of those off-farm, external and non-renewable inputs with the greatest potential to damage the environment or harm the health of farmers and consumers;
- A more equitable access to productive resources and opportunities, and progress towards more socially-just forms of agriculture;
- A greater productive use of the biological potential of plant and animal species;
A greater productive use of local knowledge and practices;
- An increase in self-reliance among farmers and rural people;
- An improvement in the match between cropping patterns and the productive potential and environmental constraints of climate and landscape, to ensure long-term sustainability of the soil; and
- Profitable and efficient production with an emphasis on integrated farm management, and the conservation of soil, water, energy and biological resources.

With specific reference to the question of modernizing agriculture, it should be emphasized that Gandhi had no partiality for primitive methods of production.He only challenged the sanity of what passed as progress.

In ‘Hind Swaraj’, Gandhi writes: “We have managed with the same kind of plough as existed thousands of years ago... We have had no system of life-corroding competition.” What Gandhi meant in expressing this view on agriculture was that India was an ancient land which had survived by using the plough as a technological instrument, and which had stood the test of time for the Indian peasantry.

Further, the unity in rural India, especially in its myriad villages, ensured that the harvest produced was not given over totally to the immoral and rapacious forces of the market. There was a humane system of checks and balances which guaranteed food to the hungry, the disabled, and the aged. The absence of the ‘system of life-corroding competition’ provides the historical context wherein a complementary and moral relationship existed between groups of dominant peasant castes on the one hand, and service and artisan castes on the other,
who had fashioned an elaborate system for organization of production and distribution.\textsuperscript{53}

Gandhi writes: \textit{“From the very beginning, it has been my firm conviction that agriculture provides the only unfailing and perennial support to the people of this country.”} It is clear later in this text that when Gandhi refers to ‘the people of this country’, he is explicitly concerned about the \textit{kisan} or peasant, the cultivator and tiller of the soil.

The quest for Sustainable Agriculture must be related to the critical aspect of social and economic justice. In India, this entails sharing the profits of production essentially with primary producers in such a way that would reduce economic and social inequality, and enhance their moral and ethical qualities. This latter aim would have to be concurrent with the goal of giving higher priority to agriculture. The rationale for this seminal understanding flows from the Gandhian perspective that poverty or agricultural impoverishment is not a pure economic phenomenon. It has moral and ethical components. Therefore Gandhi fixed a moral anvil for testing all changes either in the agricultural or other sectors of the economy. The harrowing results of India’s oft-trumpeted Green Revolution have left ample lessons to show what happens when growth without morality and ethics is given precedence.\textsuperscript{54}

In conclusion, it needs to be emphasised that the quest for Sustainable Agriculture must be understood and attempted, as Gandhi repeatedly exhorted, in the context of its moral underpinnings, vision and context.
Notes and References


Ibid.


C. Alvares, ed., The Organic Farming Sourcebook (Goa: The Other India Press, 1996).


Ibid.


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42. La Via Campesina, “Impact of the WTO on Peasants in South-East Asia and East Asia”, 2005. See <viacampesina.org/main_en/index.php?option=com_content&task=view=blogsection&id=8&itemid=30>


