MODERN AGRICULTURE: CONCEPT AND IT'S BENEFITS

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"Food production growth is inevitably limited by physical resource availability while population growth is geometric in its nature…"
- Thomas Malthus

Abstract

This paper observes that the threats to human wellbeing that Thomas Malthus saw more than two centuries ago are still real, important and potentially dangerous. While the world can afford more optimism now than it could then, achieving the goals of a better-fed global population with fewer impoverished people, better protected resources and more effective strategies to deal with the changing climate is still an enormous challenge.The paper discusses what modern agriculture is, and the keys to its potential success—ever more effective control of the many processes it employs, achieved by harnessing expertise and support from the full range of private and public sources and avoiding the isolation inherent in traditional systems. It concludes that in spite of immense challenges, future technology needs are increasingly well understood so that with improved public understanding of the importance of these investments, global agriculture can reasonably expect to achieve the difficult objectives being established for the next years.

Keywords: Modern Agriculture, Technology, Effective Strategies.

Introduction

Agriculture is the backbone of every economy. In a country like India, which has ever increasing demand of food due to rising population, advances in agriculture sector are required to meet the needs. To add to it, the present economic conditions and government policies of India are such that it necessitates the adoption of Precision farming or smart farming. It will enable the farmers to maximize their crop yields and minimize the input costs as well as the losses due to reasons like uncertain rainfall, droughts etc. The agriculture sector needs a huge up-gradation in order to survive the changing conditions of Indian economy. Along with the advances in machines and technologies used in farming, useful and accurate information about different matters also plays a significant role in it. This information is being gathered by the use of remote sensors, satellite images, surveys etc. This information along with the knowledge of subject experts and researchers should be readily available to the farmers in order to exploit its potential worth. Also, as the amount of such information is increasing gradually, there is a dire need to analyze it to extract useful facts and patterns. This is where computer science and technology comes into the picture. The advancements in technology must be worked upon across various disciplines and it has already shown dramatic improvements in many fields. However, agriculture has not benefitted much from such advancements. Smart farming is the need of the hour of the Indian economy.

The main driver of global food demand in the future is the expanding purchasing power of middleclass populations in developing countries who are demanding higher quality diets. This trend has become especially important now as agricultural resource limits tighten at the same time competition for the same resources grows among urban, infrastructure and industrial users.

What is Modern Agriculture?

The modernity of agricultural systems is a characteristic well understood by farmers but not easily defined with specificity. Still, the distinctions between modern and traditional systems have powerful implications for the future development of the global food system—even though it is important to recognize that few, if any, systems fall entirely into either the modern or traditional categories.

Traditional systems: Perhaps the most important difference between the categories is the way farmers see themselves and their roles. Traditional farmers, for example, often say that they seek to work effectively with resources at hand. That is, they use the land, rainfall, seeds, tillage methods and power sources they have to produce what nature offers. Conventional processes are used to till the land, select and plant seeds, protect plants from competing plants and animals and gather the harvest. Surpluses are marketed through nearby outlets. Such producers frequently report only limited capacity to change these processes—and some seek to avoid change.The productivity of such systems depends primarily on the natural fertility of the soils—enhanced by skillful care—and on the climate. The technology and management systems involved are often characterized by lack of access to, or reluctance to use new information about production and/or management, or public or commercial assistance. Their productivity tends to grow slowly, often in response to outside developments that reduce producer isolation, increase access to markets or support investment in water and land.

Modern agriculture: In modern agricultural systems farmers believe they have much more central roles and are eager to apply technology and information to control most components of the system, a very different view from that of traditional farmers. In contrast to the isolation inherent in traditional arrangements, modern agriculture tends to see its success as dependant on linkages—access to resources, technology, management, investment, markets and supportive government policies.

As a result, much of the success of modern systems depends on the development and maintenance of soil fertility through the specific provision of nutrients when they are depleted; of machine power and technology to create soil conditions necessary to promote plant growth with minimal disturbance and minimal soil loss; of the use of improved genetics for crops and livestock to enhance yields, quality and reliability; and, on modern genetic and other techniques to protect plants and livestock from losses to competing plants, diseases, drought insects and other threats.

This success also depends on access to efficient, effective irrigation to supplement rainfall in many climates; on advanced harvesting, handling and storage equipment and techniques to prevent losses and to market commodities efficiently. It depends, in turn, on both public and private investment to provide access to technology, equipment, information and physical facilities throughout the production-marketing system. And, it depends on well supported commercial and financial systems and broad public policies that support effective commercial markets at all levels that generate economic returns throughout the system.

Modern agriculture in developed countries including the United States involves far more than farms and farmers—it depends on enormous, highly sophisticated systems that move, store and processes producers' output throughout an extensive value chain that extends to food products and final consumers.

Why Modern Agriculture is Important? :

There is really little mystery about why agriculture is important—it is the physical foundation of human energy, health, and physical well being—all key components of every important human activity. To the degree these components are missing, the human existence is defined primarily by the effort necessary to provide them. Making them more widely available at lower costs increases the capacity of any population to invest in more productive work, education, economic development and cultural activities.

The basic facts are clear: More people the world over eat more and better because of modern agriculture. Increased production continues to enable steadily improving diets, reflecting increased availability of all foods, dietary diversity and access to high-protein food products; The additional food modern systems provide has enabled hundreds of millions of people to realize more of their potential and better lives—thus enhancing the achievements of all, from students to retirees. It increases workforce productivity and generally supports human development and growth; The current hunger and malnutrition that extends to some one billion people reflects poor policies, low productivity and low incomes. Failure to continue to apply new technologies to advance productivity on the farm and across the food system simply worsens every aspect of these problems, especially those forced on individuals and families who live in poverty. To a very large extent, current food insecurity problems reflect bad policies, poor infrastructure and low economic productivity in the nations where these conditions occur, rather than a physical lack of food or food production capacity;The significant hunger and malnutrition that persist in many parts of the world would have been far worse had agricultural systems not grown and developed as they did;

The physical pressures on the environment that have become increasingly prominent public concerns have been greatly ameliorated by modern agriculture, which has reduced:

o The need to expand land area, and thereby reduced pressure to cultivate fragile lands and forested areas. Modern agriculture includes successful new technologies, including biotechnology to enable both higher yields and reduced environmental impacts. These reduce the land, fertilizer and pesticide use per unit of output;

o Pressure on grassland, forestland and cropland thus increasing wildlife habitat as a result;

While the unintended negative environmental consequences of modern agriculture are frequently noted, little mention is ever made of the negative environmental impacts that frequently arise from smallholder farming, especially from ―slash and burn‖ primitive systems in wide use in developing countries where vertical rows are often planted up steep hillsides, resulting in some of the world's heaviest soil erosion, badly polluted watercourses and many other problems of both efficiency and sustainability. The lack of sustainability of these practices can be seen in the fact that they typically lead to abandonment of successive plots year after year;

Processing technology and handling advancements contribute enormously to improved food safety through pathogen reductions and large reductions in post-harvest losses thatfurther increase food supplies. Pasteurization of milk, canning, freezing, and other processing technologies significantly reduce health risks associated with food. Threats from bacteria and other contaminants are still important, but the risks of illness and death are far less than in the past, a fact that is widely underappreciated;

Modern agriculture brings enormous economic and social benefits to consumers including:

o Improved quality of life and living standards as food costs decline. This effectively raises

consumer incomes since it leaves greater purchasing power for other consumer goods, for education, health care, leisure, etc., a trend that has been a major driver of economic growth in developed countries, and in some developing countries, as well. Today, consumers in the United States spend less than 10% of their disposable income for food while many in the developing world spend from half or more of their income on food, a huge drag on quality of life. It is now widely recognized that the development of modern food system has been a major factor in improving the standard of living enjoyed in much of the world today;

When consumers spend the major share of their income and virtually all of their daily efforts simply to find food, little money or time is left for human investments. This ―survival treadmill‖ characterizes the lives of most smallholder farmers, especially in developing countries;

Modern agriculture increases global political stability by making more food available, improving its quality and making it accessible to more people.

o Without the advances that characterize modern agriculture, the world arguably would be a much more dangerous and volatile place because more people would be food insecure—as the food price spikes of mid-2008 clearly illustrated.

o Development of a robust, rules-based trading system has been extremely important in improving food distribution and increasing accessibility in food-deficit areas.

The major threat to modern agricultural development comes not from lack of interest and willingness to invest by farmers, but from increasingly vocal opposition from a constellation of activists who have succeeded in shifting agricultural policies in several areas.

Benefits of Modern Agriculture:

While the phrase, ―industrial farming‖ is frequently intended to deride modern farm organization, it is impossible to ignore the fact that agriculture, like other sectors, has become much more productive as machines and computers have eliminated the most laborious (and, dangerous) parts of the job.15,16 And farming communities have educated their children to choose, in many cases, other careers—and the number of people who want to work on farms in the old, labor-intensive way is very small. The result is that hand-labor-intensive crops (e.g., coffee, strawberries…), or high labor cropping systems (e.g., organic) appear to be on a collision course with demographic trends, since the pool of unskilled, low cost farm labor upon which those crops and systems have depended appears likely to continue to decline—and increasingly to make non-mechanization an increasingly non-viable option. At the same time, modern agriculture has become much more productive (Chart 9). ―Pre-industrial‖ yields were low and stagnant before introduction of better machines, synthetic fertilizers, improved plant and animal breeding, pesticides and, most recently, biotechnology and the huge changes these new techniques brought. At the same time, it is true that environmental issues that led to the Dust Bowl calamity of the 1930s also led to the establishment of the Soil Conservation Service and other important steps that continue to improve farming practices through public and private programs until they have all but eliminated wind and water erosion hazards.

For example, the pioneers of ―no-till agriculture actually began in the early 1960s in efforts to save fuel and stop erosion. And, the environmental movement of the late 1960s lead to the creation of the Environmental Protection Agency in 1969—and to major changes in pesticides and pesticide regulation since that time. A few relatively simple practices have had great success in protecting both soil and water quality and are being widely adopted now.

These include: Continuous ―no-till, which saves fuel, stores soil moisture better, eliminates erosion and off-site movement of pollutants, increases biodiversity; Cover-cropping, which when combined with no-till leads to net carbon sequestration, and can be used either to produce biologically fixed nitrogen or to scavenge excess nitrate as needed; A few relatively simple practices have had great success in protecting both soil and water quality and are being widely adopted now. These include: Continuous ―no-till,‖ which saves fuel, stores soil moisture better, eliminates erosion and off-site movement of pollutants, increases biodiversity; Cover-cropping, which when combined with no-till leads to net carbon sequestration, and can be used either to produce biologically fixed nitrogen or to scavenge excess nitrate as needed.

Evidence of agriculture's persistent adoption and use of new technologies comes from around the globe, and includes both large and small-scale operations. Plantings of biotech varieties are continuing to grow—some 330 million acres used biotech technologies in 2009, up about 7 percent over 2008. The United States continues to be the leading user of this technology with 158 million acres planted last year, but Brazil likely will have the largest gain with 53 million acres planted by 150,000 farmers, mostly in soybeans, a 35 percent increase from 2008.17

Argentina, with the second largest biotech area in 2007, fell to third, but still relies more heavily on biotech crops than India, Canada and China. China planted 9.1 million acres of biotech crops - mostly cotton - last year, but its recent approval of genetically modified rice and corn suggests plantings there will expand soon. Genetically modified corn and rice will be field tested for two or three years before being planted commercially.

Conclusion:

The foregoing sections make the case that global food challenges have intensified steadily in recent years, especially since the beginning of the 20th Century—when the world's population was only 1.6 billion people and global needs could be met by increasing yields and agronomic improvements—and, fossil fuels became increasingly essential in the development of machines to replace animal power, and to allow production of fossil fuel-based ammonium fertilizers.

Now, at the beginning of a new century, the global population is much larger—6.1 billion in 2000 and expected to exceed 9 billion by 2050. The combination of population and economic growth, especially in developing countries means that the world must nearly double food production—yet again—but, in only the next 40 years. This daunting challenge is further exacerbated by resource limits that mean that available arable land will be approximately static while availability of water and nitrogen could decline—even as new challenges associated with climate change begin.

It also is clear from this discussion that that the only feasible approach that can permit the world to meet the competing demands it faces while more effectively dealing with its physical, economic and social constraints is through increasingly rapid innovation and productivity growth. It also has shown that these goals are feasible, given the necessary public and private support, including support for both continued modernization of agriculture and food systems in the developed world, and for more effective assistance for developing nations to modernize their agricultural sectors. It also emphasized the need to build in new and more effective safeguards all along the way to minimize the unintended problems that sometimes arise.

Across agriculture today and in many of the world's most powerful institutions, there is a growing consensus that the sector is well positioned to meet expected 2050 needs at the same time it undertakes to alleviate the poverty, hunger and malnutrition now afflicting more than one billion people. Numerous prestigious international groups have assigned their most

urgent priorities to these concerns, including, for example, the G-20 group of international leaders, the Food and Agriculture Organization of the United Nations in its recent food summit, the World Bank, the Bill and Melinda Gates Foundation and the Royal Society of London, among many others. Each has advocated urgent attention to agriculture, food security and the alleviation of hunger, malnutrition and poverty. However, meeting these challenges will require continuous progress, building on past successes and taking advantage of technology—challenges increasingly well understood across the industry. And, it will require increasingly supportive and effective policies, which take long periods of time to design and implement. Today, there is a growing consensus across the sector that at least six specific actions are needed to achieve the necessary progress, including: Increased public and private support for agricultural research and extension;

Increased public support for agricultural infrastructure investment, especially in developing countries but in developed countries, as well;

Better organized and supported foreign aid with much greater emphasis on agriculture, agricultural productivity and development;

Systematic efforts to improve agricultural policies globally, including new emphasis on open markets and effective, feasible and equitable safety nets for producers and for private, as well as public risk management;

Reduced barriers to agricultural trade; and

Renewed focus on negotiations to reduce barriers to technology and to increase reliance on science-based international sanitary-phytosanitary rules.

Statements by industry leaders broadly support these commitments. For example, in 2008, Monsanto announced a new program to develop sustainable yields that include producing more, conserving more, and improving lives—and the company is now making the investments to develop seed to double yields with traditional and advanced breeding, protected by biotechnology traits that deliver when coupled with the farmer's innovation. The company is committed to accomplish this doubling with each bushel produced using one-third fewer resources. Its statements indicate that it is prepared to invest about $1 billion a year, or $3 million every day to reach these objectives, and that it now believes its research pipeline is delivering results that reflect these overall commitments.

The Monsanto commitment clearly is one of several, and fully reflects increasing agricultural and agribusiness confidence that it will find the necessary tools to meet global needs, do it environmentally and economically on a sustainable basis for the entire system—the challenge for the next 40 years

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