

**INSTITUTE OF APPLIED RESEARCH IN SUSTAINABLE ECONOMIC
DEVELOPMENT – IPADES**

REVOLUTIONS AND CHANGES IN AGRICULTURE

Francisco Benedito da Costa Barbosa

Founding Partner – IPADES

The emergence of agriculture for 10,000 years is known as a revolution, for it began to radically change the way of living of Homo sapiens, before a nomad living gathering and hunting, went to a sedentary lifestyle by planting, creating and domesticating plants and animals. Known as the Agricultural Revolution gave rise to complex societies that have made civilizations.

From the eighteenth century agriculture began to benefit from technological revolutions. The first was the invention of the steam engine (1760). The second occurred with the chemical industry, electronics, petroleum and steel (1850-70). The third settled with computers, fine chemicals and biotechnology from 1950.

The concept of agribusiness emerges as a response to the challenges related to the administration of the farms. On one side, there was a capacity of increasing production in the production of surpluses, in the face of the releases of inputs, machinery and implements. On the other side, this process required marketing services, storage, processing and transportation, among others, to bring the production to the consumer centers, increasingly urbanized. It was the integrated vision of the productive chain, whose coordination is still a challenge for Brazil.

Based on packages of production, genetic improvement, the development of agrochemicals and the advances in mechanization has been the explosion of production, especially of the grains. This gave the Nobel Peace Prize to the agronomist north American Norman Ernest Borlaug (1914-2009), in 1970, considered the father of modern agriculture. Convinced that the first step to ensure peace in the world was feeding the hungry of the planet, the scientist North American Norman Borlaug devoted

his life to the scientific resolution of the problem, triggering the so-called Green Revolution.

Continuing his slow evolutionary, agriculture is benefited by the three technological revolutions and now joins the fourth revolution taking place and at an early stage. All of this comes quickly to Brazil, a vigorous power in global agribusiness. In this technological revolution, in which agriculture is called Agriculture 4.0, associates the agriculture to the environment of the fourth technological revolution. It is the frontier technology.

This is the robotics and the use of drones (Unmanned Aerial Vehicles - UAVS) integrates the field operations. Already the monitoring with the use of smartphones, tablets and computers they simplify, streamline and improve the management models of traditional small, medium and large plantations. The farmer came in real time the activity of the farm, even without the physical presence, with an advantage in terms of time and resources.

The 1° Census AgTech Startups Brasil, initiative of the Escola Superior de Agricultura “Luiz de Queiroz” da Universidade de São Paulo (Esalq/USP), in partnership with the AgTech Garage, points 75 companies in Brazil in the last three years involved with agriculture 4.0. In this climate of innovation and investment in start-ups, companies in the sector were attracted, universities have formed public-private partnerships, entrepreneurship was stimulated and the Government has supported research projects with future prospects for business.

Research conducted by the Boston Consulting Group at the end of last year the results showed that the investments in R&D reached US\$ 20 to 25 billion in 2015, with 75% of them mentioned as a priority technology agriculture based on data, which is offered by Agriculture 4.0.

Studies of the UN Food and Agricultural Organization (FAO) indicate more than 60 environmental factors that influence the livestock production, the points of view of the soil - the physical, chemical and biological - the plant and the climate. There is a broad involvement of complex subjects and diverse, in terms of knowledge and practice. A recommendation for success, a lot of times it takes some years of observation to have technical validity.

These factors can be so broken. Soil physical aspect: density, humidity, hydraulic, absorption, aeration (porosity, flocculation, dispersion, cooling), texture, Horizon, topography, color exposure. Soil chemical aspect: CEC (cation exchange

capacity), CAE (capacity of anionic exchange), composition (mineral, organic), bioavailability, toxicity, heavy metals, reactions (precipitation, soil electrochemistry reaction), salinity, power plug and solubilization of the soil. Soil, biological aspect: mineralization, rhizosphere, organic matter, soil fauna, microorganisms, enzymes, biodiversity and minerals available.

Plant: absorption and translocation of nutrients (hardiness, adaptability, plasticity, defense system, drainage, ecological relationships among organisms), competition (diseases, pests, weeds), crop management system (leaf architecture, genetics, farm), availability of water, sucking, spacing, population, seed quality, training of the stand, light and CO₂, micro-organism.

Climate: solar radiation, albedo, temperature, thermal amplitude, atmospheric gas, fluid balance, evapotranspiration, atmospheric pressure, geographic coordinates, relative humidity, wind speed.

How much progress since the first revolution! This demonstrates that the agricultural production to meet the current demands of supplying food, raw materials, energy and preserve the environment, it has no condition to continue based on empirical knowledge, and with the administration of "general clinic".

Science and technology, combined with a modern management with technical advice expert, are essential and indispensable for the success of Agriculture 4.0. This agriculture has to meet the demands mentioned above of 7.2 billion people, in 2013, on our planet, according to data released by the United Nations Population Fund (UNFPA). This will not happen without the permanent participation and development of Agricultural Sciences.