Brazil – China Innovation Dialogue 2024
Technology and Development

Medium and long-range key drivers for the RD&I considering the agriculture´s technological and social frontiers

Décio Luiz Gazzoni
Brazilian Agricultural Research Corporation

In the coming decades, it will not be enough to produce food, it must also be sustainable! As world leaders in production, consumption, and international markets, Brazil and China will be deeply involved and intertwined in the near future.

China is at the forefront of scientific and technological development in various areas of knowledge and will be an important partner for Brazilian universities and institutes, which seek to develop technologies and sustainable agricultural production systems. Brazil will continue to be one of the most important producing countries and an essential agricultural products supplier to the world.

A review of the goals of Chinese agribusiness was published by Gazzoni (Cultivar nb. 293, May 2023 - gazzoni.eng.br/Texto%20completon%20China.pdf) indicates that the Chinese proposal aims to build a solid agricultural country with guaranteed supply, backed by scientific and technological advances, large investments, adequate management systems, industrial resilience, and market competitiveness. Environmental, social, scientific, and technological improvements are transversal to the proposal.

A recent publication of the Brazilian Institute for Research in Applied Economics (IPEA) presents a comparison of sustainability and the forest-saving index of several important food-producing countries (hrepositorio.ipea.gov.br/bitstream/11058/13408/1/TD_2980_Web.pdf). The article demonstrates that Brazil is the major liquid exporter of agricultural products on the international market, followed by the United States and the Netherlands.

According to this study, Brazil stands out as a leader in several sustainability aspects compared to other countries. An important

statement of this publication is " …*Brazil has led the growth in production per unit of GHG emissions in recent decades. For example, in 1990, Brazil emitted 1 t of carbon to obtain 243 t of agricultural products. In 2020, with the same emission, production was 774 t, three times higher. No other country in the world has achieved anything similar to what Brazil has attained*.".

Another important consideration is the Forest Sparing Effect (EPF), an index of the impact of technical change on agricultural production, expressed as a percentage of the area saved by technological advances. According to this index, the EPF of Brazil between 1990 and 2020 is 43.2%. The following countries are Spain (20.4%), the United States (8.9%), Italy (4.3%), and a series of countries with rates below 3%. One should note that there are cases of a negative index, such as Belgium (-3.3%).

These considerations demonstrate the importance of the technological development of Brazilian agriculture in recent decades, a proxy of what should and can be done in the coming years. Predictably, Brazilian agriculture will continue to advance in the sustainability parameters supported by its vigorous institutional RD&I systems.

As seen, there is a broad interface of commonly shared objectives between Brazil and China, to support sound cooperation in the ground of Science and Technology, not only for the benefit of both countries but also for all of humanity.

An important point I would like to stress as an example comes from the recent Food Waste Index Report (unep.org/resources/publication/food-waste-index-report-2024). According to the UNEP, households on every continent wasted more than one billion meals a day in 2022, while 783 million people were affected by hunger, and almost a third of humanity faced food insecurity. The agency reports losses of up to one billion tons of food, more than 17% of all global food produced that year. This amount would be enough to eliminate the hunger that plagues around 783 million people across the globe (fao.org/hunger/en/).

In two articles, Gazzoni analyzed this issue: *Mais alimentos* (More food) (Cultivar nb. 168, 2013) and *Desperdício de grãos* (Food Waste) (Cultivar nb. 292, 2023). The publication Global Food: Waste not, want not (httimeche.org/policy-and-press/reports/detail/global-food-waste-not-want-not) pioneered the analysis of food chains to conclude that food waste had rates higher than estimates at the time. According to the publication, "…*With current practices wasting up to 50% of all food*

produced, engineers need to act now and promote sustainable ways to reduce waste from the farm to the supermarket and by the consumer.".

Food waste is a crucial problem that must be solved through technological advances, public policies, and awareness and training campaigns. By reducing hunger in the world, we can achieve SDG 2 targeting Zero Hunger. By doing so, the world will not only reach a social advancement but will also avoid environmental impacts linked to the horizontal expansion of agricultural land to produce the same amount of food that is currently wasted.

Other challenges need addressing to provide the demand for high-quality food for the coming decades, as estimations point to a demand increase surpassing 60% in 2050, as compared to 2010 (nature.com/articles/s43016-021-00322-9). Population and per capita income increments will modulate food demand. However, we must go beyond food, because the theme of agricultural sustainability on a background of growing demand also covers fibers, flowers, wood, and agri-energy.

Scientific development alone will not guarantee the achievement of such a goal, and it certainly will not be achieved without solid and sustainable food production systems and value chains supported by disruptive technological advances.

Both to support the achievement of SDG 2 and the supply compatible with the increase in the demand for agricultural products, we need strong support for ID&I institutions, which include: a) Institutional reinforcement; b) Training; c) Networking; d) International cooperation; e) Adequate infrastructure, including talent, equipment, and financial resources.

In addition to classical scientific tools, several new areas will be paramount for the challenging tasks of the near future, including a) Biotechnology and omics such as genomics, proteomics, metabolomics, metagenomics, phenomics and transcriptomics.; b) Nanotechnology; c) Digital sciences, including IoT, Big Data, AI, among others; d) Mechanization, digitalization and automation; e) Bioproducts and ecosystem services linked to pollination, nutrition, biological control, etc.

Cooperation between China and Brazil for scientific and technological advances in sustainable production systems and agricultural product value chains should be at the center of the dialogue for the future of food systems in the world.