

## Chapter 3

# Challenges and opportunities for Embrapa

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## Introduction

Embrapa has been active in the segment of agricultural research, development and innovation for 45 years and, over that period, its results have been addressing the main problems of the production sector and of the agricultural production environment, identified by its network of employees (researchers and analysts) and by its institutional mechanisms. In the books of the Sustainable Development Goals Collection (SDG Collection), some of Embrapa and partners contributions were presented, comprising all 17 SDGs and 76 of its 169 listed targets, and revealing the commitment that Embrapa has always had to sustainable development throughout its history.

Considering the UN [2030 Agenda](#) scenario, in addition to actions already implemented or in progress, there are efforts of Embrapa that can be directed towards common global challenges presented in the Agenda. The alignment with SDGs is considered as an opportunity for expanding the reach and results of Embrapa, together with other public and private actors, at national and international levels, focusing mainly on the national targets that will come up from the UN Agenda.

As part of activities conducted by the SDG Embrapa Network, which seek to identify the contributions of Embrapa to accomplish SDGs, the [five dimensions \(5 Ps\) of the 2030 Agenda are also included: Planet, Partnership, Prosperity, People and Peace](#). When the sample of contributions reported in the book collection is analyzed in relation to these sustainability dimensions, the interdependence between SDGs becomes more visible and concrete. One example of such interdependence is the biodigester septic tank, a social technology recently included in a [public policy of the Ministry of Cities](#), which can potentially impact the People, Planet and Prosperity dimensions. The septic tank, an innovation for rural sanitation (SDG 6), improves the quality of water available for the rural population and the management and reuse of waste (SDG 12), which results in good health and well-being for people (SDG 3), in resilience and sustainability of communities (SDG 11) and in avoiding environmental damage (SDG 15).

The last chapter of each book in the collection presents the perspectives, opportunities and technological challenges posed by each SDG. The analysis of these technological challenges and the set of existing contributions per dimension also highlights the institutional challenges that Embrapa and similar institutions need to address by 2030.

## Institutional challenges

The main contribution of science and technology institutions (STIs) to SDGs is to continuously provide knowledge-based value for society. Scientific research plays a key role in identifying challenges for sustainability in different contexts, in understanding the links between the different goals, their synergies and potential conflicting areas (Le Blanc, 2015), and in using tools for due monitoring of action progress to reach the goals.

The institutional challenges for STIs related to management, governance and articulation posed by the 2030 Agenda are as great as the opportunities. Some of the challenges listed below, from the perspective of Embrapa, can also provide useful insights for other institutions involved in science, technology and innovation for sustainable agriculture.

### *Internalization of the 2030 Agenda*

One institutional challenge is to involve research teams in this important global Agenda and in medium and long-term efforts. It represents an opportunity to

enhance, in the corporate culture, the systemic view and understanding of the complex character of sustainable development challenges. The 2030 Agenda is based on this rationale, and its Internalization can help people understand how SDGs relate to actions they already carry out in research, innovation, technology transfer and interactions with partners. In addition, it is an opportunity for them to perceive more clearly the real and potential impacts of their actions to solve problems related to agricultural sustainability based on an integrated and systemic approach. Thus, new research proposals in line with SDG targets may directly contribute to the 2030 Agenda.

### *Anticipatory capacity*

Rural areas worldwide have undergone profound changes due to economic, technological, cultural, social and environmental dynamics. The pace and complexity of societal transformation require that any vision of the future is constantly evolving. In 2012, Embrapa established a Strategic Intelligence System, [Agropensa](#), for permanently monitoring of the external environment. Based on prospective studies, Agropensa provides information as input for the strategies of Embrapa and other parties and agents of all links in agricultural production chains. These actions allow Embrapa to offer knowledge and technological solutions to support national public policies and to influence debates in global forums, thus contributing to Brazil's recognition as an active country in SDG implementation.

The organization of the most recent set of [signals and trends captured by Embrapa](#) in a matrix of integrated analysis gave rise to a group of megatrends, considered as major processes of economic, social, technological and environmental transformation, with long-lasting consequences (for over 10 years) and substantial impact on several sectors of society. The megatrends with potentially strong impact on Brazilian agriculture are the following:

- Socioeconomic and Spatial Changes in Agriculture.
- Intensification and Sustainability of Agricultural Production Systems.
- Climate Change.
- Risks in Agriculture.
- Added Value in Agricultural Production Chains.
- Consumer empowerment.
- Knowledge and Technology Convergence in Agriculture.

These megatrends reflect global, national and local challenges, on which Embrapa and partners are already working, but with much room for expansion. Obtaining primary and secondary information, together with the need for doing analysis, studies, diagnostics, assessments and modeling, are essential for new technological innovation proposals and political and institutional partnerships that contribute to achieve the 2030 Agenda goals. Mitigation and adaptation to climate change (SDG 13), intensification and sustainability of production systems (SDGs 2, 3, 14 and 15), poverty reduction, decent work and food safety (SDGs 1, 2, 3, 6 and 8), clean energy (SDG 7), capacity building (SDGs 4 and 5) and biodiversity sustainable use (SDGs 2, 12, 14 and 15) are examples of complex issues within the megatrends in the agri-food sector. Other challenges are the greater integration between rural and urban environments (SDGs 9, 10, 11 and 16) and the complexity involved in the implementation and access to new partnerships (SDG 17). They all afford innovation opportunities for Embrapa and its partners to bring – economic, social, environmental, and cultural – benefits through agricultural research and innovation. Obviously, these challenges require strategic positioning, technical excellence for competitiveness, complementary abilities and structures, converging governance, and sharing similar responsibilities among the involved institutions, bringing together parties from a wide network of knowledge and purposes.

### *Orientation towards desired impacts*

Society demands, especially from public institutions, accountability for resources applied in terms of impacts on the sustainable development process, with a special focus on improving the population's well-being and contributing to the planet's resilience. As a result-oriented research, development and innovation institution, Embrapa has been working to join advancing science and technology with meeting the needs of modern society. Thus, Embrapa is aware that to address the major effectivity challenge, guidance and planning are needed to achieve the desired positive impacts, for which strong and effective institutions (SDG 16) and partnerships for common purposes (SDG 17) are fundamental.

Embrapa's strategic planning process has been evolving to reinforce the institutional purposes before its customers and to affirm commitments shared with other parties and partners to promote desired changes for all. This is the basis for the 2030 Agenda rationale. The path to desired impacts involves a strategic planning that already indicates intended positive effects and an implementation

strategy including effective innovation management. Quality results, monitoring the use of these results by clients and beneficiaries, and medium-and-long-term assessment of impacts are also key elements in the search for effectivity.

### *Information and knowledge management*

The [research, development and innovation agenda of Embrapa](#) is strongly responsive to the 17 SDGs. The challenge is to organize and disseminate research results, while providing input for the innovation process. The main instruments that allow putting this agenda into practice are the project portfolios that make up the RD&I agenda. A project design stems from the identification of a problem to be solved in a certain theme area, followed by the formulation of a strategy to seek the solution and by building up networks of multidisciplinary and multi-institutional partnerships. The management of data, information and knowledge is key to ensure that solutions generated by the institutions are readily available to the target audience.

The main current challenge for any institution, company or government, in addition to data generation, is getting the meaning of the large amount of data available every day. Innovative information management tools are used to map the cross-relations between SDGs, the synergies among them and trade-offs from the technical-scientific point of view. Concepts such as big data, data mining, analytics, semantic mapping, domain analysis, and artificial intelligence will be required to navigate the large and complex mass of information being generated within the scope of the 2030 Agenda. To be implemented, these concepts involve both investments and adequate structures, as well as abilities in computing and information and communication technology (ICT). However, to ensure good performance levels, technologies and people must be in line with a change in corporate culture, for people (and their intelligence) are still the most relevant and transformative capital of an institution.

There is much expectation on innovation, as a scientific basis and organized process to apply and incorporate knowledge, to provide itineraries for solving current and future global society problems. Part of this intended innovation is based on re-reading, recombining and giving new meaning to already consolidated knowledge. In this context, implementing and adopting “excellence” data and information management practices become important to ensure safe and accessible repositories, modern and smart management tools and universal and

interoperating conceptual models for organizing and representing agricultural knowledge.

In line with technological practices, enhancing communicative properties of information and knowledge must focus on its objective and wide dissemination and clarification, thus favoring innovation processes. The concept of open access is already consolidated worldwide as a viable, inclusive and interactive resource for communicating and disseminating data, information and scientific knowledge, and is already practiced and improved in Embrapa. More than isolated initiatives, Embrapa already has its data and information governance model, based on the dynamic, continuous and feedback nature of these elements life cycles. With the implementation of corporate processes based on this model, the innovative transformation of data and information into knowledge can now be systemically aligned with other corporate initiatives to guarantee the contributions of Embrapa to the 2030 Agenda.

### *Partnerships, networks and alliances*

The numerous achievements of Embrapa over its 45 years result from various partnerships with national and international public and private sectors based on the idea that relations must bring benefits for all those directly or indirectly involved. Institutional relations are assets that Embrapa must continually increase, value and manage, for they are being essential to accomplish its mission and its vision.

The joint work of parties involved in research and innovation for agriculture is a decisive step to encourage the use of research-based knowledge, thus adding more value to the entire sector and attracting new public and private funding sources. The premise for new institutional arrangements is that there are common purposes among science, technology and innovation (ST&I) organizations that require a modern and bold framework to foster and leverage the innovation process, focusing on problem solving and taking opportunities for the agricultural sector, within the 2030 Agenda and beyond.

Expanding the range of public-private, technical and financial partnerships at national and international levels can eliminate redundancies and improve efficiency in using public and private resources to promote the collaborative development of innovations for agriculture and to contribute to sector public policies. Producing knowledge and sustainable technologies to increase the

competitiveness of Brazilian agriculture in domestic and international markets will strengthen Brazil as an important food supplier and main player in the new era of sustainable bioeconomy, thus contributing even more to achieve SDGs.

Moreover, there are indications that trade competition between countries tends to reduce the flow of financial investments on the more traditionally adopted strategies for establishing partnerships. Finding innovative and alternative strategies to establish cooperative actions at various magnitude levels is a current challenge, important to offset this trend on a win-win basis. New association and funding models need to be put into practice, such as multilevel (global, regional, local) partnerships based on common goals.

Fortunately, several initiatives are already converging towards the 2030 Agenda, such as the European Union Programme for Research and Innovation (Horizon 2020), which has encouraged partnerships among Europe and groups in Latin America and Africa; and there may be international investment on Agenda-related themes such as technical and scientific cooperation.

### *Contribution to indicators for agriculture*

The success of the 2030 Agenda depends, to a large extent, on involving signatory nations in [monitoring and evaluating indicators for each SDG target](#). The Food and Agriculture Organization of the United Nations (FAO) is the custodian UN Agency for [21 agriculture-related indicators](#), among the 231 indicators on the 2030 Agenda, and is expected to collect, validate and harmonize indicators at national or regional levels, and then contribute to international monitoring reports of the Agenda.

Embrapa and other agricultural research institutions must contribute with the agencies responsible for the elaboration, collection and analysis of national indicators (IBGE and IPEA), so that Brazilian agriculture indicators are well representative of the national reality.

### *Contribution to public policies*

The 2030 Agenda recognizes and predicts that achieving its goals will depend on integrated public policies that, based on a systemic vision, lessen conflicting issues and enhance existing synergies. Once national targets derived from SDG targets have been established and prioritized, a cross-sector approach to national

public policies on the 2030 Agenda themes will have to be adopted, and science will play the fundamental role of supporting the debate between different sectors.

Embrapa, as other STIs, has supported the design and improvement of laws, regulations, plans, programs, and governmental positions regarding agriculture and interface themes, taking a more proactive approach. However, the discussion of highly complex issues – such as the impacts of agriculture on climate change, eradication of poverty, food and nutritional security, access to genetic resources, biosafety and those contained in the new Brazilian Forest Code – reveal that data and evidence must be made available to effectively help lawmakers and other parties to mediate ideological dissent and make decisions that address economic, social and environmental liabilities.

Based on the Sixth Master Plan of Embrapa (Embrapa, 2015), which highlights the contribution to public policies as one of the impact axes in its strategic map, the current challenge is to encourage improvements in Embrapa's capacity to respond, whether in terms of knowledge and information organization, or in terms of promoting joint efforts both within the institution and with other institutions. Some important aspects of this challenge of bridging the gap between the world of science and the one of public policies are:

- Difficulty of communication among the parties, to be solved by the use of a common vocabulary. It is very important that science is communicated in an accessible and clear way; this should be standard for science and technology institutions.
- Need to enhance scientists' proactivity in helping design and implement public policies.
- Need to develop robust methods that involve planning, monitoring and assessing the participation of science in public policies.
- Encouragement to the work of institutions that bridge the gap between the different parties, aiming to improve their interaction.
- Insufficiency of technical indicators for design and implementation, focusing on the effectivity of public policies, to better monitor and assess.
- Improved dialogue with the end customer of policies, both regarding scientists and formulators, by sharing experiences and perceptions.

- Need to have specific intelligence to deal with complex and systemic issues, with its own structure to work with information, signal capture and communication with society.
- Identification of elements for consensus on divergent points of view, based on available data interpretation.

### *Attention to gender issues*

Women play a key role in production activities that promote social equity, environmental justice and sustainable development. Among the challenges faced by women are the invisibility of their work, violence and discrimination in rural areas and also inside institutions, restricted access to land and credit, and difficult access to public policies.

Designing and implementing various governmental policies and programs have led to many advances in women achieving economic and social autonomy. However, new strategies are needed to maintain, enhance and complement these initiatives to overcome gender inequality and ensure the effective participation of women in sustainable rural economy and development.

Embrapa plays a key role in supporting the design and implementation of these policies by carrying out actions that contribute to value, appreciate and enhance women's empowerment and entrepreneurship in activities related to the agricultural and agro-industrial sectors.

### *Communication with society*

Another challenge to be faced by STIs is to adopt efficient strategies to communicate with key parties and with the whole of Brazilian society to provide accurate and qualified answers to the demands of a dynamic and increasingly well-informed population.

Knowledge produced by science, if well communicated, may mitigate conflicts and lessen polarized views in society. In addition to informing what the institution is doing, it is necessary to strengthen interactions in order to identify and understand interests and demands, risks and opportunities, and thus provide timely and qualified answers useful for guidance and dialogue.

Farmers and other parties in agricultural production chains, consumers, organized civil society, legislators, media professionals, all need informational input, messages and narratives that guarantee proper understanding of how important Brazilian sustainable agriculture is, as a key factor for social well-being, job creation, trade surplus and food availability, diversification, quality and affordability.

## Final considerations

A multifunctional sustainable agriculture is a recurring and cross-cutting theme in the 2030 Agenda, and its importance must be well-defined throughout the processes of internalizing the Agenda in Brazil. The country has been playing a prominent role as this debate evolves and, because it has a strong economy based on natural resources, regional leadership, strong technical-scientific capacity and private entrepreneurial potential, it will continue to effectively contribute to achieving these common sustainable development goals.

The most obvious connections are between food production, health care and poverty, or between agriculture, natural resources, clean energy and climate change. However, on closer examination, the links between agriculture and all other themes are undeniable: quality education; decent work and economic growth; sustainable communities; sustainable consumption; industry, innovation and infrastructure; and even peace and social justice. It is necessary to recognize and balance conflicts and competition between agriculture-related goals when these connections are examined.

The extent to which the 2030 goals will be achieved will depend on the incorporation of existing technologies into production processes and public policies, on the emergence of disruptive innovations in specific sectors and on gathering parties of all sectors of society to implement SDGs targets. In terms of science and technology, the 2030 horizon is not a distant future considering that the path from producing new knowledge to incorporating it into people's lives is often long. Research, development and innovation depends on continuing and persistent purposes so that its results cause changes in the real world.

This effort to gather contributions of Embrapa and partners in line with SDGs over the last years is a first step towards revealing that there is a large set of solutions already available to all who also want to contribute to alleviate problems raised by the 2030 Agenda.

## References

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