

AGRICULTURAL RESEARCH AND INNOVATION IN THE 2030 AGENDA

CONTRIBUTIONS OF EMBRAPA AND PARTNERS

Valéria Sucena Hammes
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Technical Editors



Brazilian Agricultural Research Corporation
Ministry of Agriculture, Livestock and Food Supply



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Foreword

Launched by the United Nations (UN) in 2015, 2030 Agenda for Sustainable Development is powerful and mobilizing. Its 17 goals and 169 targets seek to identify problems and overcome challenges that affect every country in the world. The Sustainable Development Goals (SDG), for their interdependent and indivisible character, clearly reflect the steps towards sustainability.

Reflecting and acting on this agenda is an obligation and an opportunity for the Brazilian Agricultural Research Corporation (Embrapa). The incessant search for sustainable agriculture is at the core of this institution dedicated to agricultural research and innovation. Moreover, sustainable agriculture is one of the most crosscutting themes of the 17 goals. This collection of books, one for each SDG, helps society realize the importance of agriculture and food in five priority dimensions – people, planet, prosperity, peace and partnerships –, the so-called 5 Ps of 2030 Agenda.

This collection is part of the effort to disseminate 2030 Agenda at Embrapa while presenting to the global society some contributions of Embrapa and partners with potential to affect the realities expressed in the SDG. Knowledge, practices, technologies, models, processes, and services that are already available can be used and replicated in other contexts to support the achievement of goals and the advancement of 2030 Agenda indicators.

The content presented is a sample of the solutions generated by agricultural research at Embrapa, although nothing that has been compiled in these books is the result of the work of a single institution. Many other partners joined in – universities, research institutes, state agricultural research organizations, rural technical and outreach agencies, the Legislative Power, the agricultural and industrial productive sector, research promotion agencies, in the federal, state and municipal ranges.

This collection of books is the result of collaborative work within the SDG Embrapa Network, which comprised, for 6 months, around 400 people, among editors, authors, reviewers and support group. The objective of this initial work was to demonstrate, according to Embrapa, how agricultural research could contribute to achieve SDGs.

It is an example of collective production and a manner of acting that should become increasingly present in the life of organizations, in the relationships

between public, private, and civil society. As such, this collection brings diverse views on the potential contributions to different objectives and their interfaces. This vision is not homogeneous; sometimes it can be conflicting, just as is society's vision about its problems and respective solutions, a wealth which is captured and reflected in the construction of 2030 Agenda.

These are only the first steps in the resolute trajectory that Embrapa and partner institutions draw towards the future we want.

Maurício Antônio Lopes
President of Embrapa

Preface

The 2030 Agenda for Sustainable Development was ratified in 2015 by 193 United Nations (UN) member states during the *UN Summit on Sustainable Development*. Brazil, as a signatory, encouraged governmental institutions to rethink their “deliveries” to Brazilian society, in accordance with established goals and targets.

The Sustainable Development Goals Collection (SDG Collection) presents, in this volume (*Agricultural research and innovation in the 2030 Agenda: contributions of Embrapa and partners*), actions joined by the Brazilian Agricultural Research Corporation (Embrapa) to contribute to achieve the 17 UN Sustainable Development Goals (SDGs) to “Transforming our World: the 2030 Agenda for Sustainable Development”.

This book represents a synthesis of Embrapa’s strategic position – as an agricultural research and innovation institution – facing the challenge of incorporating this contribution and communicating how it is dealt with to Brazilian and global societies.¹

The [first chapter](#) describes how Embrapa welcomed, incorporated and acknowledged the governance and management of SDGs, and the strategy of institutional incorporation proposed by the UN, which led to the establishment of the SDG Embrapa Network. The [second chapter](#) explains how the SDG Collection, whose 18 volumes include this one, addresses each SDG based on its five dimensions: People, Planet, Partnership, Peace and Prosperity. Finally, the [third and last chapter](#) discusses the role of Embrapa and its challenges in the 2030 Agenda scenario.

This is Embrapa’s way of showing Brazilian society and the world how it is taking its responsibilities, based on the three (economic, social and environmental) pillars of sustainable development, together with an evolving vision of the future and improved strategies to accomplish its mission. Therefore, Embrapa contributes to improve people’s quality of life and to enhance the planet’s resilience to anthropic actions, supported by partnerships to promoting peace and prosperity.

Technical Editors

¹ Editor’s note: This book collection has been first published in Portuguese in 2018. Therefore, in the current translation into English published in 2021, names of institutions and governmental authorities (ministries, offices, departments, among others), and the organization chart of Embrapa mentioned in the book were kept as they were in 2018.

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Chapter 1

Contextualizing Sustainable Development Goals in Brazil and Embrapa

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Introduction

During the 1960s, particularly after Rachel Carson's *Silent Spring* (Carson, 1962) was released, global society started paying attention to environmental problems stemming from human activity on the planet. Since then, a number of United Nations (UN) conferences have addressed the issue, such as those in [Stockholm in 1972](#) and [Rio de Janeiro in 1992](#). In 1987, the Brundtland Report, also known as "Our Common Future" (United Nations, 1987), prepared by the UN's World Commission on Environment and Development, coined the first universally recognized definition on Sustainable Development: "[...] development that meets the needs of the present without compromising the ability of future generations to meet their own needs [...]".

In 1992, during Rio 92, [Agenda 21](#) was agreed upon; it was consolidated in 2000, when 191 UN member states signed a commitment entitled [Millennium Declaration](#) (United Nations, 2000), which resulted in the definition of the [United Nations Millennium Development Goals \(MDGs\)](#).

As this policy unfolded, the [Sustainable Development Goals \(SDGs\)](#), as set out in the [2030 Agenda](#) (Transforming our World: the 2030 Agenda for Sustainable Development), were agreed upon in 2015 during the United Nations Summit on

Sustainable Development. SDGs result from the decision of 193 nations, including Brazil, and representatives of global civil society.

The 2030 Agenda guides the planning of actions and public policies so that Brazil can effectively reach sustainable development. Its foundations lay on the three pillars of sustainability. Thus, the economic and social pillars were derived from MDGs, and the environmental pillar from Agenda 21. In addition, as part of a more ambitious effort to fulfill aims that demand greater focus, the institutional vision focusing on partnerships for target implementation was included.

SDGs are [17 goals](#), with a total of [169 targets](#), based on five structuring elements, known as areas of critical importance to mankind and to the planet, named by the UN as the [5 Ps: Peace, Prosperity, Planet, People and Partnership](#). In this work, these five elements or areas of critical importance were considered as “dimensions” that encompass the 17 SDGs:

- **Goal 1** – End poverty in all its forms, everywhere.
- **Goal 2** – End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.
- **Goal 3** – Ensure healthy lives and promote well-being for all, at all ages.
- **Goal 4** – Ensure inclusive and equitable quality education, and promote lifelong learning opportunities for all.
- **Goal 5** – Achieve gender equality and empower all women and girls.
- **Goal 6** – Ensure availability and sustainable management of water and sanitation for all.
- **Goal 7** – Ensure access to affordable, reliable, sustainable and modern energy for all.
- **Goal 8** – Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.
- **Goal 9** – Build resilient infrastructures, promote inclusive and sustainable industrialization and foster innovation.
- **Goal 10** – Reduce inequality within and among countries.
- **Goal 11** – Make cities and human settlements inclusive, safe, resilient and sustainable.
- **Goal 12** – Ensure sustainable consumption and production patterns.

- **Goal 13** – Take urgent action to combat climate change and its impacts.
- **Goal 14** – Conserve and sustainably use the oceans, seas and marine resources for sustainable development.
- **Goal 15** – Protect, restore and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation, and halt biodiversity loss.
- **Goal 16** – Promote peaceful and inclusive societies for sustainable development, provide access to Justice for all and build effective, accountable and inclusive institutions at all levels.
- **Goal 17** – Strengthen the means of implementation and revitalize the global partnership for sustainable development.

Governance of SDGs in Brazil

Taking into consideration the specificities and complexities of Brazilian society and its agricultural vocation, the Presidency of the Republic established the governance of SDGs by setting up the [Comissão Nacional para os Objetivos de Desenvolvimento Sustentável](#) (Brazilian Commission for Sustainable Development Goals – CNODS), whose structure is presented in Figure 1.

Previously to the official launch of the Brazilian Commission, established by Decree No. 8,892 of October 27th, 2016, the Secretariat of Government (Segov) and the Ministry of Planning, Development and Management (MP) proposed that all ministries validated a proposal for aligning the 17 goals, 169 targets and 241 UN indicators with the 54 programs, 303 goals, 1,132 targets and 3,094 initiatives of the [Plano Plurianual 2016-2019](#) (2016-2019 Multi-Annual Plan – PPA) of the federal government.

Implementation of SDGs by the Ministry of Agriculture, Livestock and Food Supply

The Ministry of Agriculture, Livestock and Food Supply (Mapa) created the Commission on Sustainable Development of Agribusiness (Comissão de Desenvolvimento Sustentável do Agronegócio - CDSA) (Brasil, 2016), which joins working groups (WGs) – one of them is on SDGs – with Mapa representatives

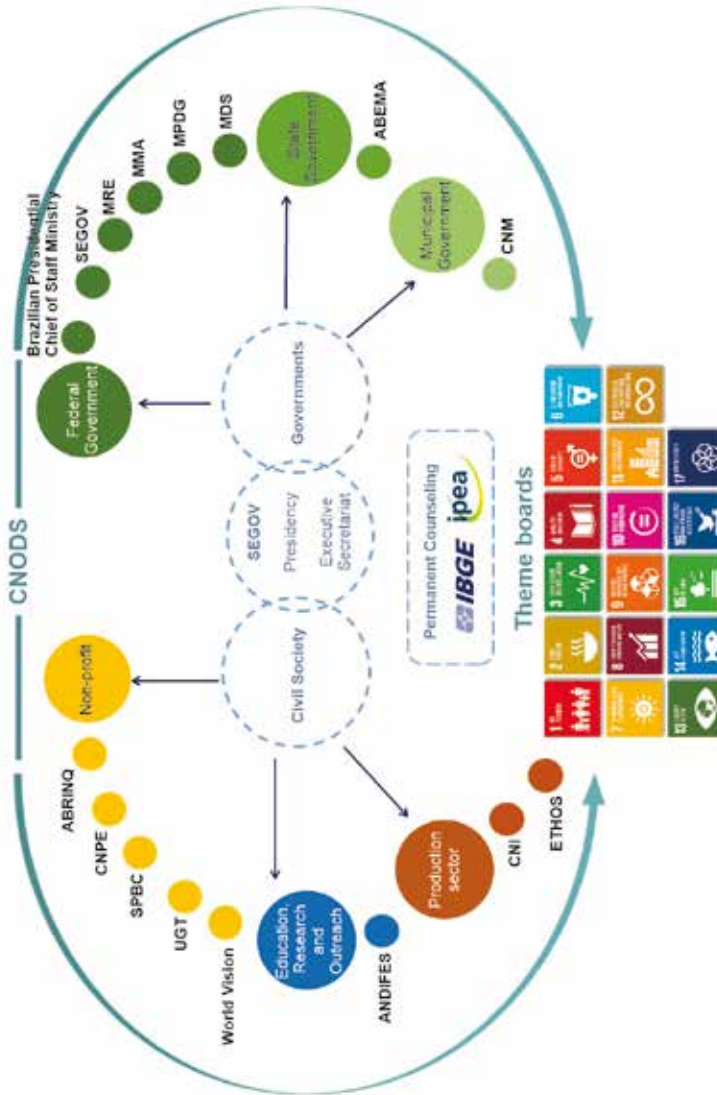


Figure 1. Structure of the Brazilian Commission for Sustainable Development Goals (CNODS).

ABRINQ = Brazilian Association of Toy Manufacturers; CNPE = National Council for Energy Policy; SBPC = Brazilian Society for the Advancement of Science; UGT = General Union of Workers; ANDIFES = National Association of Directors of Higher Education Federal Institutions; CNI = Brazilian National Confederation of Industry; SEGOV = Secretary of Government; MRE = Ministry of Foreign Affairs; MMA = Ministry of the Environment; MPDG = Ministry of Planning, Development and Management; MDS = Ministry of Social Development; ABEMA = Brazilian Association of State Environmental Authorities; CNM = National Confederation of Municipalities.

Source: Brasil (2017).

appointed by the Executive Secretariat and representatives of Embrapa and of the Companhia Nacional de Abastecimento (National Supply Company – Conab).

In order to institutionalize Embrapa's efforts, its Board of Directors has appointed an internal working group to assign an institutional locus for the theme SDGs – the SDG Embrapa WG.

The steps – from the MDGs design to the consolidation of CNODS, with the involvement of Embrapa, the response to demands of the Federal Court of Accounts (TCU) and the participation of Mapa – are represented in a timeline, in Figure 2.

The SDG Embrapa WG aligned research, development and technology transfer actions/themes related to the [Sixth Master Plan of Embrapa](#) (Embrapa, 2015) to the 2016-2019 PPA, a federal government plan announced every 4 years. Analyses carried out in 2017 revealed that, by generating knowledge and technological assets for the sustainability of Brazilian agriculture, Embrapa contributes directly and indirectly to all 17 SDGs.

Internalization of SDGs at Embrapa

The 5 impact axes and the 12 Strategic Goals of the Sixth Master Plan of Embrapa (Figure 3) are clearly aligned with all SDGs. The impact axes refer to the main transformations that Embrapa expects to leverage in agriculture and Brazilian society in the 2014-2034 period. The 12 Strategic Goals, which are guidelines for achieving the desired transformations, are also in line with the 2030 Agenda.

Subsequently, at the request of the Secretary of Government (Segov) and the Public Prosecutor's Office (MP), the ministries aligned the targets and initiatives of the 2016-2019 Multi-Annual Plan programs with SDG targets. The SDG Embrapa WG participated in the alignment phase of Mapa, focusing on the governmental commitment of Embrapa established in [Program No. 2042](#) (Research and Innovations for Agriculture) and [Program No. 2050](#) (Climate Change), in which Embrapa has action responsibilities.

The selection of relevant targets for Embrapa's work within each SDG, carried out in line with the Sixth Master Plan of Embrapa, was used to cross-refer to the targets and initiatives of Program 2042 Goals. To align targets, the SDG Embrapa WG was based on the potential of agricultural research contributions to SDGs by 2030.

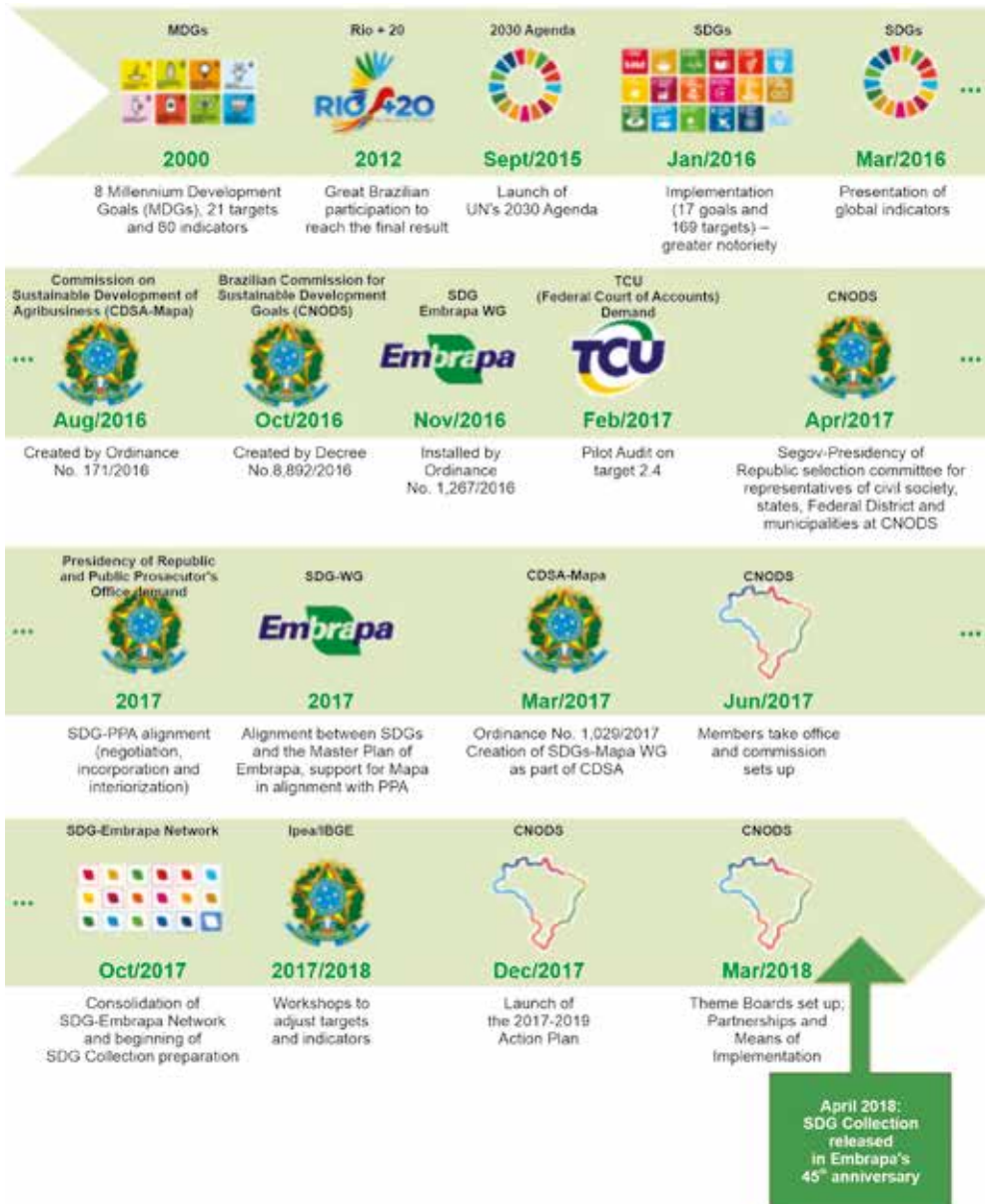


Figure 2. Timeline of the participation of Embrapa in the context of the Sustainable Development Goals (SDGs).

Ipea = Institute for Applied Economic Research; IBGE = Brazilian Institute of Geography and Statistics.

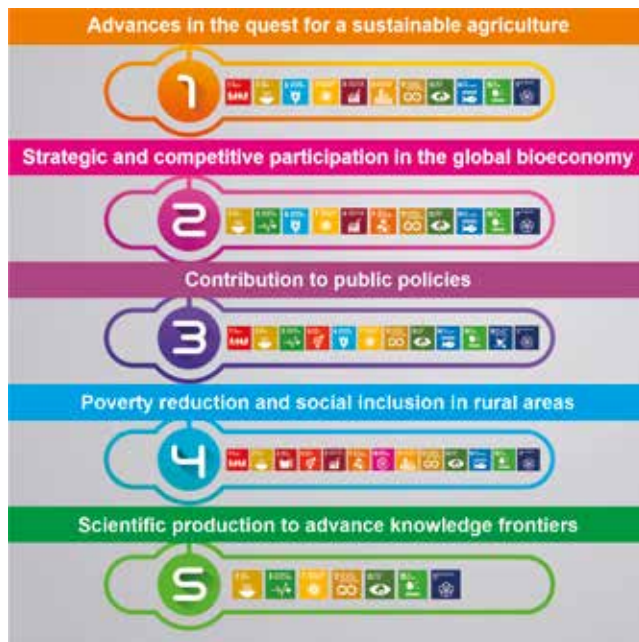


Figure 3. Alignment between Impact Axes of the Sixth Master Plan of Embrapa and the Sustainable Development Goals.

Source: Embrapa (2017).

The crossing results were categorized into three priority levels according to the direct or indirect participation of Embrapa, as follows:

- Perspective of direct action/influence of Embrapa not depending on other authorities.
- Perspective of action/influence of Embrapa depending on interaction with Mapa and/or other agricultural sector parties.
- Indirect action/influence of Embrapa depending on interaction with other authorities/parties outside the agricultural sector.

Figure 4 shows a summary of the programs, goals and actions under Embrapa's responsibility in relation to SDGs. There is great interrelation in terms of alignment, since actions and potential contributions cover all 17 SDGs and 76 of the 169 targets (45% of the Agenda targets).

Based on the results presented after aligning targets, one can infer that, since SDGs represent the most important current global agenda, the forthcoming scenario of

difficulties is an opportunity for Embrapa to strengthen its actions to promote institutional sustainability. In addition, SDG targets, which in turn will be aligned with national targets, are inspiring sources for the strategic planning of Embrapa.

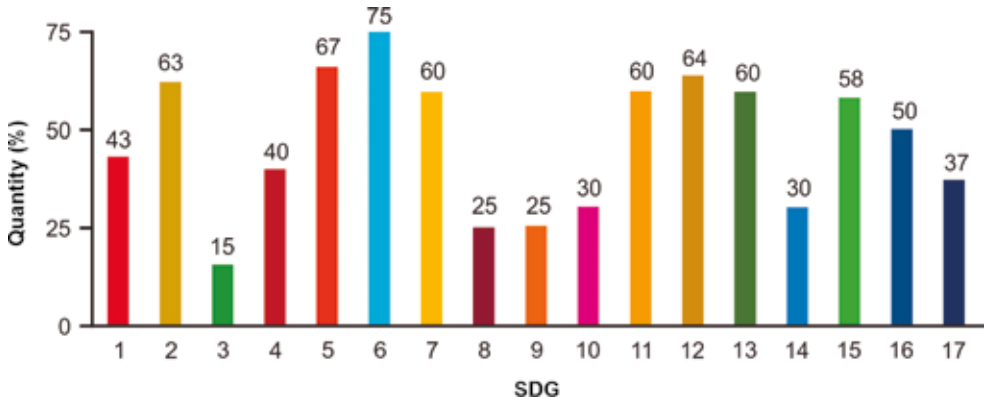


Figure 4. Relative quantity of targets per SDG referred to in the 2016-2019 Multi-Annual Plan of Embrapa addressed by Embrapa initiatives.

Creating the SDG Embrapa Network

In order to internalize the 2030 Agenda at Embrapa, a collaborative network was created to join employees of several Units (Embrapa Research Units) into a virtual community called SDG Embrapa Network. It was based on Embrapa's PGMacro method (Hammes; Arzabe, 2016), which relies on collaborative and systemic work, that is, one that gathers the whole internal community. It is a work methodology conducted by a moderator, based on planned actions, in which three assumptions are considered:

- Multilevel training of teams with the future perspective of involving everyone who act to produce results.
- Creation of space for all in the working environment.
- Participatory planning to produce results in line with SDGs purposes.

Based on the adherence to the 17 SDG and the 76 targets selected, the SDG WG was requested to answer the question "How does Embrapa contribute to achieve the selected targets?". Because of the complexity of Embrapa's mission, which has been operating throughout Brazil for 45 years, this response should be given by researchers of all Embrapa Units.

By organizing the collaborative work and gathering the collective intelligence through the PGMacro method targets previously selected by the SDG WG were validated. To do so, the team of voluntary researchers and analysts made a quick survey limited to records in easily accessible internal systems over the last 10 years to identify contributions resulting from interactions between Embrapa and partners. The intention was to identify technologies, products, processes and contributions to public policies with potential impact in the 2030 Agenda context.

PGMacro involves planning and collaborative implementation to achieve a collectively ratified result. In this case, this process was managed according to the following steps:

- **Ideation** – Outlining a proposal to create the SDG Network based on three pillars: people, work environment and result.
- **Responsibility assignment** – Assigning responsibility in the process of gathering a multilevel team (coordination, technical editors and authors).
- **Reconstruction** – Reconstructing and expanding the systemic view on the contributions of Embrapa to achieve SDGs (outlining an editorial design for each SDG and its respective selected targets).
- **Adjustment** – Adjusting active surveys guided by Embrapa’s search system managers to gather and group possible solutions to problems related to the selected targets, for which Embrapa, according to its mission, conducted agricultural research with its partners (prototype development).
- **Habituation** – Habituating to effectively incorporate this new way of perceiving the solutions compiled by the teams in debating, organizing and summing information on context, problems, different ways of contributing, and future challenges for Embrapa to meet the 2030 Agenda, as validated from the perspective of the five UN dimensions: People, Planet, Partnership, Peace and Prosperity (creation of the book collection).

The creation of this book collection was the first step towards internalizing SDGs in Embrapa. The SDG Embrapa Network intends to expand its activities to include all Embrapa researchers and analysts, in a process of institutional strengthening, and then gradually involve all its partners so as to enhance their assuming responsibilities within the three (economic, social and environmental) pillars of sustainability. Figure 5 sums the process of establishing governance, organization, and outcome/target production of the SDG Network.

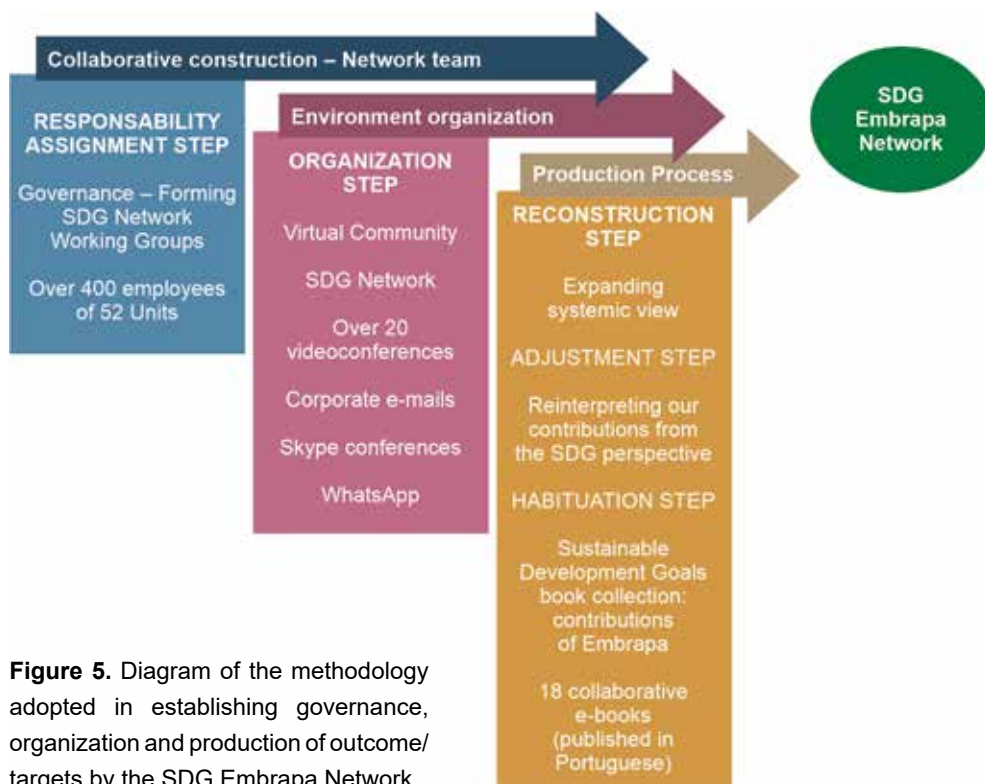


Figure 5. Diagram of the methodology adopted in establishing governance, organization and production of outcome/targets by the SDG Embrapa Network.

The process was established in agreement with the following PGMacro indicators:

- Efficacy in involving the target audience.
- Efficiency in creating an adequate work environment for providing rapid response (response time).
- Effectivity in producing the expected results.

This work reveals the strength of Embrapa's team, made up of researchers and analysts from several areas of knowledge and active throughout Brazil, which allowed us to set up discussions and debate, in addition to producing, in four months, book prototypes and launching this collection of 18 books, with the main purpose of providing Brazilian society with an overview on the contributions of Embrapa to the 2030 Agenda according to Brazil's commitments.

The SDG Embrapa Network is a strategy to encourage the Embrapa internal community to take part in a productive debate on the solutions already available,

those that are underway and future actions that will contribute to reaching SDGs. The platform will also be a repository of documents and action records, thus providing input for institutional strategic planning. In the process of internalizing the 2030 Agenda, it is necessary, at first, to raise the awareness of administrators, from directors to supervisors at Embrapa Units, and to engage researchers/analysts who lead research and technology transfer initiatives, in order to ensure the proper support for actions and individuals joining the network.

Our hope is that this work may be the basis for a long-term perspective, since SDGs can permeate all the work of Embrapa by 2030, according to the targets validated during the internalization step, described in this book. With this collection, it is possible to know how Embrapa can contribute to achieve SDGs. The [next chapter](#) addresses this set by assessing its potential to contribute to five dimensions: People, Prosperity, Planet, Partnership and Peace.

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Chapter 2

Contributions of Embrapa to the 5 Ps: People, Prosperity, Planet, Partnership and Peace

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Introduction

In the other 17 books of the Sustainable Development Goals Collection (SDG Collection), several contributions of Embrapa are presented to support the achievement of SDG targets, with solutions that represent important advances in the quality of life of rural and urban populations, both nationally and internationally.

The first step was accomplished in a 20-hour workshop, which was attended by 24 researchers and analysts, all of whom involved in organizing the SDG Collection. Together, they organized files with the contributions quoted in the books, to which several authors of the respective books collaborated. The result was a sample of 670 contributions mentioned in the SDG Collection.

The contributions represented the six result categories below:

- **Capacity-building and training** – Support for training undergraduate and graduate students; capacity-building and technological refresher training to peer educators.
- **Support for designing or implementing public policies** – Identification and prioritization of opportunities and demands related to public policies.
- **Advancing knowledge** – Production of research solutions that can be applied in agricultural production; impact assessment or socioeconomic studies; prospective studies.
- **Technological solutions** – Development of cultivars; strains/races/types; agro-industrial or agricultural inputs; innovation assets; technical-scientific methodologies in R&D, TT or communication; technology business; new technical processes; agro-industrial practices/processes; agricultural practices/processes; improved processes, methodologies or technical studies; agro-industrial products; pre-technological products; prototypes of machinery, equipment and implements; information or analysis systems; software for external customers.
- **Biodiversity maintenance** – Building up and/or conservation of biological collections and germplasm banks; inventories and characterization of genetic and biocultural diversity.
- **Institutional development** – Internal capacity-building in strategic areas; corporate image; incremental improvements or technical-administrative processes; corporate or specific software; new organizational and/or managerial processes; improved processes, methodologies or organizational and/or managerial studies.

Most contributions were categorized as a technological solution or support for public policies (Figure 1).

In order to build a systemic view of all these contributions, the sample of contributions was reorganized according to the five areas considered of critical importance for humanity and the planet, named by the United Nations (UN) as [5 Ps, that is, People, Prosperity, Planet, Partnership and Peace](#). The 17 SDGs were classified according to these dimensions, based on a proposition by Wollaert (2016): in the People dimension, SDGs 1, 2, 3, 4 and 5 are grouped together; in the Prosperity dimension, SDGs 7, 8, 9 and 10; in the Planet dimension, SDGs 6,

12, 13, 14 and 15; in the Partnership dimension, SDGs 11 and 17; and in the Peace dimension, SDGs 16 (Figure 2).

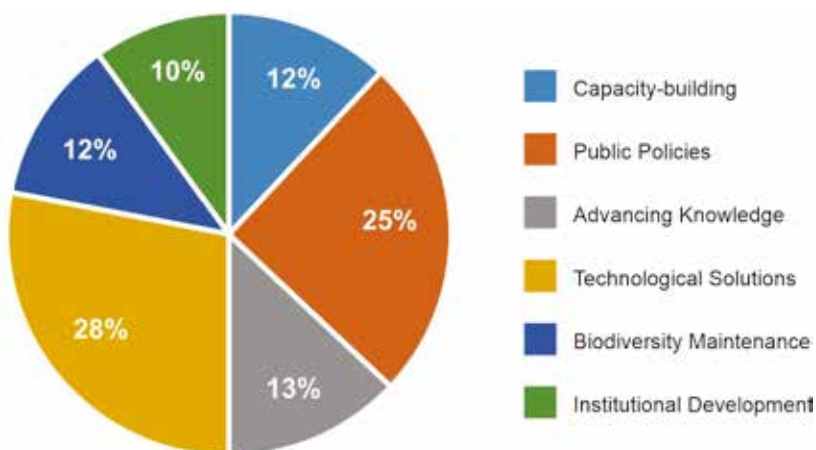


Figure 1. Percentage distribution (by category) of the contributions of Embrapa to SDGs, as collected in the workshop.



Figure 2. Schematic representation of the 5 Ps of the [2030 Agenda](#) and the 17 UN Sustainable Development Goals.

Source: Wollaert (2016).

In the initial steps of aligning to SDGs, the Working Group set up by Embrapa to assign an institutional locus for the theme (SDG Embrapa WG) listed 76 SDG targets that could be supported by Embrapa. Based on the classification proposed by Wollaert (2016), 60% of these 76 targets relate to the Planet (34%) and People (26%) dimensions of 10 of the SDGs. The remaining 40%, to which Embrapa provides contributions, relate to Partnership, Prosperity and Peace dimensions of 7 SDGs (Figure 3).

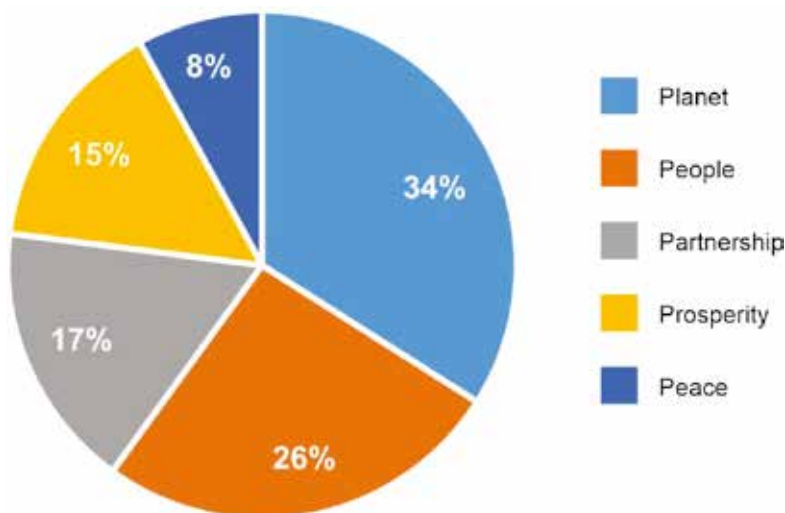


Figure 3. Percentage distribution of the contributions of Embrapa to the 5 Ps dimensions of the UN 2030 Agenda, considering the 76 SDG targets selected by Embrapa.

The following topics show the results and analyses resulting from these categorizations per dimension.

Contributions to the People dimension

In the People dimension, the commitment of the UN member states is to end poverty and hunger in all its forms and dimensions and to ensure that all human beings can realize their full potential with dignity and equality in a healthy environment.

In the context of Embrapa, in tune with the listed targets, the People dimension is addressed in SDGs 1, 2, 3, 4 and 5 (Figure 4), which together comprise 20 targets (26% of the total) to which the actions of Embrapa contribute directly or indirectly.

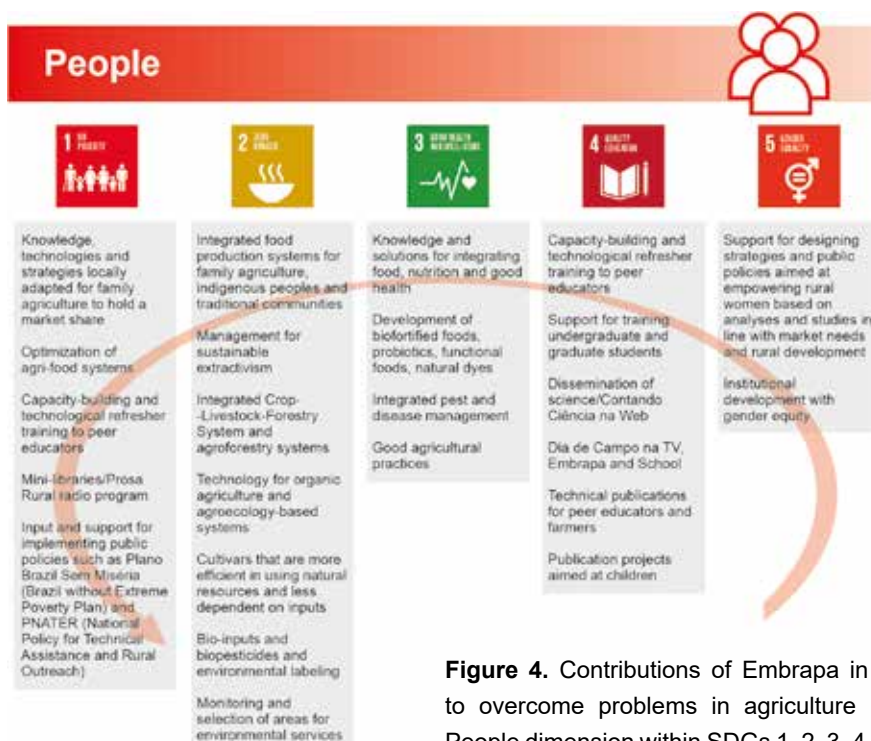


Figure 4. Contributions of Embrapa in RD&I to overcome problems in agriculture in the People dimension within SDGs 1, 2, 3, 4 and 5.

These actions involve supporting the generation of employment and income, especially for family farmers, by optimizing their agri-food systems, taking into account the multifunctionality of rural areas, with the production of nutritious, safe, diversified and accessible food for all, as a way of coping with problems related to poverty and hunger (SDGs 1 and 2).

In order to maintain a healthy environment and well-being for all, Embrapa produces, for example, knowledge and technologies for sustainable agriculture, such as inputs and products that reduce environmental impacts (SDG 2) and biofortified, functional and probiotic foods, among others, with a focus on integrating food, nutrition and health (SDG 3). Finally, in order for people to realize their full potential with dignity and equality (SDG 4 and 5), Embrapa offers quality training and information that are easily accessible to women and men in the countryside and in the city.

In order to promote a healthy environment and well-being for all, Embrapa produces, for instance, knowledge and technologies for sustainable agriculture, such as inputs and products with reduced impact (SDG 2) and biofortified,

functional and probiotic foods, among others, focused on integrating food, nutrition and health care (SDG 3). Finally, so that people can fully realize their potential with dignity and equality (SDGs 4 and 5), Embrapa provides opportunities for quality training and information that are easily accessible by men and women from the countryside and the city.

A healthy environment is that where an activity is carried out without endangering human good health and environmental health. Sustainable agriculture (SDG 2), in addition to enabling the economic sustainability of people (reducing social inequalities and expanding rights and access to public services, especially education and healthcare), should aim at the rational use and conservation of natural resources. There are many Embrapa efforts in pursuit of low-impact production systems and technologies, as well as good agricultural practices, that keep soil, water, air and, consequently, human health, intact. In all the SDG Book Collection volumes, one can clearly see Embrapa's efforts towards human development in a country where differences between regions and ecosystems entail specific local needs.

Contributions to biodiversity conservation, management and use (SDGs 2 and 15) encompass several actions:

- Maintenance of germplasm banks, herbariums, museums and databases on plants, animals and microorganisms.
- Forest management, forest certification and sustainable extraction of (timber and non-timber) forest products.
- Studies and technologies for freshwater species.
- Community management of agrobiodiversity genetic resources.
- Studies on endangered animal species and pollinating insects.
- Strategies for conserving food plant diversity in *ex situ* and on-farm gene banks.

Also in terms of healthcare and well-being (SDG 3), Embrapa stands out by creating raw materials and agro-industrial processes to obtain products that meet the nutritional, functional and sensorial demands of consumers. The nexus between food, nutrition and good health is one of the most important in the People dimension; however, in the Agenda, the synergy between these elements and SDGs 2 and 3 is not very explicit.

To ensure that everyone can fully realize their potential with dignity and equality, Embrapa collaborates with quality education (SDG 4) by substantially supporting the training of undergraduate and graduate students and promoting the capacity-building and technological refresher training to peer educators, as well as offering a wide range of publications to different audiences, thus expanding society's access to proper technical and scientific information and popularizing science. In addition, at the invitation of popular radio and TV theme program producers, Embrapa provides agricultural research information, which is available at virtual networks, videos, interactive digital books and institutional channels on the Internet ([Embrapa Portal](#), [facebook.com/embrapa](#), [twitter.com/embrapa](#), [youtube.com/embrapa](#), [flickr.com/Embrapa](#), [Dia de Campo na TV](#)). Aimed at the children and youth audience, the [Programa Embrapa & Escola](#) was created to educate children and youth; and [Mini-libraries](#) material is distributed to public schools free of charge. These are examples of contributions to educate thousands of people not only in Brazil but also in other parts of the world.

At the international level, Embrapa contributes to training people living in more than 30 countries in Africa, especially in Mozambique, Angola, Cape Verde, São Tomé and Príncipe and Guinea Bissau. Training also extended to some countries in Latin America: Colombia, Ecuador, Peru, Venezuela and Mexico.

Finally, to ensure that everyone can fully realize their potential with dignity and equality, the promotion of economic autonomy must also reach women, who must be benefited by having access to quality information and support for their specific demands. Embrapa has been providing input and supporting the implementation of national public policies for this audience mainly involving rural women and collectors. Providing access to knowledge by implementing production system demonstration and observation units, small animal breeding, medicinal plants, processing and adding value to different products, are actions that seek to expand the productive activities of women and promote their entrepreneurship. Embrapa's adherence to the [Programa Pró-Equidade de Gênero e Raça da Secretaria Nacional de Políticas para as Mulheres da Presidência da República](#) (Gender and Race Pro-Equity Program of the Brazilian Secretariat of Policies for Women of the Presidency of the Republic – SPM/PR) and to the [Women's Empowerment Principles – Equality Means Business](#) (ONU Mulheres, 2016) were also highlighted as part of enhancing the role of women in institutional development.

Embrapa researchers have been working with rural communities, whose members are unable to meet their basic needs, especially in terms of access to quality food

in a satisfactory quantity, have limited capacity for social organization and lack of technical training. Therefore, the implementation of mechanisms and instruments for planning, organizing, managing, training and implementing agri-food systems represent effective Embrapa strategies to bring about changes in the local quality of life.

Contributions to the Prosperity dimension

The Prosperity dimension established in UN's 2030 Agenda aims to ensure that all human beings can enjoy a prosperous life and full personal fulfillment, and that economic, social and technological progress take place in harmony with nature. In the context of Embrapa, the Prosperity dimension is addressed in SDGs 7, 8, 9 and 10 (Figure 5), which together comprise 11 targets (15% of the total) to which actions of Embrapa contribute directly.



Figure 5. Contributions of Embrapa in RD&I to overcome problems in agriculture in the Prosperity dimension within SDGs 7, 8, 9 and 10.

The Prosperity dimension directly resonates with at least five strategic goals of the [Master Plan of Embrapa](#):

- Expanding the knowledge base and increasing assets to accelerate the development and incorporation of advanced solutions to agri-food and agro-industrial systems, based on sciences and emerging technologies.
- Developing, adapting and disseminating knowledge and technologies in automation, precision agriculture and information and communication technologies to increase the sustainability of production systems and to add value to agricultural products and processes.
- Increasing agricultural innovation assets based on the use of biocomponents, substances and technological routes that contribute to the development of new bio-industries, focusing on renewable energy, green chemistry and new materials.
- Supporting the improvement and design of strategies and public policies based on analysis and studies focused on market needs and rural development.
- Producing knowledge and technologies that promote managerial innovations to address, with efficiency, efficacy and effectivity, the increasing complexity and multifunctionality of agriculture.

Embrapa contributes with SDG 7 (which addresses Clean and Accessible Energy) by producing knowledge and technological solutions on energy sources alternative to fossil fuels based on biomass, wind and solar energy, biogas production and micro-generation of electric power, among others.

Contributions to SDG 8, on Decent Work and Economic Growth, involve, among others, inputs for delimitation of geoeconomic regions and for Geographical Indication (GI), which are excellence production areas where unique products are developed, thus enhancing their recognition and favoring the economic growth of the involved communities. Also addressing this SDG are Embrapa technological solutions for developing cultivars and breeds that increase productivity and/or product quality, and prototypes of machinery, equipment and implements that increase efficiency and reduce the hard work in the field.

In relation to SDG 9, regarding Industry and Innovation and Infrastructure, Embrapa has been increasing agricultural innovation assets based on the use of biocomponents, substances and technological routes that contribute to developing new bioindustries focused on renewable energy, green chemistry and

new materials within bioeconomy. Examples of pre-technological products in the biotechnology area for industry use are: mini-processing facilities, mini-plants for waste use, new agro-industrial practices and/or processes for beverages, preserves, meat, dairy products and extractive crops, among others.

In relation to SDG 10, on Reduced Inequalities, contributions of Embrapa involved the capacity-building and technological refresher training to peer educators; the domestication and management of extractive resources with a broad consumer market, so that the living standards of riverine people could improve; the support for the interaction among local socio-technical networks; and the strengthening of agro-industrial enterprises that aim to add value to products from collectors and family farmers. Other contributions to SDG 10 are the availability of qualified and accessible information that favors farmers (both men and women) in entering markets and the fostering of entrepreneurship. Examples of this type of contribution are Embrapa's Open Access Repository to Scientific Information ([Alice](#), in Portuguese) and Embrapa's Open and Integrated Information System in Agriculture ([Sabia](#), in Portuguese).

Because of the interdependence between dimensions, the People dimension greatly influences the Prosperity dimension. Thus, SDG 1 (No Poverty) stresses the development of agri-food systems and other activities that contribute to reducing social differences, along with enhancing value generation for the agricultural sector, especially in extreme poverty regions.

In relation to SDG 4, which addresses Quality Education, actions are related to formal and non-formal education based on the perception that it is necessary to foster entrepreneurship and disseminate knowledge and technologies to all, and encourage inclusive and awareness-building education that affords learning opportunities and promotes change. Qualified and accessible information helps farmers (women and men) to enter markets and develop entrepreneurship.

Entrepreneurship leads to autonomy, income generation and access to products and services, which improve the quality of life and makes it possible to include the poor and extremely poor Brazilian population, thus reducing inequalities. In order to provide effective technological solutions, the training of present and future peer educators both supports technology users and provide an opportunity to identify needs for improvements or new technological challenges, which must be faced with new technologies. It thus closes a virtuous circle of generation of technology-capacity-building-use-generation of new demands, reconciling scientific and popular knowledge for prosperity.

In turn, in relation to SDG 11 (Sustainable Cities and Communities), the influence of the Planet dimension is clear, as perceived by Embrapa through the intense relationship and, therefore, the strong interdependence between urban and rural areas. The flows of goods, people, money and information between these environments reveal this close and prosperous relationship. Natural resources, which are mostly concentrated in the rural areas, are vital to supply the population and enable industry, commerce and services to function properly. The richest cities are those that demand more energy and those that throw more solid waste and effluent into the environment. In this context, Embrapa has sought to understand these environments as parts of a single structure, considering that an isolated approach is only a partial approximation of reality. This strategic and broad vision is fundamental to a prosperous country.

Contributions to the Planet dimension

UN's concept of the Planet dimension concerns the protection of the planet from degradation, especially through sustainable consumption and production, sustainable management of its natural resources and urgent measures on climate change, so that it can meet the needs of present and future generations.

In the context of Embrapa, the Planet dimension is addressed based on SDGs 6, 12, 13, 14 and 15 (Figure 6), which together comprise 26 targets (34% of the total), for which actions of Embrapa contribute directly.

Six of the 12 strategic objectives of Embrapa, included in its 2014-2034 Master Plan (Embrapa, 2015) are related to the targets of SDG 15. The main contributions address the following areas: knowledge for the sustainable use of Brazilian biomes, management of forests, water and soil resources, diagnosis and assessment of ecosystem services, conservation and management of biodiversity and agrobiodiversity, assessment of environmental impacts and actions for the mitigation of greenhouse gases (GHGs) and adaptation to the negative effects of global warming, including the restoration of degraded vegetation.

Research and innovation contributions to water resources management (SDG 6) address, among other themes: water conservation and harvesting, water quality monitoring, water production, wastewater use, treatment of effluent sediments of agricultural and livestock operations, water use efficiency in irrigation, land classification for irrigation, water demand for agriculture, multiple water use, monitoring of rural basins, decision support systems for irrigation, and

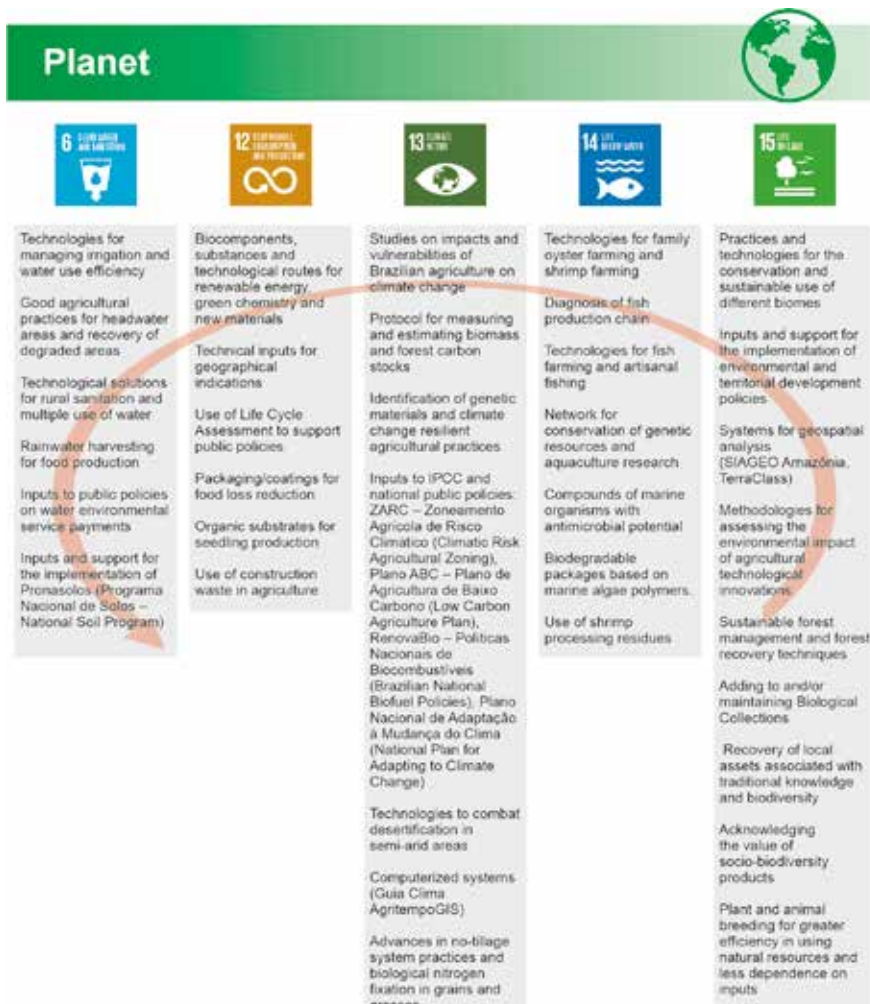


Figure 6. Contributions of Embrapa in RD&I to overcome problems in agriculture in the Planet dimension within SDGs 6, 12, 13, 14 and 15.

methodologies for environmental risk assessment in water and soil resources. Based on the results and their experience, Embrapa researchers provided input for environmental and territorial development policies.

Contributions related to sustainable production and consumption (SDG 12) cover the following areas: research and development of organic and ecologically-based production systems, integrated production systems and good agricultural practices; the latter concerns, among other factors, agriculture without burning, biological nitrogen fixation, biological control, loss reduction

at harvest and post-harvest. The survey and interpretation of Brazilian soils and the contributions for conservation and management practices and for degraded areas recovery are efforts to contribute to environmental quality in urban and rural areas. The Life Cycle Assessment (LCA) stands out, which is a management tool that allows evaluating the environmental performance of products throughout their entire life cycle. In the national agricultural sector, LCA can contribute to promote a cleaner agriculture and to increase the international market share of Brazilian agricultural products. Among the objectives of the [Embrapa national LCA network research](#) is to provide information to support analyses of production systems of some of the most important Brazilian agribusiness products: sugarcane, soybean, maize, mango, eucalyptus and beef cattle.

In addition, Embrapa contributes with technical studies conducted by teams engaged in its Climate Change Projects portfolio, which, in turn, provide input to the Intergovernmental Panel on Climate Change (IPCC), the Laboratório de Avaliação de Emissão (Emission Assessment Laboratory) and the Inventário Nacional de Gases de Efeito Estufa (National Inventory of Greenhouse Gases) (SDG 13). This knowledge also helps to support agriculture negotiations on international climate change agendas, such as the UN Framework Convention on Climate Change (UNFCCC) and also contribute to set targets for adaptation and reduction of greenhouse gas emissions, such as those negotiated under the Kyoto Protocol, Nationally Appropriate Mitigation Actions (NAMAs), the Paris Agreement and Brazil's Nationally Determined Contribution (NDC).

In addition, Embrapa contributes to mitigating GHGs emissions and adapting to climate change aiming at the sustainability of human life on the planet. These initiatives include research, studies and assessments on the following topics:

- Extreme events and their impacts.
- Availability of information systems on agrometeorological data.
- Climate risks monitoring and zoning.
- Conservation practices for agriculture.
- Identification and/or development of drought-and-high-temperature-tolerant genetic materials.
- Renewable sources of energy to improve the Brazilian energy mix.
- Decarbonization of agriculture and actions to combat desertification.

There are also research actions aimed at identifying, in different ecosystems, the synergic potential of tree species and food producing species, thus seeking to design agroforestry systems that both provide environmental services and lead to increased farmer income. The new models and associations provided by the [Rede de Integração Lavoura, Pecuária e Floresta](#) (Integrated Crop-Livestock-Forestry System Network) have allowed sustainable production on a smaller scale, thus contributing as income options in small properties.

Concerning life in the oceans (SDG 14), contributions are focused on the following topics:

- Technologies for oyster farming, shrimp family farming, fish farming and artisanal fisheries.
- Analysis of fish production chains.
- Compounds of marine organisms with antimicrobial potential.
- Biodegradable packages based on algae-based polymers.
- Use of shrimp processing residues.

SDG 15 is essentially related to the work carried out by Embrapa. For example, nearly all Decentralized Units of Embrapa are involved in maintaining the genetic variability of Brazilian biomes. Active germplasm collections are the basis for the genetic and phenotypic characterization of accessions, which involve identifying unique characteristics of each sample. Technological solutions developed by Embrapa to improve production systems of relevant species for the Brazilian population's diet seek to create and assess genetic material suitable to each environment, which includes creating biological inputs, agricultural practices that favor the maintenance of soil biological activity, integrated production systems linking crops to animal breeding, water resource conservation and low carbon technologies. Embrapa is also focused on designing protocols and models to recover degraded environments and developing and offering technologies to enhance planted forests productivity. Embrapa has been giving priority to forest management, a topic which involves long-term research, since the creation of its research groups, that is, from 1978 onwards. Contributions related to advancing research on ecosystem services involve mapping them, developing technologies, knowledge and practices as inputs for policies and maintenance actions, expanding and recovering environmental services, strengthening sustainable production systems and rationally using different Brazilian biomes, as well as improving environmental impact assessment methods.

In addition, Embrapa, in collaboration with ministries, has been monitoring and managing institutional positions on natural resource management and climate change in conventions, agreements, protocols, treaties, commissions and world forums. In addition, it has participated in decisions related to national and global policies by offering technical and scientific support. In these international events, Embrapa has been offering support for the Brazilian delegations. In addition, it has been supporting congressmen and special commissions in discussing new laws on those topics in the Brazilian Congress.

Contributions to the Partnership dimension

The Partnership dimension addresses the need to mobilize the necessary resources to implement UN's 2030 Agenda through a global partnership for sustainable development based on an enhanced spirit of global solidarity, focusing particularly on the needs of the poorest and most vulnerable, with the participation of the whole of society.

In the context of Embrapa, the Partnership dimension is addressed in SDGs 11 and 17 (Figure 7), which together encompass 13 targets (17% of the total), for which actions of Embrapa contribute directly. SDG 11 reveals the concern to make cities and human settlements inclusive, safe, resilient and sustainable places. SDG 17 addresses the strengthening of means of implementation by revitalizing global partnership for sustainable development.

The Partnership dimension is directly related to at least two strategic goals of the Master Plan of Embrapa: "Expanding networking and relations with national partnerships" and "Consolidating Embrapa's international presence".

National and international partnerships and working in cooperation have been part of the routine of Embrapa throughout its existence. Its technical staff was trained in leading universities in Brazil and abroad, where employees had the opportunity to complete their academic training. Most of these networks still remain and have strengthened over time through joint projects and exchange of people. Technical cooperation, by integrating efforts of Embrapa and national and international universities, aiming at conducting agricultural research of mutual interest, also strengthens undergraduate and postgraduate programs.

Various cooperative working models have been established, thus taking the best of time and resources and reducing costs. Regardless of geographic coverage, cooperation and partnership strategies that join Embrapa to the production



Figure 7. Contributions of Embrapa in RD&I to overcome problems in agriculture in the Partnership dimension within SDGs 11 and 17.

sector and to peer educators and technology transfer agents bring significant gains to society.

Many solutions developed by Embrapa and partnerships, commonly used today in Brazilian agriculture, are the result of institutional arrangements with other institutions in the tropical world. Strong examples of the value of partnerships can relate to:

- Adaptation to Brazilian conditions of African grasses, which today support our powerful livestock.
- Intense sharing of knowledge between Embrapa and foreign institutions, which allowed conducting research studies related to biological nitrogen fixation.
- Joint work with representative associations of vulnerable Brazilian rural segments in order to develop sustainable solutions to support small farmers market entrance.

Some themes often relate to partnerships of Embrapa, such as: family agriculture, biome sustainability, international agreements, use and conservation of natural resources, biodiversity conservation, agroecology, genetic resources, climate zoning, benefit sharing, and food security.

Collaboration with companies, cooperatives, associations, universities and research institutes in Brazil and abroad provides feedback to the Research & Development process, thus allowing future goals to be set and corrections to be made with enough precision to continuously meet society's demands.

Embrapa has gained expertise and developed technologies that have been shared with other countries (SDG 17), especially to support efforts to end poverty in all its forms and dimensions, including extreme poverty, considered by the UN members as the greatest global challenge and an indispensable requirement for sustainable development. Shared results respond to global demands for science-based development and have been key elements for joint technological development. This cooperation opens new routes for development, including commercial ones. Experience teaches that partnerships are effective means to positively affect the socioeconomic reality of peoples.

Embrapa also supports most agreements signed by Brazil at major United Nations conferences and summits by offering its research results and technical and scientific knowledge, which have helped to set solid foundations for sustainable development and to shape the new Agenda. These events include: the Rio Declaration on Environment and Development; the World Summit on Sustainable Development; the World Summit for Social Development; the Program of Action of the International Conference on Population and Development; the Beijing Platform for Action; and the United Nations Conference on Sustainable Development (Rio+20).

Embrapa also provides scientific knowledge as inputs for Brazil to take its position at different conferences, such as the following: Fourth United Nations Conference on the Least Developed Countries, Third International Conference on Small Island Developing States; Second United Nations Conference on Landlocked Developing Countries; Third UN World Conference on Disaster Risk Reduction and the principles of the Rio Declaration on Environment and Development, including the principle of common responsibilities. In addition, Embrapa has actively participated in discussions coordinated by the Ministry of Foreign Affairs, which lead to the Cartagena and Nagoya Protocols, within the Convention on Biological Diversity, and to the Paris Agreement, within the Convention on Climate Change.

Contributions to the Peace dimension

According to the UN 2030 Agenda, the Peace dimension is defined as the ability to “We are determined to foster peaceful, just and inclusive societies which are free from fear and violence. There can be no sustainable development without peace and no peace without sustainable development” (United Nations, 2020).

The international community recognizes the close relationship between peace and food availability. FAO, for its part, has drawn attention to the risks of conflict caused by hunger and to the fact that sustainable agriculture and food safety are essential components for conflict resolution and peace consolidation.

Brazil is one of the main food suppliers of the planet, because of science and technology developed in its continuous search for alternatives to combat hunger and reduce poverty. In the context of Embrapa, the Peace dimension is approached based on SDG 16, which encompasses six targets (8% of the total), for which actions of Embrapa contribute directly or indirectly (Figure 8). SDG 16 fosters peaceful and inclusive societies for sustainable development through access to Justice for all and creation of effective, accountable and inclusive institutions at all levels. Technological solutions presented in all SDGs have led to increased agricultural production and improved food quality, essential requirements to avoid innutrition, malnutrition and diseases.

As part of its mission, Embrapa contributes to the Peace dimension by minimizing conflicts based on high-quality technical information provided for debates between interested parties. Examples of these efforts include actions for the conservation of ecosystems and natural resources, support for the of coexistence of traditional communities and productive activities in general (thus ensuring access, territory, food security and autonomy), access to and sharing of benefits related to genetic resources and traditional knowledge, development of low-impact technologies and alternative technological solutions for food production and income, and agroecological/economic and climate risk zoning (Zarc).

Still as part of its competences, Embrapa develops institutional governance actions and participates in the following global forums: UNFCCC, Convention on Biological Diversity (CBD) and UN Convention to Combat Desertification (UNCCD). In addition, it supports international institutions, the design and implementation of public policies and promotes the establishment of knowledge networks and partnerships, aiming at the planet’s sustainable development in all the aspects advocated by the UN.



Figure 8. Contributions of Embrapa in RD&I to overcome problems in agriculture in the Peace dimension, within SDG 16.

As SDG 16 concerns the creation and the maintenance of strong institutions, it is worth recalling here the values expressed in the institutional documents of Embrapa:

- **Commitment** – Committed and responsible work in doing its activities.
- **Cooperation** – Teamwork, with collaboration and cross-cutting disciplines.
- **Equity** – Acceptance and appreciation of differences in achieving the Company's goals.
- **Ethics** – Work for the common good, with respect to the human being and to integrity.
- **Excellence** – Commitment and effort to obtain high-quality results.
- **Socio-environmental responsibility** – Solutions provided for society on investments made with a commitment to the environment.
- **Flexibility** – Adaptation to changes and creative solutions to meet the needs and face the challenges of agriculture.
- **Transparency** – Actions guided by dissemination and sharing of information, thus assuring an open communication with all interlocutors.

Final considerations

The set of universal and transformative goals and targets that make up UN's 2030 Agenda is comprehensive, far-reaching and people-centered.

Although SDGs have been classified in the five dimensions of the 2030 Agenda (People, Planet, Partnership, Peace and Prosperity), all contributions have impacted peoples as well as the planet in such a way that these dimensions cannot be set apart, which is the core of the sustainable development concept. People need natural resources and, at the same time, affect the availability and quality of these resources. The way they use these resources defines their prosperity, ability to establish partnerships, and maintain peace in the short, medium and long terms.

Embrapa assumes its role of contributing with research and innovation to consolidate the changes needed for a better world, with more respect for the environment, which is the source of life and well-being of all living species.

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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.

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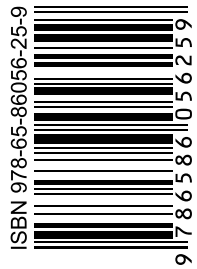
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