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The International Treaty ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

Item 11 of the Provisional Agenda

SIXTH SESSION OF THE GOVERNING BODY

Rome, Italy, 5 – 9 October 2015

Development of a Toolbox for Sustainable Use of Plant Genetic Resources for Food and Agriculture

Executive Summary

The Governing Body of the Treaty has recognized the pivotal role of sustainable use of plant genetic resources for food and agriculture (PGRFA) in addressing global challenges, including biodiversity loss, climate change adaptation, poverty alleviation, and food security, especially for smallholder and subsistence farmers, and the implementation of Article 6 of the Treaty, 'Sustainable Use of Plant Genetic Resources' is a standing priority item on its agenda. At its Third Session, the Governing Body proposed the development of a toolbox to assist Contracting Parties in designing measures to promote the sustainable use of PGRFA and to support the implementation of Article 6, and at its Fourth Session established the *Ad Hoc* Technical Committee on Sustainable Use of PGRFA (ACSU). At its first meeting, the ACSU supported the concept of the Toolbox as a one-stop shop from which institutions and individuals can draw selectively from a comprehensive set of instruments tailored to provide solutions to specific needs. At its second meeting, the Committee reconfirmed the validity of the Toolbox as a practical instrument to assist with the implementation of Article 6 and supported the launch of an online consultation to gather the views and needs of stakeholders in sustainable use of PGRFA to inform its development. The consultation was conducted from April to June 2015 to gather information on stakeholder needs regarding the Toolbox in which all FAO sub-regions were represented across 109 countries and the European Union, of which 90 are Contracting Parties to the Treaty.

Results of the consultation highlight the broad range of stakeholders involved in aspects of PGRFA sustainable use and have enabled a better understanding of their specific roles and interests which need to be catered for in the Toolbox. The consultation has also allowed a clearer understanding of the 'bottlenecks' in the sustainable use system and a deeper comprehension of the constraints and needs regarding the implementation of the sustainable use provisions of the Treaty. In particular, there is a critical need to address limitations regarding policy in support of sustainable use activities—both with respect to missing policies and problems with the implementation of existing ones—as well as capacity building needs in all areas of the PGRFA sustainable use spectrum. Further, access to plant genetic material and associated information urgently needs to be addressed in order that countries can move ahead with the development of coordinated and comprehensive sustainable use strategies. The consultation also confirmed that a wide range of types of resources are important to support the activities of stakeholders, and critically, why specific types of resources are useful and practical, as well as which additional resources are needed. Based on the results of the consultation and earlier deliberations about the development of the Toolbox, a proposed outline of its preliminary structure, content and mode of delivery is presented and recommendations made for next steps in its development.

Contents

List of Acronyms

ABS	–	Access and benefit-sharing
ACSU	–	*Ad Hoc* Technical Committee on Sustainable Use of PGRFA
AGDT	–	Agriculture Department of FAO – International Treaty on Plant Genetic Resources for Food and Agriculture
AGPMG	–	Seeds and Plant Genetic Resources team
AnGR	–	Animal genetic resources
CBD	–	Convention on Biological Diversity
CGIAR	–	Consultative Group on International Agricultural Research
CGRFA	–	Commission on Genetic Resources for Food and Agriculture
CWR	–	Crop wild relative(s)
EC	–	European Commission
ECPGR	–	European Cooperative Programme for Plant Genetic Resources
EUCARPIA	–	European Association for Research on Plant Breeding
FAO	–	Food and Agriculture Organization of the United Nations
FIGS	–	Focused Identification of Germplasm Strategy
GBIF	–	Global Biodiversity Information Facility
GCDT	–	Global Crop Diversity Trust (now the Crop Trust)
GEF	–	Global Environment Facility
GFAR	–	Global Forum on Agricultural Research
GIPB	–	Global Partnership Initiative for Plant Breeding Capacity Building
GPA	–	Second Global Plan of Action for Plant Genetic Resources for Food and Agriculture
IPR	–	Intellectual property rights
ITPGRFA	–	International Treaty on Plant Genetic Resources for Food and Agriculture
MLS	–	Multilateral System
MTA	–	Material transfer agreement
NGO	–	Non-governmental organization
NUS	–	Neglected and underutilized species
PAR	–	Platform for Agrobiodiversty Research
PGRFA	–	Plant genetic resources for food and agriculture
PIC	–	Prior informed consent
PPB	–	Participatory plant breeding
PPP	–	Public–private partnerships
PVS	–	Participatory varietal selection
PW-SU	–	Programme of Work on Sustainable Use of Plant Genetic Resources for Food and Agriculture
SADC	–	South African Development Community
SMTA	–	Standard Material Transfer Agreement (under the MLS)
SPC	–	Secretariat of the Pacific Community
SPGRC	–	SADC Plant Genetic Resources Centre
UNEP	–	United Nations Environment Programme
UNESCO	–	United Nations Educational, Scientific and Cultural Organization
UPOV	–	International Union for the Protection of New Varieties of Plants
WIEWS	–	World Information and Early Warning System on PGRFA

I. INTRODUCTION

Background

1. The International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA[1]) is a legally binding instrument with the objectives of facilitating conservation and sustainable use of plant genetic resources for food and agriculture (PGRFA) and the fair and equitable sharing of benefits derived from their use, in harmony with the Convention on Biological Diversity (CBD). The Governing Body of the Treaty has recognized the pivotal role of sustainable use of PGRFA in addressing global challenges, including biodiversity loss, climate change adaptation, poverty alleviation, and food security, especially for smallholder and subsistence farmers. The implementation of Article 6 of the Treaty, 'Sustainable Use of Plant Genetic Resources' (Appendix 1) is a standing priority item on the agenda of the Governing Body with the aim of promoting an integrated approach to the sustainable use of PGRFA among Contracting Parties.

2. At its Third Session (Tunisia, 2009), the Governing Body reiterated the fundamental importance of promoting the implementation of Article 6, noting that in many regions its implementation is lagging behind in comparison with other elements of the Treaty, and that further financial resources, capacity building and technology transfer are required. The Governing Body proposed the development of a toolbox to assist countries in designing measures to promote the sustainable use of PGRFA and requested the Secretary to clarify the notion of a toolbox in order to come to a common understanding with regard to such an instrument. At its Fourth Session (Bali, 2011), the Governing Body requested the Secretary to continue developing the Toolbox in order to assist Contracting Parties in the implementation of Article 6 and established the *Ad Hoc* Technical Committee on Sustainable Use of PGRFA (ACSU). At its Fifth Session (Oman, 2013), the Governing Body adopted Resolution 7/2013[2]) and the Programme of Work on Sustainable Use of Plant Genetic Resources for Food and Agriculture (PW-SU) and its Supporting Initiatives, as well as reconvening the ACSU.

Defining sustainable use of PGRFA

3. The Treaty defines PGRFA as "any genetic material of plant origin of actual or potential value for food and agriculture", genetic material being "any material of plant origin, including reproductive and vegetative propagating material, containing functional units of heredity"[3]. PGRFA include cultivated varieties of plant species (landraces and modern cultivars), wild plant species with potential as trait donors to crops (crop wild relatives – CWR), wild-harvested species used for human and animal food, and plant breeders' material—advanced lines, élite varieties and DNA. Specifically with regard to conservation and sustainable use, the primary targets are those PGRFA that are threatened by: a) under-use or abandonment (many landraces/farmers' varieties, as well as neglected and underutilized species—or 'orphan crops'); b) a range of primarily human-induced threats, including the wide-ranging and unpredictable impacts of climate change, agricultural intensification, land-use transformation, habitat destruction, and pollution—all factors affecting *in situ* populations of wild and cultivated PGRFA; and c) over-use (many wild-harvested species and some CWR).

4. The objectives of the Treaty are "the conservation and sustainable use of plant genetic resources for food and agriculture and the fair and equitable sharing of the benefits arising out of their use, in harmony with the Convention on Biological Diversity, for sustainable agriculture and food security". In the CBD, the term 'sustainable use' "means the use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological

[1] www.planttreaty.org/
[2] www.planttreaty.org/content/resolution-72013-implementation-article-6-sustainable-use-plant-genetic-resources
[3] Article 2 – Use of terms

diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations" (CBD Article 2, 'Use of Terms'[4]). Parties to the CBD are therefore obligated to use PGRFA in a way and at a rate that does not lead to their long-term decline, thus maintaining their potential to meet the needs and aspirations of present and future generations. Specifically, under Article 6.1 of the Treaty, Contracting Parties are required to "develop and maintain appropriate policy and legal measures that promote the sustainable use of plant genetic resources for food and agriculture", while Article 6.2 lists examples of measures for the sustainable use of PGRFA (Box 1).

Box 1. Examples of measures for the sustainable use of PGRFA (ITPGRFA Article 6.2)

a) Pursuing fair agricultural policies that promote, as appropriate, the development and maintenance of diverse farming systems that enhance the sustainable use of agricultural biological diversity and other natural resources;
b) Strengthening research which enhances and conserves biological diversity by maximizing intra- and inter-specific variation for the benefit of farmers, especially those who generate and use their own varieties and apply ecological principles in maintaining soil fertility and in combating diseases, weeds and pests;
c) Promoting, as appropriate, plant breeding efforts which, with the participation of farmers, particularly in developing countries, strengthen the capacity to develop varieties particularly adapted to social, economic and ecological conditions, including in marginal areas;
d) Broadening the genetic base of crops and increasing the range of genetic diversity available to farmers;
e) Promoting, as appropriate, the expanded use of local and locally adapted crops, varieties and underutilized species;
f) Supporting, as appropriate, the wider use of diversity of varieties and species in on-farm management, conservation and sustainable use of crops and creating strong links to plant breeding and agricultural development in order to reduce crop vulnerability and genetic erosion, and promote increased world food production compatible with sustainable development; and
g) Reviewing, and, as appropriate, adjusting breeding strategies and regulations concerning variety release and seed distribution.

The Programme of Work on Sustainable Use of Plant Genetic Resources for Food and Agriculture

5. The vision of the PW-SU is "plant genetic resources for food and agriculture are used sustainably in farming systems in accordance with Article 6, to enable more inclusive, sustainable and efficient agricultural and food systems at local, national and international levels" and its mission is "to enhance the sustainable use of plant genetic resources for food and agriculture through effective measures that translate Article 6 of the Treaty into country-level impact"[5]. The development of the Toolbox is one of two programmes of the PW-SU agreed by the Governing Body (Resolution 7/2013[8], Table 1). The Toolbox will contribute to the five goals of the PW-SU (Box 2), particularly regarding the provision of technical support to implement the provisions of the Treaty relevant to sustainable use (Goal 1), but also to help strengthen collaboration and partnerships between stakeholders participating in projects and programmes relevant to sustainable use (Goal 4).

[4] www.cbd.int/convention/articles/default.shtml?a=cbd-02
[5] www.planttreaty.org/content/resolution-72013-implementation-article-6-sustainable-use-plant-genetic-resources

Box 2. Goals of the Programme of Work on Sustainable Use of Plant Genetic Resources for Food and Agriculture[8]

Monitoring, implementing and ensuring technical support

Goal 1: To provide support to Contracting Parties and stakeholders to implement the provisions of Articles 5, 6 and 9 of the Treaty that are relevant to the sustainable use of plant genetic resources for food and agriculture, based on national priorities and needs.

Goal 2: To provide policy direction and guidance by monitoring the implementation of the Treaty in relation to sustainable use of plant genetic resources for food and agriculture.

Goal 3: To continue monitoring the technical support and expertise provided by FAO in the area of sustainable use, as foreseen in Article 6 of the Treaty.

Cooperating and improving partnerships

Goal 4: To strengthen collaboration and partnerships among stakeholders participating in projects and programmes relevant to the sustainable use of plant genetic resources for food and agriculture, taking into account the Convention on Biological Diversity's Aichi Biodiversity Targets.

Goal 5: To implement the objectives of non-monetary benefit-sharing, and the Priority Activities of the *Second Global Plan of Action*, regarding the sustainable use of plant genetic resources for food and agriculture.

Concept and development of the Toolbox

6. The concept of the Toolbox and the justification for its development were initially described in document IT/GB-4/11/17[6], and later elaborated in document IT/ACSU-1/12/Inf.4[7] which was considered at the first meeting of the ACSU in November 2012. In its deliberations, the ACSU supported its development and welcomed the concept of the Toolbox as a one-stop shop from which institutions and individuals can draw selectively for a common and comprehensive set of instruments tailored to provide solutions to specific needs (IT/ACSU 1/12/Report[8], paragraph 18). The Committee noted that the implementation of the Toolbox will progress over time, bearing in mind the limited availability of resources and indicated that when developing the Toolbox, the Secretariat and its partners should avoid duplication of efforts with other initiatives (paragraphs 19 and 20). It also acknowledged that the development of the Toolbox is a complex task and noted that while the definition of the term 'sustainable use' in the context of the Toolbox should be broad, its initial focus should be narrower (paragraph 20).

7. The Toolbox will provide Contracting Parties and stakeholders with a comprehensive set of resources, including technical information, policy options, regulatory guidelines, training opportunities, decision tools, and others materials that—used in customized combinations or as stand-alone resources—can enhance the effectiveness of activities promoting the sustainable use of PGRFA (IT/ACSU-1/12/5[9], paragraph 4). Several of these tools already exist and are ready to be deployed, others require validation or reformulation, and some remain to be developed. The Toolbox will be a collection of tools that are accessible to the user, but whose use is not set out in a defined sequence or pattern (IT/ACSU-1/12/Inf.4, paragraph 33). It will be structured according to interventions critical for attaining the sustainable use of PGRFA—such as addressing enhanced crop productivity, supporting on-farm management, and promoting the sustainable use of landraces/farmers' varieties and under-utilized species—and will address constraints identified as

[6] www.planttreaty.org/sites/default/files/gb4w17e.pdf
[7] www.planttreaty.org/sites/default/files/ACSUi4e.pdf
[8] www.planttreaty.org/sites/default/files/ACSU1Re.pdf
[9] www.planttreaty.org/sites/default/files/ACSU1w5e.pdf

negatively affecting the capacity of national and regional programmes to use PGRFA sustainably (IT/GB-5/13/9, paragraph 31).

8. At the second meeting of the ACSU in March 2015[10], the Committee reconfirmed the validity of the Toolbox as a practical instrument to assist with the implementation of Article 6 and recommended that it addresses the multiple dimensions of sustainable use of PGRFA. The Committee also indicated that the Toolbox could generate synergies with the indicators of the Second Global Plan of Action for Plant Genetic Resources for Food and Agriculture (GPA[11]).

9. The Committee recommended that the Toolbox should initially focus on uses of PGRFA that may expand the genetic base of crops, while remaining adaptable and open-ended to future needs of users. In particular, it recommended that the Toolbox contain tools for:

a) Promotion and availability of landraces/farmers' varieties (recognizing the traditional knowledge and customary rules associated with seeds and other propagation materials)—in particular, to achieve increased and sustainable production and higher resilience while increasing the diversity underpinning traditional production systems and livelihoods, as well as contributing to the goals of breeding programmes for crop improvement;
b) Pre-breeding and its increased relevance with respect to ongoing crop wild relative and landrace conservation and characterization activities, as well as progress in the application of novel characterization techniques, particularly due to recent advances in the development of 'omics' approaches (e.g., genomics, phenomics and transcriptomics);
c) Inter-linkages between PGRFA management and nutrition issues.

10. A proposed procedure for the next steps in the development of the Toolbox was discussed at the meeting and the Committee confirmed its support for the launch of an electronic consultation to gather the views of stakeholders in the sustainable use of PGRFA to inform the development of the Toolbox. This information document presents the results of the consultation and an analysis of the needs identified by the respondents. A framework for, and proposed contents of the Toolbox are defined, and the next steps needed to take it forward are outlined.

II. ELECTRONIC STAKEHOLDER CONSULTATION

Identification of stakeholders

11. In order to assemble a toolbox that will cater for the needs of all its users, it is essential for a wide range of stakeholders to be involved in all stages of its development. The institutional landscape for sustainable use was reviewed in document IT/ACSU-1/12/Inf. 4[10] and several key bodies and institutions were identified (paragraphs 35 and 36): the Secretariats of the CBD and of the Treaty itself; FAO's Commission on Genetic Resources for Food and Agriculture (CGRFA), Seeds and Plant Genetic Resources team (AGPMG), and GPA (now the Second GPA); the Global Partnership Initiative for Plant Breeding Capacity Building (GIPB); the Consultative Group on International Agricultural Research (CGIAR); the Global Crop Diversity Trust (GCDT – now the Crop Trust); national governments; the private sector; and universities. However, a broader and more clearly defined classification of stakeholder groups was adopted for the electronic consultation, comprising 11 categories: i) public research institutes; ii) governmental bodies; iii) private plant breeding companies and independent plant breeders; iv) the commercial seed and plant production industries; v) public gene banks; vi) farmers and seed producers; vii) farmers' associations; viii) seed networks; ix) non-governmental organizations (NGOs); x) local and

[10] www.planttreaty.org/sites/default/files/IT%20ACSU-2%2015-Report.pdf
[11] www.fao.org/agriculture/crops/thematic-sitemap/theme/seeds-pgr/gpa/en/

indigenous communities; and xi) any other stakeholders, including international organizations or specific initiatives relevant to sustainable use of PGRFA.

Consultation design and execution

12. The consultation was conducted via an online survey in three languages (English, Spanish and French) using the SurveyMonkey platform[12]. The survey was also made available in PDF format for respondents wishing to formulate answers on behalf of a collegiate group or network[13]. The survey comprised four sections (Box 3). Sections 3–4 included both mandatory (e.g., multiple choice and ranking) questions and optional questions in which respondents were requested to either substantiate their answers or to provide additional details.

13. A survey pilot was conducted during the two week period 30 March – 12 April 2015 in which members of the ACSU representing Contracting Parties, NGOs and international organizations, as well as a member of the AGDT[14] team at FAO, were invited to test and provide feedback on the content, functionality, length and style of the survey. Following the provision of feedback from the invited experts, final amendments were made and the survey was translated and transferred into the SurveyMonkey platform.

14. The survey was launched on 27 April and available for completion until 01 June 2015. Stakeholders were invited to participate by email from the Secretary of the Treaty. The invitation was initially sent to 1696 contacts across the full range of stakeholder groups and was circulated further to collegiate networks of the contacts and survey facilitators, as well as being broadcast on social media, including Facebook and Twitter.

15. After closure of the survey, the collected data were downloaded from SurveyMonkey in MS Excel format and organized into tables in preparation for data analysis. Responses from the Spanish and French surveys were translated into English and answers from the three surveys combined into one database for analysis. Analyses were carried out in MS Access and Excel.

Box 3. Survey design for the electronic stakeholder consultation

Section 1 – Stakeholder identification

The purpose of this section was to verify the stakeholder groups with an interest in sustainable use of PGRFA and in the development of the Toolbox, and to identify their specific roles and/or interests in sustainable use, in order to tailor the Toolbox to their needs. To assess the representativeness of the survey results in terms of geographic range and to identify any potential regional variation with regard to stakeholders' needs, respondents identified the countries in which they work, as well as the geographic scale at which they operate (national and/or regional and/or global). Respondents were requested to provide their affiliations and contact details on an optional basis in order that they may be contacted for further information or to discuss their survey responses if necessary, or to be kept informed about the development of the Toolbox.

Section 2 – Strengths and weaknesses of the current PGRFA use system

The objective of this section was to identify where the perceived bottlenecks are in the current PGRFA use system[15] in order that the Toolbox can be designed to place emphasis on providing the support required by stakeholders in these specific areas.

[12] https://www.surveymonkey.com
[13] http://www.planttreaty.org/content/sustainable-use
[14] Agriculture Department of FAO – International Treaty on Plant Genetic Resources for Food and Agriculture
[15] 'PGRFA use system' means: *plant genetic diversity conservation → availability of breeding material → (pre) - breeding /selection → seed production → seed availability → harvesting and marketing of produce. Variety testing and certification are sometimes also part of this system*.

Section 3 – Constraints and needs regarding the implementation of the sustainable use provisions of the ITPGRFA

The intention of this section was to pinpoint the specific constraints faced by stakeholders in implementing sustainable use strategies to aid the identification of the types of tools and resources that are needed to help overcome them. Potential constraints and needs were explored in three areas: i) national policy in support of sustainable use of PGRFA; ii) capacity building needs in order to implement the sustainable use provisions of the Treaty; and iii) access to PGRFA material or associated information required for sustainable use. The data gathered in this section were also used to indicate whether there are any evident associations between constraints and needs according to the different stakeholder groups and regions.

Section 4 – Types and contents of resources required in the Toolbox

This section was designed to gather information about the types of resources stakeholders have found useful and practical in guiding their work in sustainable use of PGRFA and those that they require and consider most important to support their work in this area. Respondents were asked to provide examples of existing resources and to indicate why they have found them particularly useful and practical, as well as to list the types and topics of resources required, indicating why they are needed.

Results

Sample size

16. In total, there were 558 visits to the survey recorded (i.e., the total number of 'hits') which could include more than one visit per person if an individual followed the survey link, was distracted and visited the survey again at later time. Some of these visitors may have been interested to investigate what the survey was about and to read the background information, but either concluded that it was not appropriate for them to contribute to it or that they did not have sufficient time available. Of these 558 'hits', 70% (392) proceeded to answer the survey questions. Out of this sample of 392, 65% (254) of the respondents completed the entire survey by answering the mandatory questions across all four sections, 69% (271) completed sections 1–3, and 74% (289) completed sections 1 and 2. The sample size on which the results are based therefore ranges between 254 and 289, since despite a portion of respondents not completing the entire survey, their responses to the section 2 and 3 questions are nonetheless informative for the development of the Toolbox.

Stakeholder identification

17. The 289 survey responses were received from stakeholders in 109 countries and the European Union, of which 90 are Contracting Parties to the Treaty (i.e., 67% of Contracting Parties). All FAO sub-regions were represented in the survey. However, the response rate was noticeably low from western and middle Africa, the Caribbean, and central and eastern Asia. Seventy-five percent of the respondents operate at national level in their work, 36% at regional level, and 38% at global level (n = 429[16]).

18. Figure 1 illustrates that the ten pre-defined stakeholder groups were represented by the survey respondents, with the largest numbers of responses from representatives of the public research, government and public gene bank sectors. Many respondents belong to more than one stakeholder group. For example, 44% (63) of respondents representing the public research sector also represent public gene banks and 37% (52) also represent government bodies, while 32% of respondents representing farmers' associations also identify a role in public research, as do 44% of respondents representing seed networks. Individuals representing NGOs are also associated with the private/independent plant breeding and farmer/seed producer communities, commercial industries, government bodies and public gene banks, and of course farmers' associations, seed

[16] Many of the stakeholders who responded operate at more than one level.

networks and local/indigenous communities. Not surprisingly, more than half of the respondents belonging to private plant breeding companies, or who are independent plant breeders, also represent the commercial seed/plant production industry. A few respondents representing local/indigenous communities indicated that they also belong to the private plant breeding/independent plant breeder group or the commercial seed/plant production industry. A small number of respondents indicated an affiliation with both the private/independent plant breeding community and the public research sector, public gene banks and government bodies, indicating some misinterpretation or misreading of the categories presented in the survey.

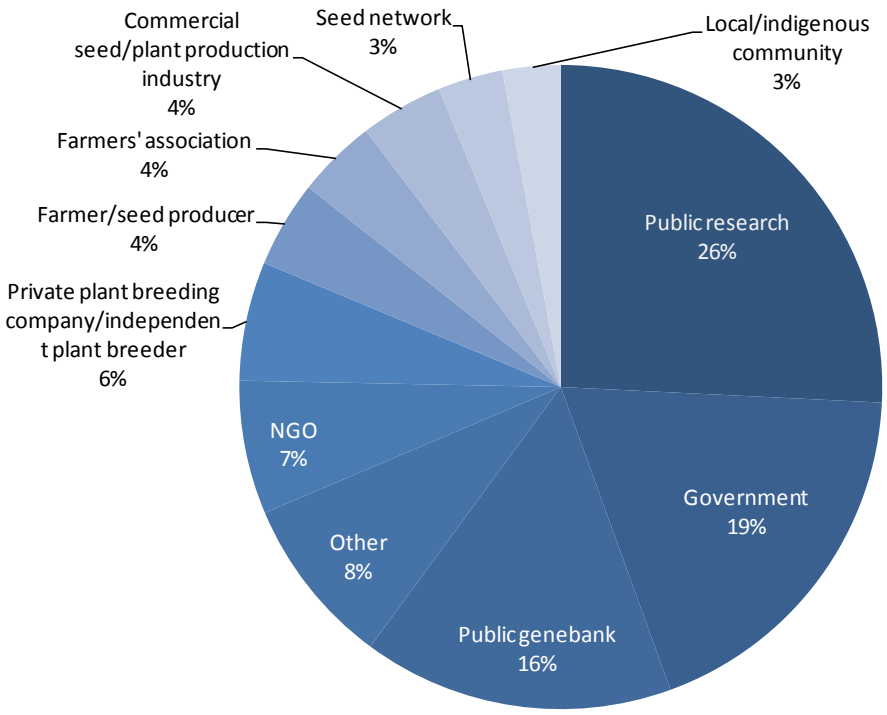


Figure 1. Proportional representation of stakeholder groups based on responses (n = 551) of the 289 respondents who fully or partially completed the survey

19. Representation of other types of stakeholder groups was reported by 47 (16%) of the respondents (or 8% of total responses per stakeholder group – Figure 1). These respondents are affiliated with universities/research/educational establishments, international bodies such as FAO[17], UNEP[18], UNESCO[19], the EC[20] and the GEF[21], and international organizations, networks or services such as the CGIAR, ECPGR[22], Red Mesoamericana de Recursos Fitogenéticos, Secretariat of the Pacific Community (SPC) and SADC[23] Plant Genetic Resources Centre (SPGRC). A small number of respondents who specified an association with these types of organizations in the 'other' category also indicated that they belong to the public research and public gene bank stakeholder groups.

[17] Food and Agriculture Organization of the United Nations
[18] United Nations Environment Programme
[19] United Nations Educational, Scientific and Cultural Organization
[20] European Commission
[21] Global Environment Facility
[22] European Cooperative Programme for Plant Genetic Resources
[23] South African Development Community

20. The roles or interests of the respondents in the sustainable use of PGRFA were collected in 12 pre-defined categories reflecting aspects of the PGRFA sustainable use system (Fig. 2), with the addition of an 'other' category. A high percentage of respondents (82%) indicated a role or interest in plant genetic diversity conservation. These respondents are primarily from public research institutes (27%), public gene banks and government bodies (18%), other organizations (8%) and NGOs (6%)—the remainder belonging to the private/independent plant breeding community, the farmer/seed producer group, commercial seed/plant production industries, seed networks, farmers' associations and local/indigenous communities (5% or less) (Fig. 3). Of the 166 respondents who indicated a role or interest in the maintenance of a broad base of crop varieties, 93% also have a role or interest in plant genetic diversity conservation—a satisfying result confirming that plant genetic diversity conservation is not perceived as an independent activity from the maintenance of a diverse array of crop varieties. Rather, the maintenance of crop varieties is viewed as one component in the spectrum of PGR diversity conservation activities.

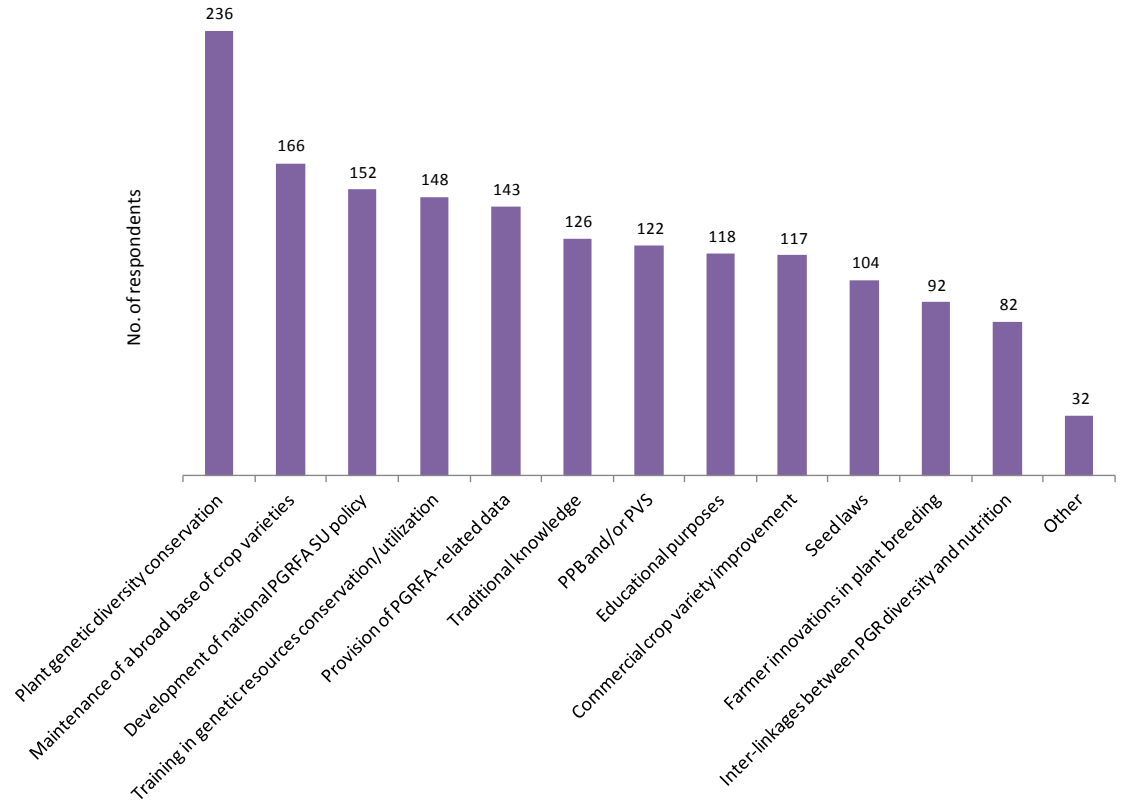


Figure 2. The roles or interests of the 289 respondents who fully or partially completed the survey[24]

[24] PPB – participatory plant breeding; PVS – participatory varietal selection

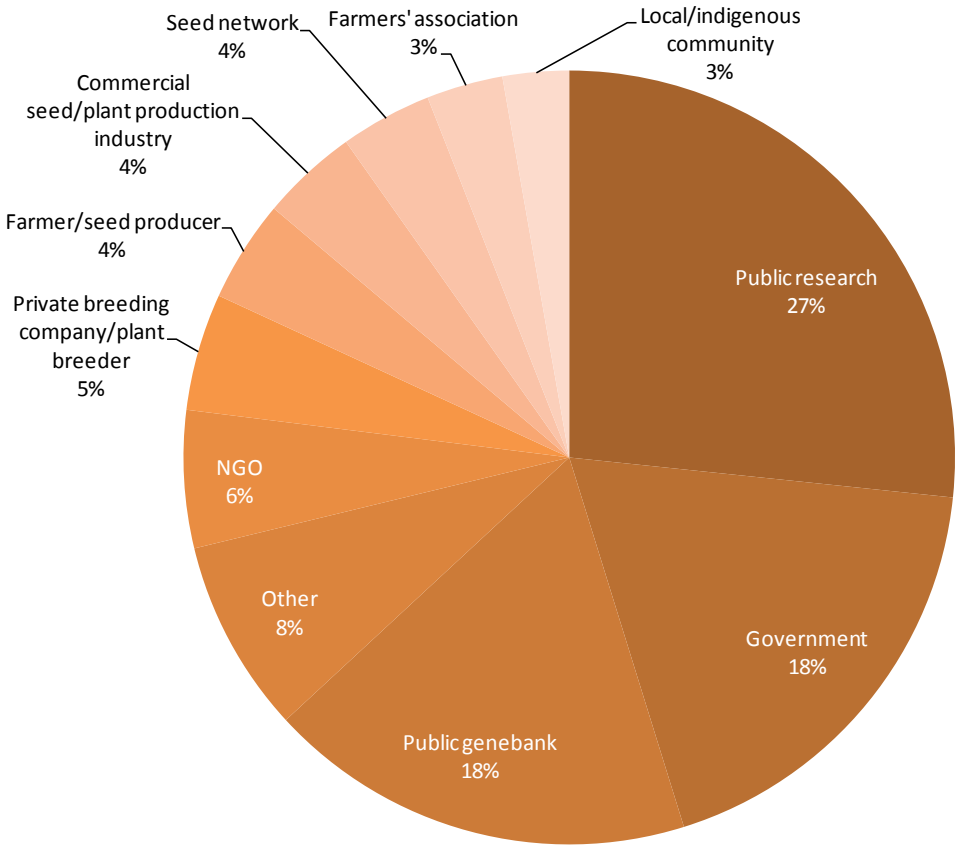


Figure 3. Proportional representation of stakeholder groups based on responses (n = 469) of the 236 survey respondents who indicated a role or interest in plant genetic diversity conservation

21. It is noteworthy that of the 122 respondents who play a role or are interested in participatory plant breeding (PPB) and/or participatory varietal selection (PVS), 25% are affiliated with public research institutes, 18% with government bodies, 14% with public gene banks, and 9% with NGOs (Fig. 4). Six percent belong to the farmer/seed producer stakeholder group and other organizations, 5% to farmers' associations and the private/independent plant breeding group, and 4% to local/indigenous communities, seed networks and the commercial seed/plant production industries. This may reflect a need for greater efforts to bring together the public and private sectors in participatory approaches to plant breeding through the promotion of public–private partnerships (PPP).

22. Other specific roles or interests in sustainable use of PGRFA reported by 32 respondents are wide-ranging and can be broadly classified into six groups: i) plant breeding and crop improvement; ii) the seed system, diversification and marketing; iii) research and data access; iv) policy and economics; v) public awareness, education and capacity building; vi) international and cross-sector collaboration (Table 1).

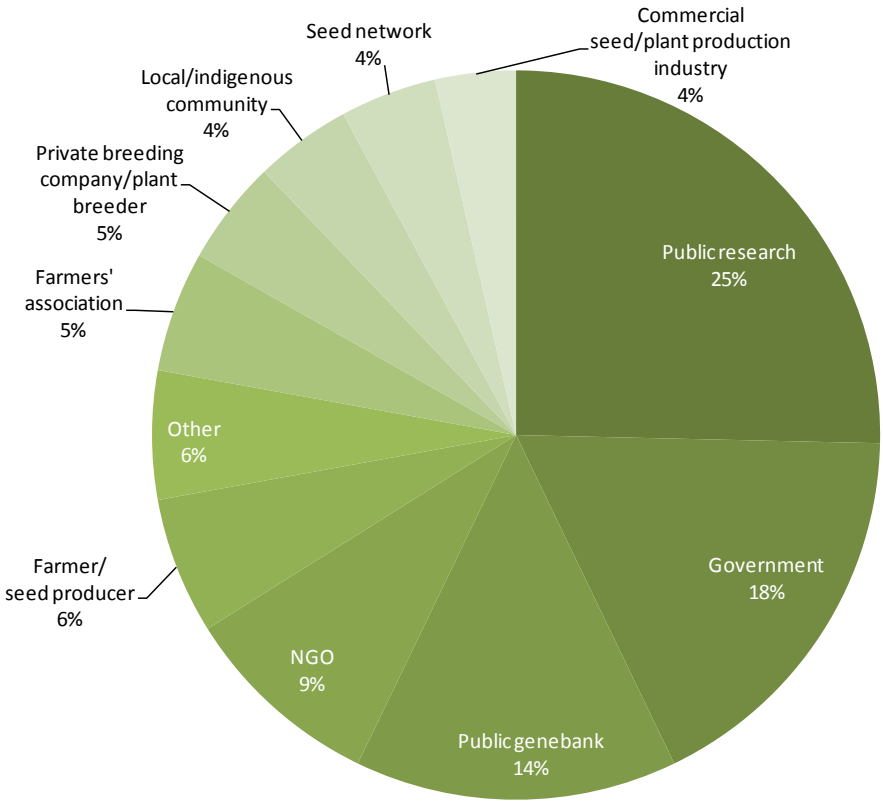


Figure 4. Proportional representation of stakeholder groups based on responses (n = 280) of the 122 survey respondents who indicated a role or interest in PPB and/or PVS

Table 1. Other specific roles or interests in sustainable use of PGRFA reported by 32 survey respondents[25]

Plant breeding/crop improvement
- Use of genetic resources in pre-breeding
- Development of novel technologies for the development of new and more productive crops
- Morphological and molecular characterization of local varieties

Seed system/diversification/marketing
- Promotion of farmer-led seed systems
- Diversity in production systems
- Promotion of marketing activities of PGRFA diversity products through labelling
- Neglected and underutilized species (NUS)

Research/data access
- Promotion of principles of ecological agriculture-genecological approach
- PGR, climate change and adaptation
- Learning from what has been achieved in PGR for use in animal genetic resources (AnGR)
- Evolution of cultivated plants
- Research on PGRFA utilization
- Plant biology
- Open access to data on plant varieties
- Provision of assistance in PGRFA documentation

[25] Respondents answers are summarized and/or edited.

Table 1. Other specific roles or interests in sustainable use of PGRFA reported by 32 survey respondents[25]

Policy/economics
- Implementation of the international instruments related to PGR in the region (e.g. ITPGRFA, Nagoya Protocol)
- Policy work on PGRFA with a focus on intellectual property rights (IPR)
- Advice to governments on the interface between the IP system and CBD access and benefit-sharing (ABS) rules (Nagoya Protocol)
- National focal point for PGRFA
- Economics
- Acceptance of cisgenesis

Public awareness/education/capacity building
- Strengthen/raise public awareness on the importance of PGRFA
- Dissemination and public sensitization of the importance and conservation of PGRFA
- Promotion of sustainable use of PGRFA
- Communication about the importance of PGRFA and their role in changing food systems
- Human resource development for PGRFA breeding and conservation

International/cross-sector cooperation
- Facilitating intergovernmental dialogue, collaboration, strengthening of capacities and standard-setting for the conservation and sustainable use of PGRFA
- Governance of PGRFA
- Germplasm exchange between countries
- Linkages between PGRFA conservation and PGRFA end users

Strengths and weaknesses of the current PGRFA use system

23. To identify where the perceived bottlenecks are in the PGRFA use system, survey participants were asked to indicate their level of agreement with ten positive statements related to aspects of the system (Fig. 5) and to substantiate their answers. A significant percentage of respondents (in the range of 17–36% across the statements) stated that they neither agreed nor disagreed with the statements, or that they were either not sure or did not know. There is clearly a concern regarding policies to promote farmer innovation in plant breeding and marketing opportunities for landraces/farmers' crop varieties, with significantly more respondents stating that they disagreed (or strongly disagreed) with these two statements (43% and 42% respectively) than those who agreed (or strongly agreed) (25% and 26% respectively).

24. In the case of policies to promote farmer innovation in plant breeding, the majority of respondents who disagreed (or strongly disagreed) simply stated that there are no policies in place at all, while other respondents provided more detailed views (Table 2). The explanations of respondents who disagreed (or strongly disagreed) with the statement that there are adequate marketing opportunities for landraces/farmers' crop varieties can be summarized as: a) informal markets are available (e.g., weekly marketing fairs) but existing policies are discouraging such markets (e.g., through prohibitive legislation regarding variety registration and seed certification); b) there is potential but efforts are minimal or *ad hoc* and require further strengthening and financial support; c) commercial markets tend to favour uniformity over diversity, discouraging rather than adding value to local crop diversity—opportunities for formal marketing of farmer varieties are inadequate; d) policy to support marketing of landraces/farmers' varieties exists but it is not well known or properly implemented; and e) there is insufficient awareness of the advantages and benefits of landraces/farmers' varieties.

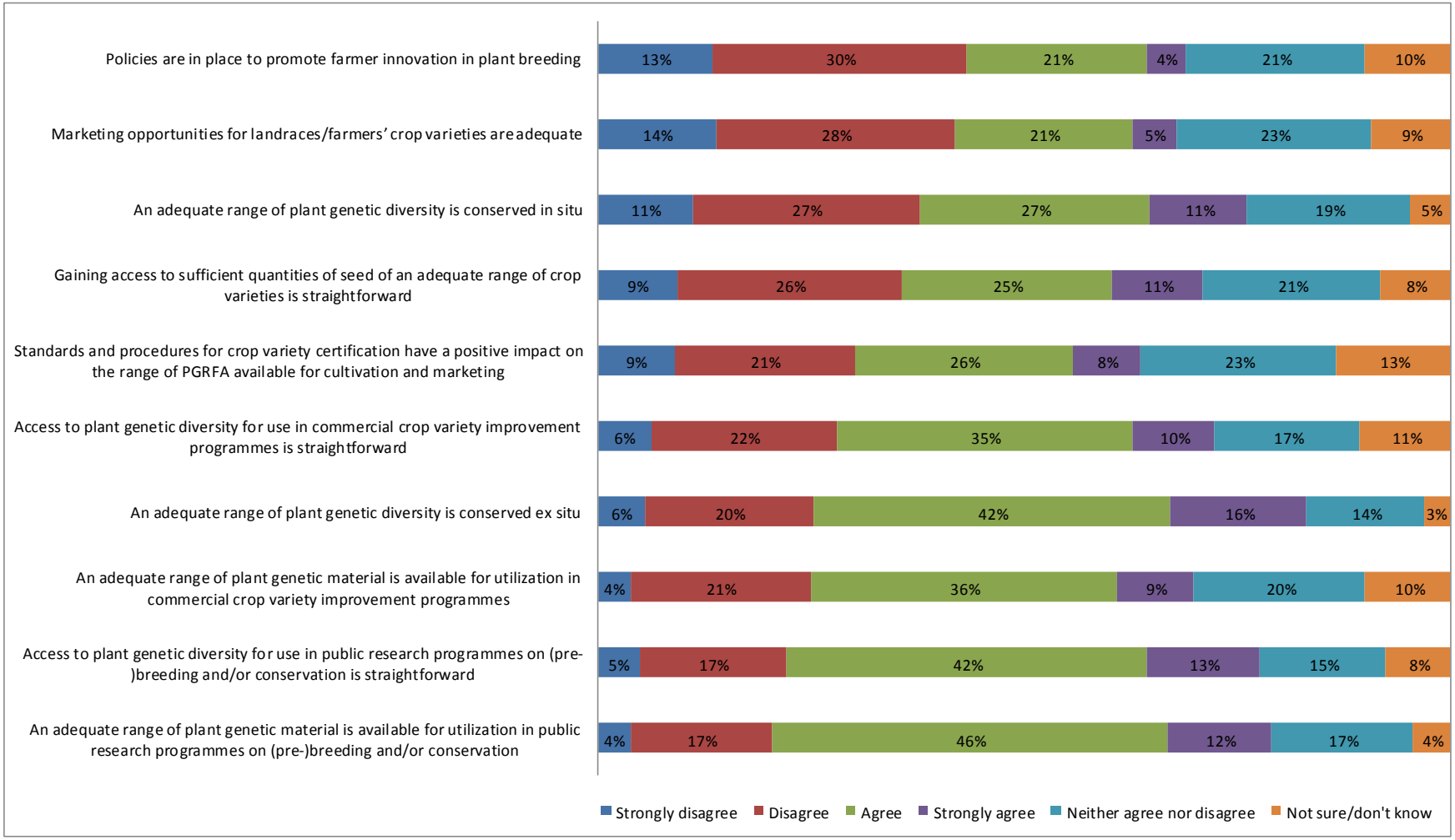


Figure 5. Stakeholders' perceptions of the strengths and weaknesses of the current PGRFA use system (n = 289)

Table 2. Examples of respondents' explanations regarding their disagreement with the statement that policies are in place to promote farmer innovation in plant breeding[26]

- There are no relevant or specific policies in place
- Policies are poorly developed and/or not well implemented (e.g., due to insufficient management and monitoring by governments and a lack of cooperation between stakeholders)
- Most policies focus on supporting the formal sector
- There is very little incentive for farmers to be involved in PPB and/or PVS
- There is no link between farmers and breeders
- There is no special policy in place to promote farmers' involvement in breeding—farmers are presently only involved in the evaluation of new varieties
- Participatory approaches have been limited to only one or two crops
- There is a Bill on Plant Breeders' Rights but no policies or laws that support smallholder farmers' efforts
- There are no policies in place to safeguard traditional knowledge and cultivars and thence the exchange of genetic resources
- Policy level support for farmer innovation is limited—most plant breeding is carried out in public and private breeding organizations
- Very few countries even recognize the role that farmers play in innovation and plant breeding, much less have policies that favour such practices—in fact, most have policies that discourage it
- Breeding activities are at a very low level and there are no policies on breeding
- The agriculture sector is relatively small and limited within in the country and there seems to be a lack of support for plant breeding
- This has received very little support—it is even opposed by some countries
- In my country, any farmer could start his/her own commercial breeding without problems—there is simply no demand for any participatory approach
- This is based on individual breeder discretion without any strong policy support
- Industry has self organized around this, but there has not been much policy in promoting participatory breeding or selection—it tends to rely on public research and on large companies to conduct
- Farmers have very restricted access to PGR and need to be registered as breeders to use released varieties in breeding programmes
- Policy without financial support through specific programmes may not function—there is a need to fund these actions
- This varies greatly from one region to another—some regions have very well-developed legislation, others not
- There is very little involvement of growers until the decision of releasing a new variety needs to be taken
- There is almost no training of breeders, curators and farmers in PPB and PVS
- Policies are inhibiting the release of *ex situ* accessions to individuals such as farmers in order to support PPB and PVS
- Very few countries and national programs recognize PPB, it is not yet supported by national seed legislation and there is limited financial and institutional support—farmers have limited access to gene bank collections for their PPB efforts
- There is not enough political or social consciousness in my country concerning this
- Governments do not recognize the local seed systems and the laws and policies limit the recognition of the varieties generated by farmers
- Not at national level—only local efforts have been made
- There are very few researchers in PPB and no recruitment policy is planned—my institute is focusing on biotechnological research for professionals in the seed sector
- Farmers' seed varieties cannot be sold.

[26] Respondents answers are summarized and/or edited

Table 2. Examples of respondents' explanations regarding their disagreement with the statement that policies are in place to promote farmer innovation in plant breeding[26]

– UPOV[27]-type laws prevent this kind of development
– There were many programmes in order to organize farmers' associations to produce quality seed (to deal with shortages in the cooperative sector)—however, these programmes have become fewer as the Ministry of Agriculture promotes the establishment of private seed markets
– The decisions that promote seed production and farmers' varieties aim to get farmers in a UPOV-like system

25. These results concur with the recommendation of the ACSU at its second meeting in March 2015[28] at which it recommended that the Toolbox should contain tools for the promotion and availability of landraces/farmers' varieties (recognizing the traditional knowledge and customary rules associated with seeds and other propagation materials)—in particular, to achieve increased and sustainable production and higher resilience while increasing the diversity underpinning traditional production systems and livelihoods, as well as contributing to the goals of breeding programmes for crop improvement.

26. Interestingly, the proportions of respondents who disagree/strongly disagree and who agree/strongly agree that an adequate range of plant genetic diversity is conserved *in situ* are equal. The explanations given by respondents who disagreed (or strongly disagreed) can be summarized as:

- There is limited financial, institutional and policy support for *in situ* conservation;
- *In situ* conservation is difficult to promote and manage;
- There are restrictions on accessing material conserved *in situ*;
- Infrastructure and trained human resources capacities are lacking;
- There is no widely applied approach for on-farm conservation;
- Conservation and dynamic management on-farm are not recognized;
- Local varieties are being replaced with highly bred commercial high yielding varieties;
- There is no targeted or active conservation of crop wild relatives in existing protected areas;
- PGRFA *in situ* are threatened by human activities.

27. The respondents who indicated that they believe there to be adequate plant genetic diversity conserved *in situ* fall into three main groups: a) those who consider the existing protected area system adequate to conserve PGRFA *in situ*; b) those who consider that on-farm conservation is an inherent activity being managed by farmers; and c) those who erroneously confuse *ex situ* conservation in field gene banks with *in situ* conservation. A fourth group appeared to mistakenly refer to *ex situ* conservation in their comments.

28. For the other seven statements regarding the strengths and weaknesses of the current PGRFA use system, although there is greater agreement than disagreement, a significant proportion of respondents are in disagreement with each (Fig. 5). Therefore, it is vital that these issues are addressed in order to strengthen the system and support the sustainable use of PGRFA. For example, gaining access to sufficient quantities of seed of an adequate range of crop varieties is perceived as problematic because:

[27] International Union for the Protection of New Varieties of Plants
[28] www.planttreaty.org/sites/default/files/IT%20ACSU-2%2015-Report.pdf

- Smallholder farmers are restricted by the cost of seed and inadequate distribution channels;
- A lack of resources and skills are hampering seed production;
- Quantities of seed in gene banks are limited and systems for multiplication are lacking;
- Many crops are unattractive to seed companies;
- Minor crops with less commercial potential have been heavily neglected in breeding and therefore the available varieties do not meet the need of farmers';
- There is no integrated system that facilitates access to farmers' seeds while recognizing and protecting Farmers' Rights.

29. Many respondents commented that standards and procedures for crop variety certification: a) are complicated, bureaucratic and too costly for many farmers; b) are not appropriate for landraces/farmers' varieties because which are not sufficiently homogeneous and stable; c) have a negative impact on the marketing of landraces/farmers' varieties; d) have contributed to the genetic erosion of on-farm plant genetic diversity; e) restrict the range of PGR for breeding new crop varieties; and f) hinder the functioning of local seed systems.

30. Access to plant genetic diversity for use in public research programmes is also a critical bottleneck in the system due to:

- Problems with the functioning of national gene banks (e.g., material requests are not honoured and there is confusion regarding the operation of the Multilateral System – MLS)—thus, public research and breeding programmes must rely on self-collected materials or those sourced from international gene banks or commercial sources;
- Complicated, time-consuming and costly procedures, particularly within the public gene bank system;
- Insufficient policies and guidelines;
- Compliance with national ABS regulations;
- Inadequate access to data on the plant material available;
- Conflicts between national and international policies (e.g., material transfer agreements – MTAs, IPRs and Farmers' Rights);
- Fragmentation of policies and conservation facilities.

31. Similar reasons are given for difficulties in accessing plant genetic material for use in commercial crop improvement programmes, although with the added issue that some companies are cautious of potential future claims on royalties due to IPRs and ABS regulations.

32. Other issues regarding the weaknesses of the current PGRFA use system highlighted by respondents were:

- Gene bank curators and plant breeders seldom collaborate in base broadening or population development;
- Human and institutional capacities for conserving PGRFA and using them in pre-breeding and plant breeding are weak;
- Many accessions held in gene banks may be unviable due to prevailing poor funding and weak infrastructure;
- No black box arrangements are in place for the conservation of farmers' varieties—the link between farmers and national gene banks needs to be strengthened and Farmers' Rights guaranteed;

- Media promotion of the work of NGOs and powerful oligopolistic retailing is having a negative impact on the implementation of serious PGR policy and activities;
- Weak compliance by Contracting Parties to the provisions of the Treaty, particularly regarding the MLS;
- Clashes between the provisions of the Treaty and UPOV;
- Lack of public awareness about the importance of PGRFA;
- Fragmented approaches in research and policy-making.

Constraints and needs regarding the implementation of the sustainable use provisions of the ITPGRFA

National policy in support of sustainable use of PGRFA

33. More than half of the survey respondents indicated that national policy in support of the sustainable use of PGRFA[29] in the country(ies) in which they (or the stakeholder group(s) they represent) work exists, but that it does not cover all elements of sustainable use of PGRFA and/or there are problems with its implementation (Fig. 6). Seventeen percent of respondents revealed that national policy in support of the sustainable use of PGRFA exists and is both comprehensive and effective. The same percentage stated that it does not exist, and the remaining 12% reported that they did not know about national policy related to the sustainable use of PGRFA.

34. There was strong concurrence among the 149 (55%) respondents who indicated that national policy in support of sustainable use exists but has limitations, with seven pre-defined categories of limitations (Fig. 7). A large proportion of these respondents substantiated their answers with specific information on the types of policies missing, the stakeholder groups that are not supported, the types of incentives and guidance needed, the areas of the PGRFA system in which financial resources are needed, and how coordination between public administrations and/or between the public and industry sectors could be improved (Table 3). The need for policies to recognize and support informal seed systems, smallholder farmers maintaining local diversity, and regulations governing the certification and marketing of landraces/farmers' varieties was frequently mentioned, as were those to recognize and support Farmers' Rights, farmer led initiatives/farmer innovation and participatory approaches to crop improvement. Policies to address ABS issues and to support *in situ* conservation of PGRFA (both wild and cultivated) are also critically needed. Overwhelmingly, respondents highlighted farmers as the stakeholders who are not currently adequately supported by national policy in support of sustainable use of PGRFA.

[29] For example, policy to support: maintenance of diverse farming systems; PPB/PVS; farmer innovation/Farmers' Rights; maintenance/marketing of landraces/farmers' varieties; use of under-utilized species; conservation of plant genetic diversity *in situ* and *ex situ*; use of a wide diversity of species and varieties on-farm; seed (exchange) networks; recognition of the value of traditional knowledge; access to plant genetic diversity for use in breeding programmes; access to information on plant genetic diversity.

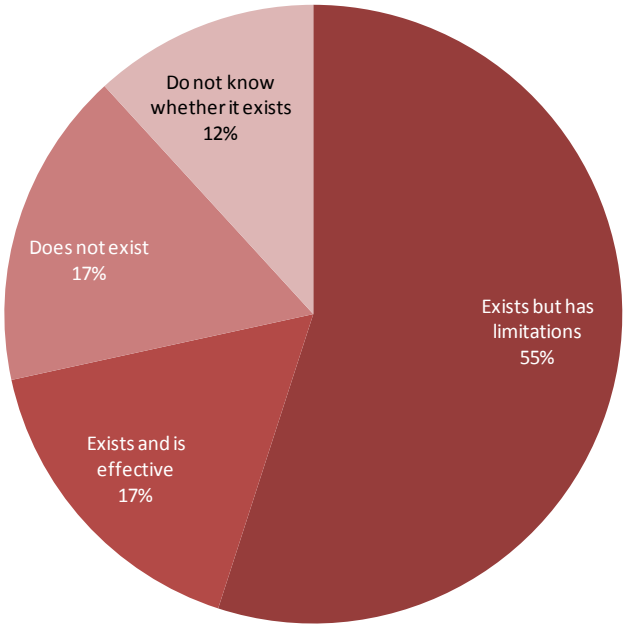


Figure 6. Stakeholders' responses regarding national policy in support of sustainable use of PGRFA (n = 271)

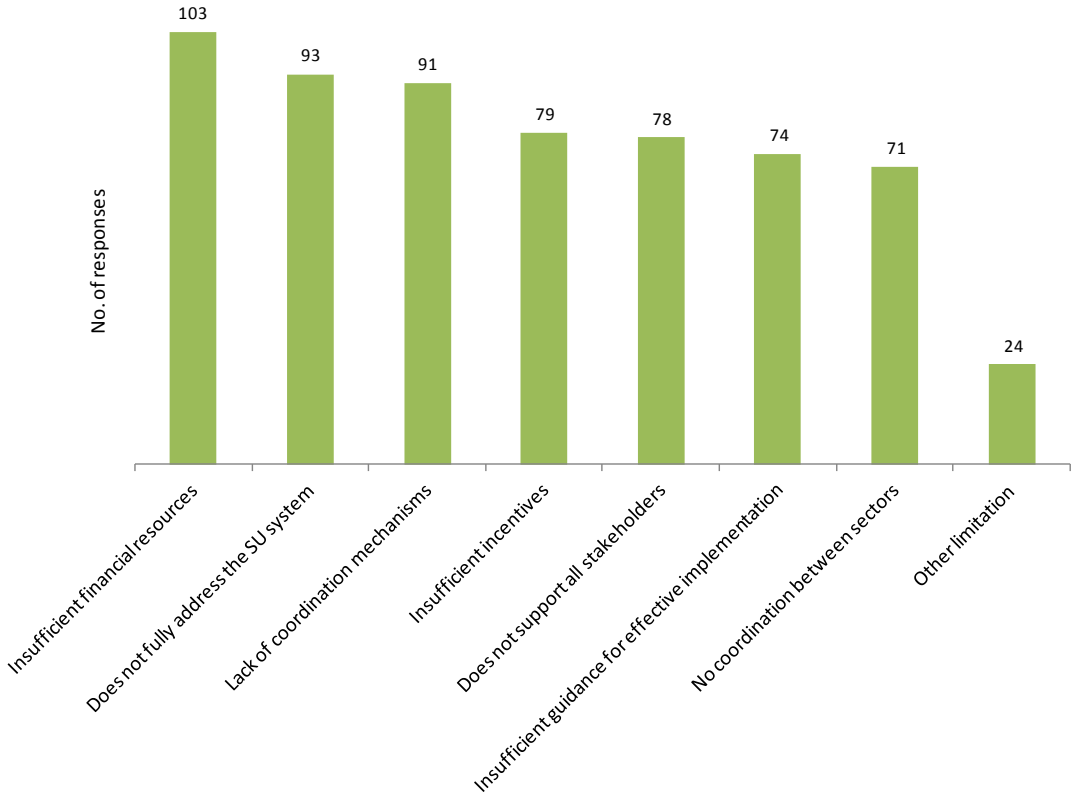


Figure 7. Limitations of national policy in support of sustainable use of PGRFA reported by 149 survey respondents (n = 613)

Table 3. Limitations of national policy in support of sustainable use of PGRFA[30]

Policies are missing for....
- The development of PGRFA conservation and sustainable use strategies
- PGRFA *in situ* conservation
- National systems for *ex situ* conservation
- Crop wild relative and landrace conservation and sustainable use
- Supporting smallholder farmers
- Recognizing and supporting informal seed systems
- Certification and marketing landraces/farmers' varieties
- Supporting landrace maintenance and use
- Maintenance of diverse farming systems
- Supporting biodiversity conservation within working landscapes
- IPR laws governing PGRFA use
- Recognition of Farmers' Rights
- Recognition of traditional knowledge
- Implementing the Nagoya Protocol (access and benefit sharing)
- The use of farmers' varieties
- Procedures for access to plant genetic material
- Data access and use
- Supporting farmer led initiatives/farmer innovation
- Supporting participatory approaches (e.g., PPB and PVS)
- Implementing Article 6.2
- Integrating PGRFA sustainable use with food security
- Linking seed production and PGRFA conservation
- Addressing the convergence between agriculture and industry
- Supporting international partnerships

Limitations relating to policy implementation
- Ratification of the Treaty
- Formal approval of national PGRFA conservation and sustainable use strategies
- Coherence in implementing the provisions of the Treaty, CBD and UPOV
- Policy strengthening/enhancement (e.g., policies regarding on-farm diversity utilization are not well defined)

Stakeholders who are not supported by national policy
- Farmers (particularly smallholders) and farmer organizations
- Women's associations
- Public research institutes
- Gene banks
- National PGR programmes
- Actors in the informal seed sector
- The private sector
- NGOs
- Small-scale plant breeding entities
- Small-scale seed companies
- Civil society and consumers
- Extension workers
- Industry

Guidance is needed on....
- Policy development to fully implement the Treaty, including the MLS and implementation of SMTAs
- Developing collaboration between the conservation and breeding sectors

[30] Respondents answers are summarized and/or edited.

Table 3. Limitations of national policy in support of sustainable use of PGRFA[30]

- *In situ* conservation of CWR, including how to undertake conservation gap analyses
- Gene bank standards and operating practices
- How to start up a local breeding company
- The NUS production chain
- Seed production, availability and marketing
- Involving farmers and the private sector in PGRFA sustainable use at the grassroots level
- How to involve smallholder farmers in decision-making meetings
- Public awareness on the importance of PGRFA

Incentives needed

- Funding (e.g., for the development of crops suitable for national production, special programmes to provide incentives to farmers, or to support participatory or diversity-oriented approaches)
- Long term commitment to the provision of resources (e.g., for national gene banks which are often funded through short term projects)
- Recognition of farmers'/local communities' roles in conservation and sustainable use of PGRFA (e.g., through public prize-giving ceremonies)
- Specific legislation to support formal markets for landraces/farmers' varieties, including trademarks, labelling, geographic indications etc.
- Provision of tools, training and technical support (e.g., in conservation and plant breeding techniques)
- Promotion of networking and collective action on PGRFA conservation and sustainable use
- Improved public awareness on the status and importance of PGRFA for economic and social development

Financial resources are needed for....

- Strengthening the capacity of national gene banks
- *In situ* conservation of CWR and landraces, including the production of inventories
- Supporting maintainers of landraces/farmers' varieties and local seed networks
- Promotion of local varieties and products
- Characterization, evaluation and (pre-)breeding, including large-scale genotyping and phenotyping
- Breeding crops suited to cultivation in marginal areas
- Production of planting material of landraces/farmers' varieties, and extension and distribution
- Training and technical support (e.g., for PPB)
- Preparation of National Action Plans
- Development of PGR data management systems, particularly to provide access to information on plant genetic diversity required by pre-breeders and breeders
- Stakeholder networking
- Public awareness campaigns
- Policy development

How coordination between public administrations and/or between the public and industry sectors could be improved

- Establish national committees involving representatives of all stakeholder groups
- Encourage PPP for plant breeding
- Increase the involvement of the plant breeding industry in policy development
- Clearly define the importance of PGRFA conservation and sustainable use and disseminate information to all sectors
- Conduct multi-sector research projects
- Increase cross-sector participation in decision-making meetings
- Define the roles and responsibilities of public and industry sectors in access and benefit sharing
- Increase the capacity of national PGR coordinators
- Use social media, newsletters, workshops and conferences to bring stakeholders together

35. While the incentives needed include financial support (e.g., for the development of crops suitable for national production, special programmes to provide incentives to farmers, or to support participatory or diversity-oriented approaches), several non-monetary incentives were highlighted, including the formal recognition of the role of farmers and local communities in the conservation and sustainable use of PGRFA, provision of training and technical support (e.g., in conservation and plant breeding techniques), and improved public awareness on the status and importance of PGRFA for economic and social development. Respondents highlighted the need for guidance in a diverse range of topics to aid the implementation of policy on sustainable use of PGRFA, including guidance in policy development to implement the Treaty itself. The need for guidance in developing collaboration between the conservation and breeding sectors was also strongly emphasized.

36. In terms of financial resources required, the most frequently mentioned need was for long-term support for national gene banks, as well as funding for *in situ* conservation, the provision of support to maintainers of landraces/farmers' varieties and for local seed systems, and for strengthening markets for local diverse products. A number of respondents consider that financial support is required for all facets of the PGRFA conservation and use system. Several proposals for improving coordination between public administrations and/or between the public and industry sectors were put forward, the most frequent being the establishment of national committees involving representatives of all stakeholder groups, and encouraging PPP for plant breeding. Other limitations to the implementation of national policy in support of sustainable use reported were:

- The need to sensitize decision-makers on the value of PGRFA for food security;
- The lack of clear policy in many countries on ABS, making it difficult to find out what rules apply and to negotiate ABS obligations;
- Insufficient support for breeding activities by small seed companies;
- The topic of conservation and sustainable use of PGRFA is not even on the agenda at national decision-making level;
- The improvement of crops not listed in Annex I of the Treaty is hindered by the Nagoya Protocol;
- There are no effective public policies to support research, training and incentives to counterbalance the dominance of the private sector and which are conducive to sustainable use of PGRFA;
- Existing national policy is for biodiversity in general and does not specifically address PGRFA;
- Existing national policy focuses only on *ex situ* conservation and does not recognize conservation and dynamic management on-farm or protect Farmers' Rights;
- A paradigm shift is needed to place farmers at the centre of the sustainable management of PGRFA within the context of Article 6 of the Treaty.

Capacity building needs for enacting the sustainable use provisions of the Treaty

37. Results show an overwhelming need for both human and institutional capacity building in order for stakeholders to effectively implement the sustainable use provisions of the Treaty (Fig. 8).

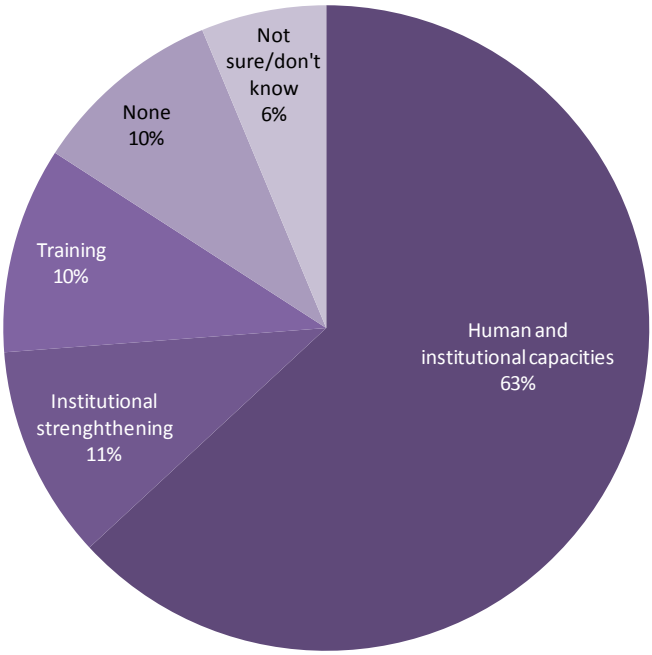
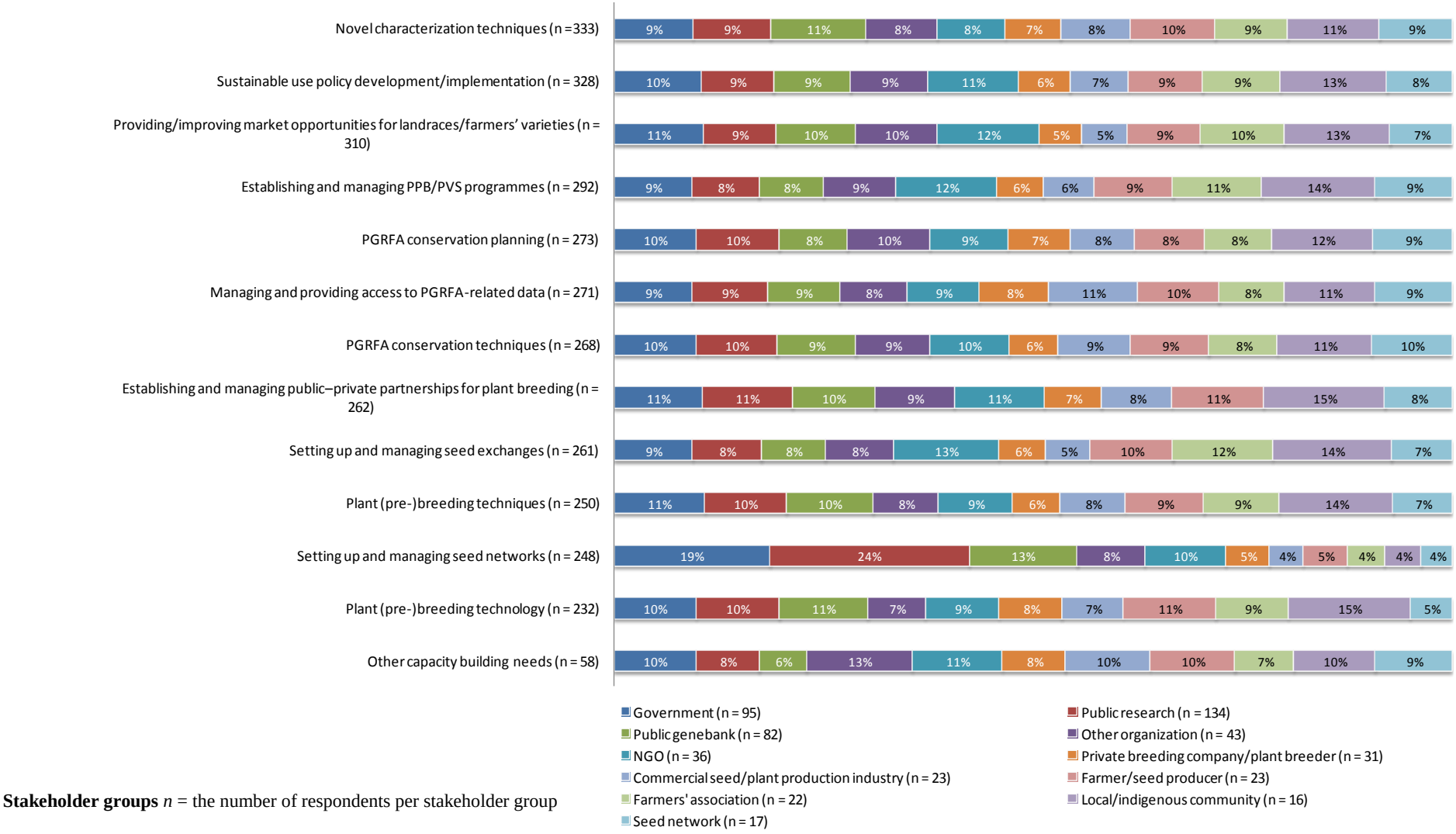


Figure 8. Stakeholders' capacity building needs for enacting the sustainable use provisions of the Treaty (n = 271)

Figure 9. Capacity building needs reported by 245 survey respondents

38. Figure 9 reveals a critical need for capacity building in all areas of the PGRFA sustainable use spectrum, the highest numbers of respondents indicating a requirement for capacity building in sustainable use policy development and/or implementation (65%), novel characterization techniques to speed up the identification of target trait sources (e.g., through the use of phenomics, genomics and transcriptomics, and/or predictive characterization techniques) (63%), and providing/improving market opportunities for landraces/farmers' varieties (61%). Between 42% and 56% of respondents identified a need for capacity building in the other nine pre-defined categories reflecting areas of the PGRFA sustainable use system, with capacity building in plant (pre-)breeding technology being identified as important by 42% of respondents, and establishing and managing PPP for plant breeding by 56%. Other types of capacity building needs were identified by 11% of respondents (see Box 4).

39. An analysis of capacity building needs according to stakeholder groups (Fig. 10) shows that on the whole, there is fairly uniform agreement across groups regarding the pre-defined categories reflecting areas of the PGRFA sustainable use system. However, it is interesting to note that no representatives of farmers' associations indicated a need for capacity building in PPP for plant breeding, and that setting up and managing seed networks is of far greater interest to representatives of government agencies and public research institutes than it is to the commercial seed/plant production industry, farmers/seed producers, farmers' associations, local/indigenous communities, and members of seed networks. This may point to a role for the Toolbox in providing focused support in these areas and to encourage greater cross-sector collaboration.



Stakeholder groups *n* = the number of respondents per stakeholder group

Figure 10. Relative contributions of stakeholder groups to the capacity building needs identified (based on the responses of 245 survey participants)

40. It may also be important to tailor the Toolbox according to differing capacity building needs driven by the geo-diverse socio-economic and political landscape. Box 4 presents a summary of the indications resulting from an analysis of capacity building needs across and within continental (macro) regions in order to identify potential variations[31] [32]. The results of the analysis are presented in Figures a–e, Appendix 2.

Box 4. Capacity building needs across and within macro regions

The African Region

The 12 pre-defined categories of capacity building needs (Fig. 9) were identified as important by 48–80% of the respondents (*n* = 40), the highest priorities being sustainable use policy development/implementation and providing/improving market opportunities for landraces/farmers' varieties (selected by 80% of respondents), and the lowest establishing/managing PPP for plant breeding (selected by 48% of respondents). With the exception of capacity building in managing/providing access to PGRFA-related data, which respondents representing Northern Africa did not consider to be needed, respondents representing all five sub-regions identified each pre-defined capacity building need as important. Other capacity building needs identified by respondents in the region were: a) support to enable a review of regulatory and policy frameworks to improve the implementation of Farmers' Rights (for farmers, researchers and policy-makers); b) awareness-raising about the importance of PGRFA conservation and sustainable use amongst national policy-makers, farmers and the general public; and c) ecological and social modelling.

The Americas

The 12 pre-defined categories of capacity building needs were identified as important by 29–57% of the respondents (*n* = 51), the highest priority being providing/improving market opportunities for landraces/farmers' varieties (selected by 57% of respondents), and the lowest plant (pre-)breeding technology (selected by 29% of respondents). With the exception of capacity building in establishing and managing PPB/PVS and PPP for plant breeding programmes, which the respondent representing the Caribbean did not consider to be needed, respondents representing all four sub-regions identified each pre-defined capacity building need as important. However, it is noteworthy that several capacity building needs were selected by a significantly smaller number of respondents representing Northern America—in particular, providing/improving market opportunities for landraces/farmers' varieties, and plant (pre-)breeding techniques and technology. Other capacity building needs identified by respondents in the region were: a) training in the implementation of Farmers' Rights (in South and Central America); and b) conservation and sustainable use of neglected and underutilized species (in South America).

Asia

The 12 pre-defined categories of capacity building needs were identified as important by 43–67% of the respondents (*n* = 51), the highest priority being establishing and managing PPP for plant breeding (selected by 67% of respondents), and the lowest plant (pre-)breeding technology (selected by 43% of respondents). Capacity building in only two of the pre-defined categories were identified as needed by representatives of all five sub-regions—PGRFA conservation techniques and PGRFA conservation planning. While representatives of Southern, Southeastern and Western Asia consider that capacity building is needed in all areas of the PGRFA use system, respondents representing Central and Eastern Asia were more selective in their responses, each choosing only six of the 12 pre-defined categories. However, these two sub-regions were only represented by one and three respondents respectively; therefore, these results are unlikely to be indicative of capacity building needs within these two sub-regions as a whole due to the very

[31] Based on macro geographical (continental) regions and geographical sub-regions as defined by the United Nations Statistics Division – http://unstats.un.org/unsd/methods/m49/m49regin.htm.

[32] Results are based on a large variation in the number of respondents per macro region and sub-region—the highest number at macro regional level was 124 respondents representing Europe and the lowest 22 respondents representing Oceania, while at sub-regional level the highest number was 45 respondents representing western Europe and the lowest, one respondent representing the Caribbean and one Central Asia.

small sample size. Further investigation by making direct contact with the respondents and other stakeholders in these sub-regions would be necessary to fully understand the capacity building needs. It was noted by one respondent representing Eastern Asia that there is a huge effort by staff working in PGRFA conservation and sustainable use but with a severe shortage of a wide range of resources. Capacity building in the area of public awareness was highlighted as important by one representative of Western Asia. No further capacity building needs were identified.

Europe

The 12 pre-defined categories of capacity building needs were identified as important by 27–52% of the respondents (*n* = 124), the highest priority being novel characterization techniques (selected by 52% of respondents), and the lowest plant (pre-)breeding technology (selected by 27% of respondents). Respondents representing all four sub-regions identified each pre-defined capacity building need as important. Other capacity building needs identified by respondents in the region were: a) cross-sector collaboration in *in situ* PGRFA conservation planning; b) the recognition and enactment of Farmers' Rights; c) defining the roles of the informal and formal breeding and seed sectors in PGRFA sustainable use; d) understanding the implications of IPR on the use of PGRFA; and e) awareness-raising about the importance of PGRFA conservation and sustainable use within the academic community.

Oceania

The 12 pre-defined categories of capacity building needs were identified as important by 45–73% of the respondents (*n* = 22), the highest priority being establishing and managing PPB/PVS programmes (selected by 73% of respondents), and the lowest establishing/managing PPP for plant breeding (selected by 45% of respondents). Respondents representing all four sub-regions identified each pre-defined capacity building need as important and no other capacity building needs were identified.

Constraints regarding access to PGRFA material or associated information required for sustainable use

41. A significant proportion of stakeholders face difficulties in accessing PGRFA material (germplasm) or associated information required for sustainable use (Fig. 11). Accessing information on plant genetic material containing specific traits is of particular concern, with 54% of respondents (*n* = 271) identifying this as a constraint impinging on effective sustainable use of PGRFA. Thirty-nine percent of respondents face difficulties in obtaining plant genetic material for crop improvement, 38% in obtaining information on plant genetic material for crop improvement and on plant genetic diversity for conservation planning, 36% in obtaining information on conserved plant genetic diversity, and 31% on potential collaborators for crop improvement programmes. While a significant proportion of respondents stated that they do not face difficulties in accessing PGRFA material or related information, this by no means negates the need to address these issues as a priority through the provision of resources to mitigate these bottlenecks which are clearly impacting a substantial number of stakeholders in the PGRFA sustainable use system. One hundred and twenty-one respondents elaborated on their responses regarding these access issues (Table 4). The main constraints can be summarized as: a) insufficient characterization and evaluation is undertaken across a broad spectrum of crop gene pools; b) for material that has been characterized and/or evaluated, access to the resulting data is problematic due to inadequate data management in national gene banks; c) germplasm collections are not established on the basis of targeted genetic diversity; d) much information on PGRFA material is not available in the public domain; e) information on material containing specific traits is difficult to obtain; f) determining and following the legal steps required to obtain germplasm is complex and time-consuming; g) plant genetic material requested is sometimes not forthcoming; h) obtaining information on potential collaborators is difficult; i) access to information and material is hampered by poor communication technology, lack of human resources, language barriers and restricted access to scientific literature.

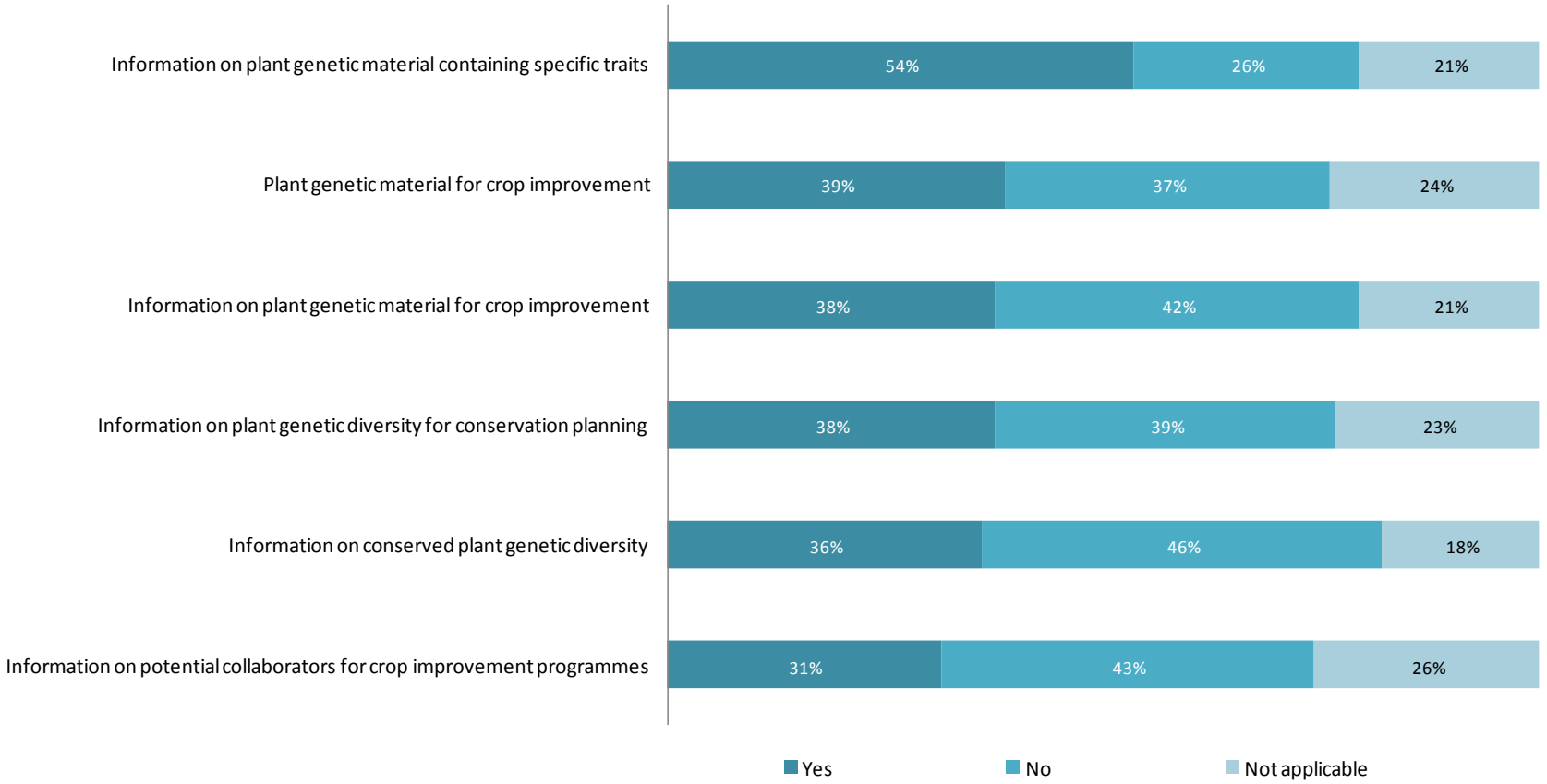


Figure 11. Constraints regarding access to PGRFA material (germplasm) or related information required for sustainable use (n = 271)

Table 4. Constraints faced by stakeholders regarding access to PGRFA material or associated information required for sustainable use

Access to information on: a) plant genetic material containing specific traits; and/or b) conserved plant genetic diversity; and/or c) material available for crop improvement

- Characterization of PGRFA is incomplete for most crops—there is a need to fully characterize PGRFA and make the data publicly available
- Many gene banks are only concerned with multiplying and conserving material
- Core collections address general rather than specific genetic variation—the application of methodologies to identify targeted genetic variation (e.g., Focused Identification of Germplasm Strategy – FIGS) is needed
- More characterization and evaluation of CWR is needed
- There are insufficient funding programmes to support characterization and evaluation
- Evaluation data have been generated for decades but are not available in gene bank information systems except for a few crops—this problem has been recognized for a long time but actions that would improve the situation have not been supported and/or taken
- A major problem remains the lack of standardized phenological and genetic information on cultivar specific traits
- Information on PGRFA held in national gene banks is often not accessible to the public
- Gene banks are not performing to expectations and most PGRFA-related information is not readily available
- Many countries do not have adequate (computerized) PGRFA documentation systems, neither *ex situ* nor *in situ*—or if they do, the information is not publicly available
- The databases on available PGRFA are not well maintained
- There is no database available to access information on specific traits
- It is difficult to obtain information on DNA markers for specific traits
- It is difficult to obtain trait specific information on PGRFA except for material in the MLS
- PGRFA information is held by different agencies and ministries—there is no central national database providing access to dispersed data sets
- Much data relating to conserved PGR material are stored in hard copy or electronically on researchers' hard drives—these data need to be linked back to the germplasm samples to which they relate[33]
- Stronger policy and support is needed for the development of global information systems such as GeneSys
- There is no information available for stakeholders who do not want to use PGR for breeding but for direct use in their fields (e.g., farmers, small seed companies, agro-NGOs and seed networks)
- Little information is available on locally important crops which not considered globally important

Access to plant genetic material for crop improvement

- Small research institutes do not have sufficient financial resources to obtain exotic germplasm
- Most countries, even those that are Contracting Parties to the Treaty, do not provide access to their germplasm, or have such a lengthy and onerous system for requesting access that it is tantamount to not providing access
- Small samples of cultivars are not accessible for experimental and breeding use, particularly from private companies
- There is a reluctance to share germplasm due to uncertainty regarding issues of ownership

[33] The respondent added: The DivSeek and GLIS (including Genesys) initiatives are to be commended in addressing this constraint, however, a lot more groundwork and collaboration is needed to successfully implement them. For example, regional programmes to address and coordinate the capture, cleansing and uploading of such data could be established.

Table 4. Constraints faced by stakeholders regarding access to PGRFA material or associated information required for sustainable use

- The most important constraint is determining and following the legal steps necessary to obtain plant genetic material—finding out whether prior informed consent (PIC) is necessary and what the MTA would be, then actually obtaining the PIC and negotiating an acceptable MTA
- Some gene banks (especially outside Europe) do not respond to seed requests
- Some providers have refused to provide PGRFA material
- Accessions may be listed but are not actually available due to germination problems
- There is insufficient plant genetic material available of many minor crop gene pools
- It remains difficult to get access to genetic resources from non-European countries, even for research use
- There is no efficient multiplication system in place to produce sufficient quantities of seed for crop improvement and cultivation of landraces
- Because of their exclusion from Annex I, access to genetic resources of certain forages might become a problem in the near future due to ongoing genetic erosion
- It is easy to obtain seed material from open gene banks but more laborious to obtain genotypes from countries which are not Contracting Parties to the Treaty

Access to information on plant genetic diversity for conservation planning

- There are insufficient data available on the *in situ* occurrences of CWR
- There is a lack of relevant expertise within the organization and in the country
- The lack of a consistent international naming system is a major challenge in establishing and coordinating duplicate *ex situ* germplasm collections

Information on potential collaborators for crop improvement programmes

- Potential collaborators in conservation, characterization and pre-breeding programmes are difficult to find
- There are no central contact points to bring potential collaborators together

General access issues

- Access to information is hampered by internet connectivity and/or language problems
- Access is hampered by poor communication technology, unskilled human resources and weak collaboration
- Access to scientific literature is restricted
- Access depends on the country and the crop species

Types of resources required in the Toolbox

42. Figure 12 indicates that a wide range of types of resources are important to support stakeholders' work on sustainable use of PGRFA, although perhaps not surprisingly, websites, web portals and online databases are the highest rated categories. Other types of resources important for stakeholders are notifications about conferences, field demonstration events, courses and training workshops, as well as access to knowledge networks and social media.

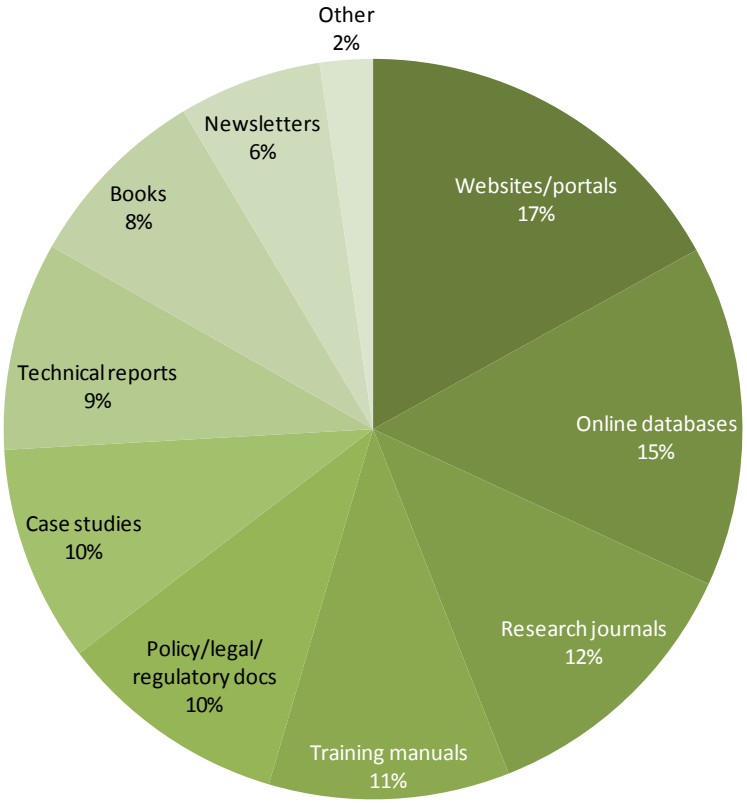


Figure 12. Types of resources that respondents have found particularly useful and practical in guiding their work on sustainable use of PGRFA (n = 254)

43. Respondents provided many examples of online resources which they have found particularly useful and practical. These include the websites of international organizations such as FAO, the CGIAR, and the Crop Trust[34]; the Treaty and the CBD; and knowledge networks such as PAR[35], GFAR[36], WIEWS[37], ECPGR and EUCARPIA[38]. Online databases of note are GBIF[39], Genesys[40], The Harlan and de Wet Crop Wild Relative Inventory[41], EURISCO[42], GRIN Taxonomy for Plants, and Mansfeld's World Database of Agricultural and Horticultural Crops[43]. Respondents also highlighted the importance of individual gene bank and company websites, and online genome databases. Online resources are considered useful and practical in supporting stakeholders' activities due to their ease of access, free availability, reliability and speed, the wealth of information they contain or provide access to, and opportunities for networking. In addition to online resources, respondents provided a broad range of examples of other types of resources and indicated why they found them useful and practical (Box 5).

[34] The Crop Trust (formerly the Global Crop Diversity Trust) – www.croptrust.org

[35] Platform for Agrobiodiversty Research – agrobiodiversityplatform.org
[36] The Global Forum on Agricultural Research – www.egfar.org
[37] World Information and Early Warning System on PGRFA – www.fao.org/wiews-archive/wiews.jsp
[38] European Association for Research on Plant Breeding – www.eucarpia.org
[39] Global Biodiversity Information Facility – www.gbif.org
[40] Genesys, Gateway to Genetic Resources – www.genesys-pgr.org/welcome
[41] Crop Wild Relatives and Climate Change – www.cwrdiversity.org/checklist
[42] EURISCO, Finding seeds for the future – eurisco.ipk-gatersleben.de/
[43] Mansfeld's World Database of Agricultural and Horticultural Crops – mansfeld.ipk-gatersleben.de

Box 5. Characteristics of the types of resources which are useful and practical in supporting stakeholders' work on sustainable use of PGRFA

Online resources (websites, web portals and databases)
- Easily accessible
- Freely available
- Reliable and fast
- Contain or provide access to a wealth of information
- Provide networking opportunities

Policy, legal and regulatory documents
- Indicate high priorities for national policy- and decision-makers
- Set the framework for national action
- Provide examples to inform the development of national policy
- Aid policy compliance
- Identify which policies can accommodate issues of PGRFA
- Allow different actors to learn and understand the range of challenges related to the use of PGRFA
- Provide visions for the future

Training manuals
- Users can learn alone and in their own time
- Practical and easy to understand
- Provide focussed practical and theoretical information
- Easily distributed and shared with relevant stakeholders
- Can be adapted and used by trainers
- Provide capacity building for junior staff and technicians

Technical reports
- Impart the latest information
- Offer crop-specific information
- Train the trainer
- Provide easy and free access for teachers and students
- Present realistic results of situations on the ground in similar areas
- Helpful as guidelines for ITPGRFA associated activities

Case studies
- Impart information on specific issues/topics
- Provide examples of lessons learned
- Highlight strengths and weaknesses of actions already taken and help to avoid risks
- Offer guidance on how/where to start collating information
- Can be used in teaching and training

Newsletters
- Provide publicity and visibility
- Impart the latest information
- Easily distributed

Research journals
- Reliable (as peer-reviewed)
- Serve as a basis for policy briefs

- Provide access to information from various applied research studies which can be replicated in other contexts
- Provide detailed descriptions of traits found in publically available germplasm
- Sources of inspiration and innovative ideas
- Useful for skills development

Books
- Provide knowledge enhancement
- Important for training and formal education
- Sources of bibliographic references

44. Figure 13 illustrates the relative importance of 11 specific tools and resources which could either be integral to the Toolbox or accessed via external links. All are considered to be vital by a proportion of the respondents (14–39%), while 37–61% of respondents consider them to be important. There was a degree of uncertainty about the value of the tools and resources—particularly with regard to web-based policy decision tools and an online discussion platform in which to share news, information and knowledge on sustainable use of PGRFA—and a proportion of respondents believe the tools and resources not to be important. However, these opinions are far outweighed by respondents considering them all to be either vital or important. Respondents also provided specific examples of resources they require in order to support their work in sustainable use of PGRFA—information that will inform the design of the Toolbox and the development of new tools in the future (see section 3.3).

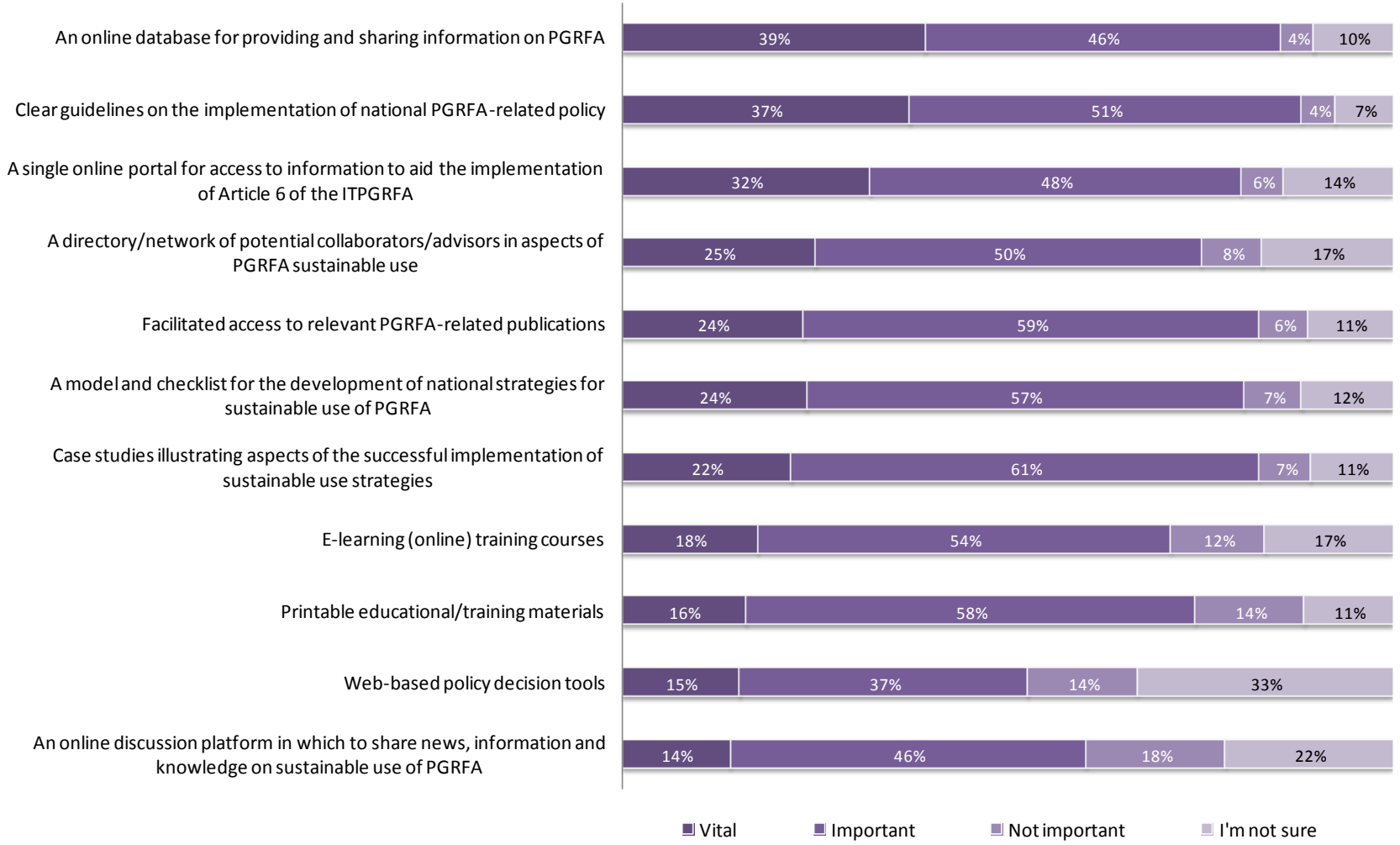


Figure 13. Relative importance of specific tools and resources to assist countries in implementing PGRFA sustainable use strategies (n = 254)

III. FRAMEWORK FOR THE TOOLBOX

Stakeholder needs highlighted by the consultation

45. The high response rate to the electronic consultation may be taken as an indicator in its own right of stakeholder interest in the topic and the need for a toolbox to assist countries in developing and implementing PGRFA sustainable use strategies. The stakeholders who responded either to the whole survey (254 respondents) or part of the survey (271–289 respondents) gave up their time to provide answers to both the mandatory and optional questions, providing a great deal of comprehensive information—no doubt a reflection of the high priority that is currently afforded to addressing aspects of PGRFA conservation and sustainable use, recognizing their critical role in food security and nutrition.

46. Results of the consultation highlight the broad range of stakeholders involved in aspects of PGRFA sustainable use (Fig. 1) and have enabled a deeper understanding of their specific roles and interests which need to be catered for in the Toolbox. For example, responses confirmed that while stakeholders identify with 12 pre-defined categories of roles or interests reflecting aspects of the PGRFA sustainable use system (Fig. 2), they also identify other more specific roles and interests (Table 1), all of which need to be considered in the design of the Toolbox. The survey has also confirmed and allowed a clearer understanding of the 'bottlenecks' in the system—the aspects of PGRFA sustainable use that present the greatest challenges and that demand immediate attention (Fig. 5). In particular, the survey reveals strong concerns regarding policies to promote farmer innovation in plant breeding and marketing opportunities for landraces/farmers' crop varieties. The Toolbox can provide the support required by countries to alleviate these bottlenecks and knowing exactly what they are means that it can be designed accordingly to place emphasis on these areas.

47. Findings of section 3 of the survey provide a deeper comprehension of the constraints and needs regarding the implementation of the sustainable use provisions of the Treaty with regard to developing and implementing national policy, capacity building needs, and access to PGRFA material and associated information required for the development of sustainable use strategies. There is clearly an urgent need to address national policy in support of PGRFA sustainable use since only 17% of respondents indicated that the required policy exists and that it is both comprehensive and effective. More than half of the respondents believe that policy exists but that it does not cover all elements of sustainable use of PGRFA and/or there are problems with its implementation, while 17% consider that national policy in this area does not exist (Fig. 6).

48. Respondents reported that there are many missing policies—particularly those for the recognition and support of informal seed systems, smallholder farmers maintaining local diversity, and regulations governing the certification and marketing of landraces/farmers' varieties, as well as to recognize and support Farmers' Rights, farmer led initiatives/farmer innovation and participatory approaches to crop improvement (Table 3). Further, they consider that a number of stakeholder groups are not supported by existing policies—in particular, farmers. Respondents also highlighted the need for more financial resources, non-financial incentives such as the formal recognition of the role of farmers and local communities in the conservation and sustainable use of PGRFA, and guidance in many areas, including how to develop collaboration between the conservation and breeding sectors. The need for improved coordination between public administrations and/or between the public and industry sectors was also strongly emphasized—for example by establishing national stakeholder committees and encouraging PPP for plant breeding.

49. The majority (84%) of respondents indicated a need for training, institutional strengthening, or both, in order for stakeholders to effectively implement the sustainable use provisions of the Treaty (Fig. 8) and Figure 9 shows that capacity building in all areas of the PGRFA sustainable use spectrum is needed. Analyses of capacity building needs across

stakeholder groups and between and within regions reveals general agreement on needs across groups (Fig. 10) and between and within regions (Box 4; Figs. a–e, Appendix 2), although some variations were detected which may be useful to inform the design of the Toolbox and regional planning and training workshops.

50. Access to plant genetic material and associated information (e.g., information on plant genetic material containing specific traits, conserved plant genetic diversity and potential collaborators for crop improvement programmes) is also a fundamental issue that urgently needs to be addressed in order that countries can move ahead with the development of coordinated and comprehensive sustainable use strategies (Fig. 11). The main constraints relate to a lack of characterization and evaluation of material in a wide range of crop gene pools, inadequate data management in national gene banks, non-targeted germplasm collection strategies, lack of information on PGRFA material and traits in the public domain, the complexities of following the legal steps required to obtain germplasm, and insufficient information on potential collaborators for crop improvement programmes (Table 4).

51. The Toolbox needs to be structured in a way that directs stakeholders to the resources they required to adequately address all of the constraints and needs regarding the implementation of the sustainable use provisions of the Treaty. Since national policy is of fundamental importance to bolster countries' efforts in sustainable use of PGRFA, this aspect of the Toolbox should be given a high level of priority in the short term.

52. The consultation has also confirmed that a wide range of types of resources are important to support the activities of stakeholders, and critically, why specific types of resources are useful and practical (Fig. 11, Box 5), as well as which additional resources are needed (Table 5). All options for specific tools and resources to assist countries in implementing PGRFA sustainable use strategies presented in the survey are considered vital by a minimum of 14–39% of respondents and important by at least 37–61% (Fig. 12). The Toolbox needs to be designed to provide access to all the types of resources which stakeholders have identified as useful and practical and which they consider will be most important to support their PGRFA sustainable use activities.

Toolbox structure and mode of delivery

53. A toolbox must contain appropriate tools and resources which have a defined purpose and which can be easily accessed by its users. If tools are thrown into a box in a haphazard way without any organization, and no training has been given in which tools to use for which job and how to use them, the toolbox is virtually worthless. It is relatively straightforward to identify tools and resources, but more challenging to find the most logical and practical means of organizing them and providing a smooth mode of access. The Toolbox (or the container for the tools) therefore requires careful design and planning to ensure that all the tools required for the job can be accommodated, identified quickly for the task in hand, and easily accessed by whichever stakeholders require them.

54. Not surprisingly, the consultation highlighted the Internet as a vital means for stakeholders to access and share information (Fig. 12). Furthermore, 80% of respondents consider that a single online portal for access to information to aid the implementation of Article 6 is either vital (32%) or important (48%) (Fig. 13). The Internet as a depository for a 'virtual box' in which to put the tools and whose 'lid' is in the guise of an online portal therefore seems the obvious approach to use—indeed, some may consider this the *only* relevant approach in the current Internet age.

55. Therefore, it is proposed that the Toolbox is a web-enabled portal which will be available via hyperlinks from many different websites and web pages. Through this single portal, stakeholders will need to search for the tools they need in order to address the provisions of

Article 6. In other words, once they have arrived at the portal they will effectively have opened the Toolbox 'lid' and will need explicit guidance on which tool or tools to select, how to find them, what they can do with them, and how to use them. This implies the need for a highly structured but simple and user-friendly online platform which caters for the full range of stakeholders and their roles and/or interests in PGRFA sustainable use, ideally providing a different 'view' of the Toolbox depending on the stakeholder community to which the user belongs. It should also be in tune with, and responsive to the major sustainable use 'bottlenecks', bearing in mind that these bottlenecks are not static. As already noted, identifying the actual tools and resources—which may be in the physical form of websites, web pages, and documents and databases published on- and off-line—is relatively straightforward. However, users need to be able to identify which tools are required, place their hands on the tools, and pick them up. Therefore, the lists of relevant resources available need to lead the user to them, and critically, the user needs to be confident that when they have gone to the trouble of locating the box, opening the lid, reading about its contents and how to use it, that when they go to pick up the tool, they will actually find it. Once built, it will be essential that users can provide feedback on their experience of using the Toolbox (as well as to recommend or provide additional resources for inclusion) and that it is adequately funded to ensure its long-term maintenance.

56. Figure 14 is a proposed schema for the Toolbox structure and mode of delivery. The portal providing access points to the tools and resources is enclosed in the dotted line. Core elements of the portal are:

a) A user guide outlining the purpose and scope of the Toolbox and how to use it (Fig. 14 in purple).
b) Multiple cross-linked access points providing internal and external links to tools and resources (Fig. 14 in blue). Access points may be organized according to: a) specific aspects of the PGRFA sustainable use system; b) stakeholder groups and interests; c) access to PGRFA material and associated information; and d) capacity building.
c) Areas for special topics and resources, such as PGRFA-related policy guidelines, an information exchange platform, a directory of potential collaborators, stakeholders' discussion forum, and publications and news feeds (Fig. 14 in green).

57. The design of the portal should allow for additional elements to be added over time—for example, access points for information specifically related to 'bottleneck' areas of the system or critical topics such as addressing the impacts of climate change.

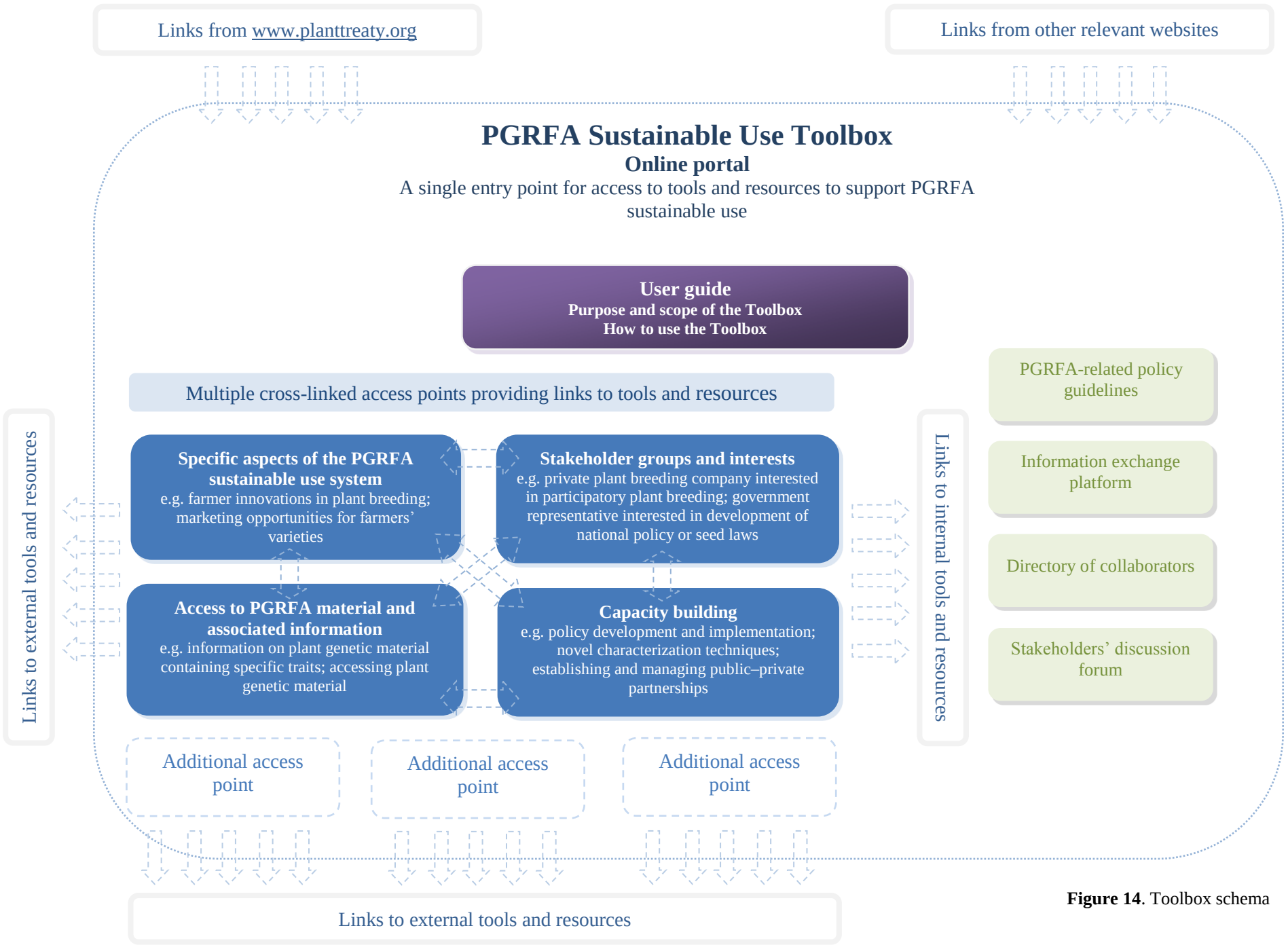


Figure 14. Toolbox schema

Toolbox contents

58. Paragraphs 42–44 describe the types and characteristics of resources required in the Toolbox, highlighting a critical need for facilitated access to a wide range of resource types—in particular, websites, web portals and online databases, but also research journals, training manuals, policy, legal and regulatory documents, case studies, technical reports, books and newsletters (Fig. 12). Other types of resources important for stakeholders are notifications about conferences, field demonstration events, courses and training workshops, as well as access to knowledge networks and social media. Eleven pre-defined specific tools and resources which could either be integral to the Toolbox or accessed via external links were considered vital or important by a large proportion of the survey respondents (Fig. 13) and should therefore be taken forward in the design of the Toolbox.

59. Respondents were also requested to provide examples of resources they require in order to support their work in sustainable use of PGRFA, stating the topic, type of resource and why it is needed. These topics can be broadly classified into those relating to: a) sustainable use policy; b) characterization and evaluation; c) PGRFA conservation techniques; d) adding value to and sustaining the use of landraces/farmers' varieties; e) crop improvement; f) access to PGRFA material and associated information; g) seed systems; and h) communication and awareness (Table 5). Combined with the knowledge gained from the consultation regarding the general types and characteristics of resources required in the Toolbox, the information presented in Table 5 on specific topics, subject categories, types of resources required, and why they are needed will inform its design.

60. Importantly, the Toolbox will as far as possible and practical be designed to cater for the needs of the different stakeholder groups. While most stakeholders are likely to be interested in multiple elements of the sustainable use system and will therefore require tools relating to those elements, some topics are of more direct importance to specific stakeholder groups than others. For example, an individual from a private plant breeding company is likely to be more interested in obtaining information relating to access to PGRFA material or in establishing a participatory plant breeding programme than they are in PGRFA conservation techniques or in communication and awareness. Similarly, a government representative is more likely to be interested in obtaining information about the development and implementation of national policy or seed laws than they are in characterization and evaluation or in crop improvement. A more tailored view for different stakeholder groups is more likely to meet their demands, although of course users will not be restricted to a single view if they wished to explore the Toolbox further.

Table 5. Examples of specific resources required by stakeholders to support their work in sustainable use of PGRFA

Themes and specific topics	Types of resources required	Why the resources are needed
Sustainable use policy		
– Development of national policies for PGRFA sustainable use	– Policy guidelines – Websites	– Lack of skills in policy development
– Implementation of national PGRFA-related policy	– Guidelines	– There is currently a lack of clear guidelines available
– Strengthening national legislation for PGRFA sustainable use	– Case studies – Training materials	– There is currently insufficient information available online
– Implementation of Farmers' Rights in the context of sustainable use of PGRFA	– Background studies – Case studies – Implementation manuals	– Inputs for the design of suitable sustainable use policies/laws/programmes
– Intellectual property implications of the CBD, Nagoya Protocol and UNCTAD[44]	– A handbook for policy-makers – Website	– To provide a basis for training courses (face-to-face and online) – As background material to clarify legal issues – Existing information is highly academic and difficult for practitioners to understand
– Repatriation of PGRFA	– Policy guidelines	– To clarify transfer regulations regarding the provision of material to users in its country of origin
– Impacts of current agricultural policies on PGRFA diversity	– Freely available publications in the same vein as the PROTA series[45]	– To create awareness at the higher education level – To provide a resource for agricultural advisory services
– General information on sustainable use of PGRFA	– Web portal on PGRFA sustainable use	– To have an overview of all elements of PGRFA sustainable use and guidance to develop policies and practices

[44] United Nations Conference on Trade and Development
[45] http://publications.cta.int/en/publications/series/prota-en/

Table 5. Examples of specific resources required by stakeholders to support their work in sustainable use of PGRFA

Themes and specific topics	Types of resources required	Why the resources are needed
Characterization and evaluation		
– Application of novel characterization techniques (e.g., FIGS[46])	– Training materials – Guidelines – Websites – Newsletters	– To increase the value of accessions – Inadequate information available online – Lack of capacity – Specific technology and knowledge transfer is required
– Characterization of genetic resources for key traits	– Database of sources of research funding	– It is currently difficult to access funds for germplasm characterization
– Evaluation technology using molecular techniques	– Training – Cooperative research	– To provide the basis for effective utilization of PGRFA
– Biotic and abiotic stresses evaluation	– Websites – Newsletters – Training materials – Case studies	– To provide information and to exchange experiences
– Characterization and commercialization of indigenous rice varieties	– Research publications	– To benefit from the niche market for indigenous rice varieties
– Crop descriptor lists	– Publications	– Access to standardized crop descriptors
PGRFA conservation techniques		
– Identification of collection sites for target species	– Training materials – Websites	– To improve the representativeness of *ex situ* germplasm collections
– Techniques for effective *in situ* conservation planning	– Websites	– Knowledge is needed on how to select the minimum number of populations which would represent the maximum genetic diversity of species *in situ*

[46] Focused Identification of Germplasm Strategy

Table 5. Examples of specific resources required by stakeholders to support their work in sustainable use of PGRFA

Themes and specific topics	Types of resources required	Why the resources are needed
– Conservation of PGRFA	– Contacts for in-country training	– Staff training for capacity building in conservation techniques
– Molecular studies and field procedures for *in situ* conservation of PGRFA	– Facilitated access to scientific journals	– Resources are limited for subscription to scientific journals
– Participatory/field procedures for *in situ* PGRFA conservation	– Technical documents – Case studies	– Although these can be accessed through the Bioversity website, the latest FAO technical reports are not always easily available – To keep up with the latest methodologies
– Tools and standards for practical PGRFA conservation and documentation	– Technical guidance	– As IPGRI no longer exists, there is no dedicated institute providing support and coordinating PGR conservation activities
– Long term seed storage for a diverse range of species	– Newsletters – Books – Journals – Reports etc. – Case studies	– To help overcome difficulties in establishing optimal *ex situ* conservation regimes for under-utilized crops and CWR
Adding value to and sustaining the use of landraces/farmers' varieties		
– Promoting conservation and sustainable utilization of landraces/farmers' varieties	– Examples of incentive mechanisms developed and applied in other countries and communities – Inventories of landraces maintained *in situ* – Websites – Newsletters – Training materials – Policy guidelines – Case studies	– To increase interest in the utilization of farmers' varieties – To provide evidence for advocacy – To increase awareness – To illustrate to decision-makers how policies can be implemented

Table 5. Examples of specific resources required by stakeholders to support their work in sustainable use of PGRFA

Themes and specific topics	Types of resources required	Why the resources are needed
– Marketing of farmers' seeds	– Case studies	– To understand and implement marketing of farmers' seeds: organization, production, business plan, profitability, benefits for food security etc.
– Multiplication of farmers' varieties for wider distribution	– Contacts for in-country training	– To encourage farmers to be involved in conserving local diversity – To provide economic incentives
– Methods to for introduction of PGRFA on-farm	– Training materials	– Specific knowledge of genetic resources and agro- ecosystems is required
– Collection of traditional knowledge of PGRFA	– Case studies	– To understand how to collect traditional knowledge in the field
Crop improvement		
– Participatory plant breeding	– Training materials in different languages for scientists, farmers and facilitators – Contacts for in-country training – Guidelines – Case studies – Research reports – Technical documents – Videos	– To enhancing PPB knowledge and skills – To assist all stakeholders in understanding and implementing PPB – For agricultural extension practitioners (agronomists) to understand techniques for conservation, use and improvement of crops for adaptation to climate change
– Innovative approaches for pre-breeding (e.g., using nested-association mapping – NAM, 'speed breeding' and double haploid technology)	– Guidelines – Training materials – Technical documents – Case studies	– To speed up the identification and deployment of novel alleles into new varieties – To address the bottleneck caused by insufficient genetic diversity available in élite germplasm

Table 5. Examples of specific resources required by stakeholders to support their work in sustainable use of PGRFA

Themes and specific topics	Types of resources required	Why the resources are needed
Access to PGRFA material and associated information		
– Facilitated access to PGRFA	– Website – Database	– To access information on country-specific legislation and rules regarding access to and use of PGRFA (i.e., whether PIC and MTAs are required and what the process is for obtaining them)
– Information on national PGRFA diversity	– National inventories of PGRFA *in situ* and *ex situ*	– To provide information about PGRFA available for use
– National PGRFA registered in the MLS	– Publicly available national register	– To know which germplasm can be exchanged without legal restrictions
– Documentation and national information system development	– Training materials – Contacts for in-country training	– Expertise is currently lacking
Seed systems		
– Community seed banks and community-based seed production	– Guidelines – Training manual – Case studies – Newsletters – Websites	– To support seed entrepreneurship by farmer groups for economic empowerment – For farmers and their organizations to learn from other experiences in regional, global or national conservation actions, regulations, and use and renewal of local germplasm
– Local seed systems and seed legislation	– Case studies	– To provide successful examples to inform their establishment in other areas
– Seed distribution/exchange	– Seed exchange website	– There is limited access for the private sector to new crop varieties

Table 5. Examples of specific resources required by stakeholders to support their work in sustainable use of PGRFA

Themes and specific topics	Types of resources required	Why the resources are needed
Collaboration/partnerships		
– Establishing partnerships with research institutes – Network of collaborators	– Network of potential collaborators (e.g., the European Agrobiodiversity Network[47]) – Websites – Online databases	– To promote and undertake research to develop agrobiodiversity knowledge – To establish collaborative initiatives such as research consortia to avoid duplication of efforts
Communication and awareness		
– Promoting the nutrition value of PGRFA	– Training – Technology transfer – Network cooperation	– There is a lack of trained personnel and knowledge of relevant technologies
– Promoting the importance of landrace and CWR conservation and utilization	– Case studies	– The best way to convince people of the importance of PGRFA is through the use of concrete examples
– The importance of NUS for sustainable agriculture	– Species-specific information on effective cultivation, production, processing and potential markets	– There is currently little information available
– Taxonomic information on crop gene pools	– Publications	– To aid communication and awareness of the importance of diversity in crop gene pools

[47] www.agrobiodiversity.net/

IV. CONCLUSION

61. Results of the stakeholder consultation have enabled a better understanding of the needs of a wide range of interest groups, organizations and individuals regarding the provision of support for their PGRFA sustainable use activities. They have also allowed a clearer understanding of the 'bottlenecks' in the sustainable use system—in particular, there is a critical need to address limitations regarding policy in support of sustainable use activities, capacity building needs, and access to plant genetic material and associated information. The consultation also confirmed that a wide range of types of resources are important to support the activities of stakeholders, and critically, why specific types of resources are useful and practical, as well as which additional resources are needed. Based on the results of this consultation and earlier deliberations about the development of the Toolbox, a proposed outline of its preliminary structure, content and mode of delivery has been presented.

62. In collaboration with other stakeholders and subject to the availability of financial resources, the Toolbox should be finalized and published by 2017 in all the working languages of FAO as contained in the revised Programme of Work on Sustainable Use of PGRFA (Table 1 – document IT/GB-6/15/12)[48]. In accordance with the same Programme of Work, an online portal will be built aiming to collect and share experiences on the implementation of the Toolbox, and should be completed by 2019.

[48] Components and expected results (2017/2019) of the Programme of Work on Sustainable Use of Plant Genetic Resources for Food and Agriculture and Supporting Initiatives.

APPENDIX 1. ITPGRFA ARTICLE 6 – SUSTAINABLE USE OF PLANT GENETIC RESOURCES

6.1 The Contracting Parties shall develop and maintain appropriate policy and legal measures that promote the sustainable use of plant genetic resources for food and agriculture.

6.2 The sustainable use of plant genetic resources for food and agriculture may include such measures as:

a) pursuing fair agricultural policies that promote, as appropriate, the development and maintenance of diverse farming systems that enhance the sustainable use of agricultural biological diversity and other natural resources;
b) strengthening research which enhances and conserves biological diversity by maximizing intra- and inter-specific variation for the benefit of farmers, especially those who generate and use their own varieties and apply ecological principles in maintaining soil fertility and in combating diseases, weeds and pests;
c) promoting, as appropriate, plant breeding efforts which, with the participation of farmers, particularly in developing countries, strengthen the capacity to develop varieties particularly adapted to social, economic and ecological conditions, including in marginal areas;
d) broadening the genetic base of crops and increasing the range of genetic diversity available to farmers;
e) promoting, as appropriate, the expanded use of local and locally adapted crops, varieties and underutilized species;
f) supporting, as appropriate, the wider use of diversity of varieties and species in on-farm management, conservation and sustainable use of crops and creating strong links to plant breeding and agricultural development in order to reduce crop vulnerability and genetic erosion, and promote increased world food production compatible with sustainable development; and
g) reviewing, and, as appropriate, adjusting breeding strategies and regulations concerning variety release and seed distribution.

APPENDIX 2. CAPACITY BUILDING NEEDS BY REGION AND SUB-REGION

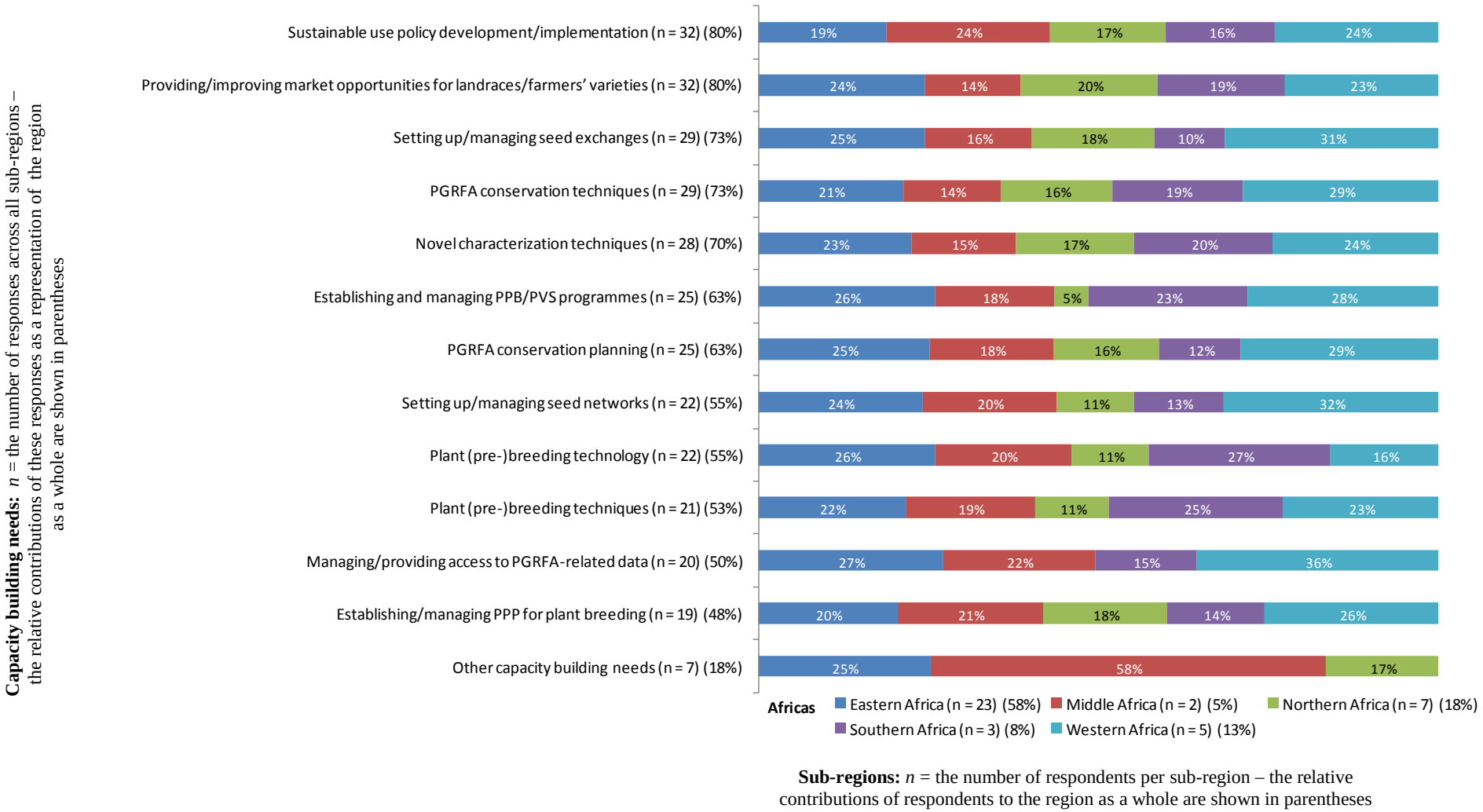


Figure a. Relative contributions to the capacity building needs identified, by sub-regions – Africas (based on the responses of 40 survey participants)

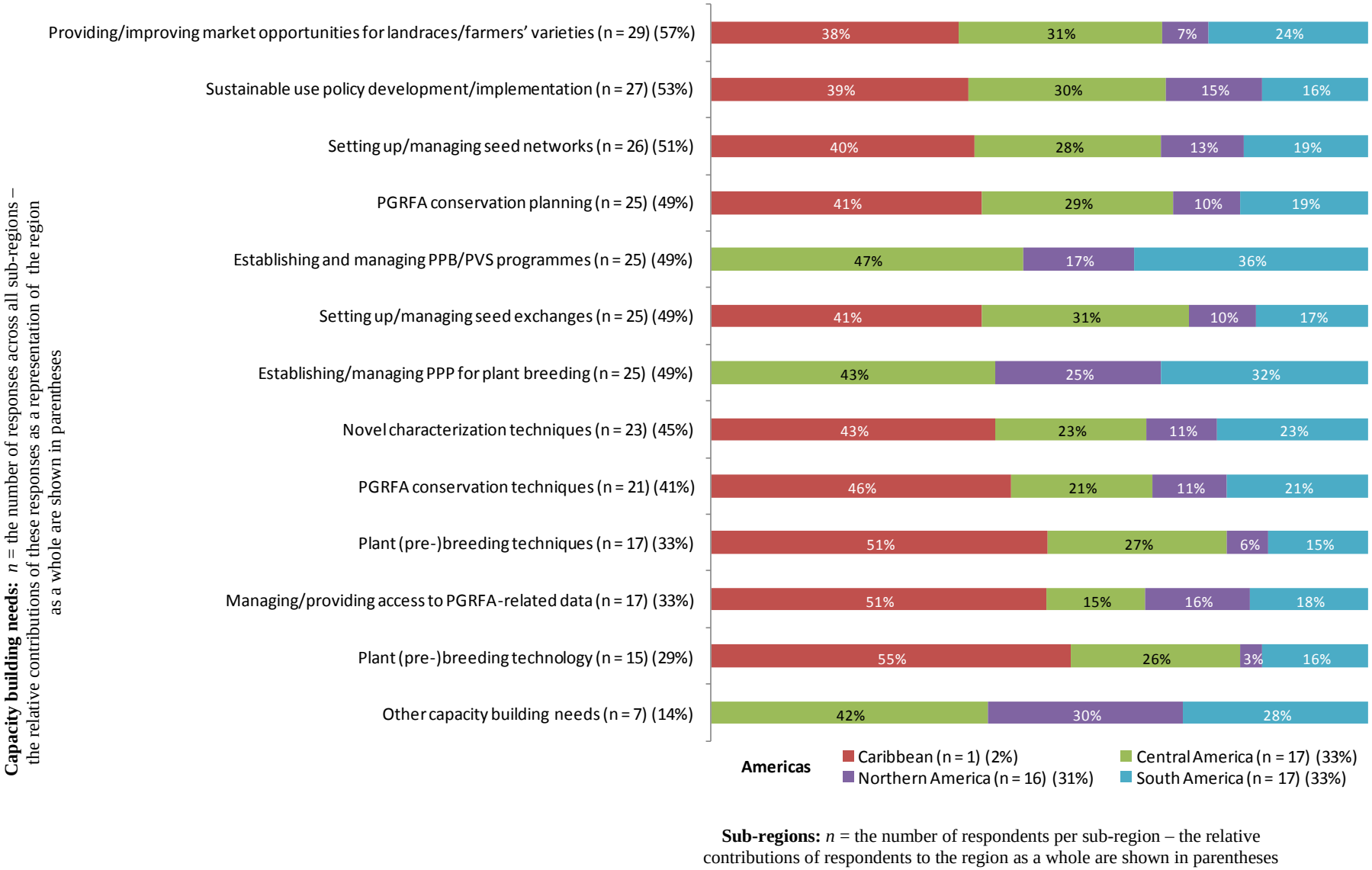


Figure b. Relative contributions to the capacity building needs identified, by sub-regions – Americas (based on the responses of 51 survey participants)

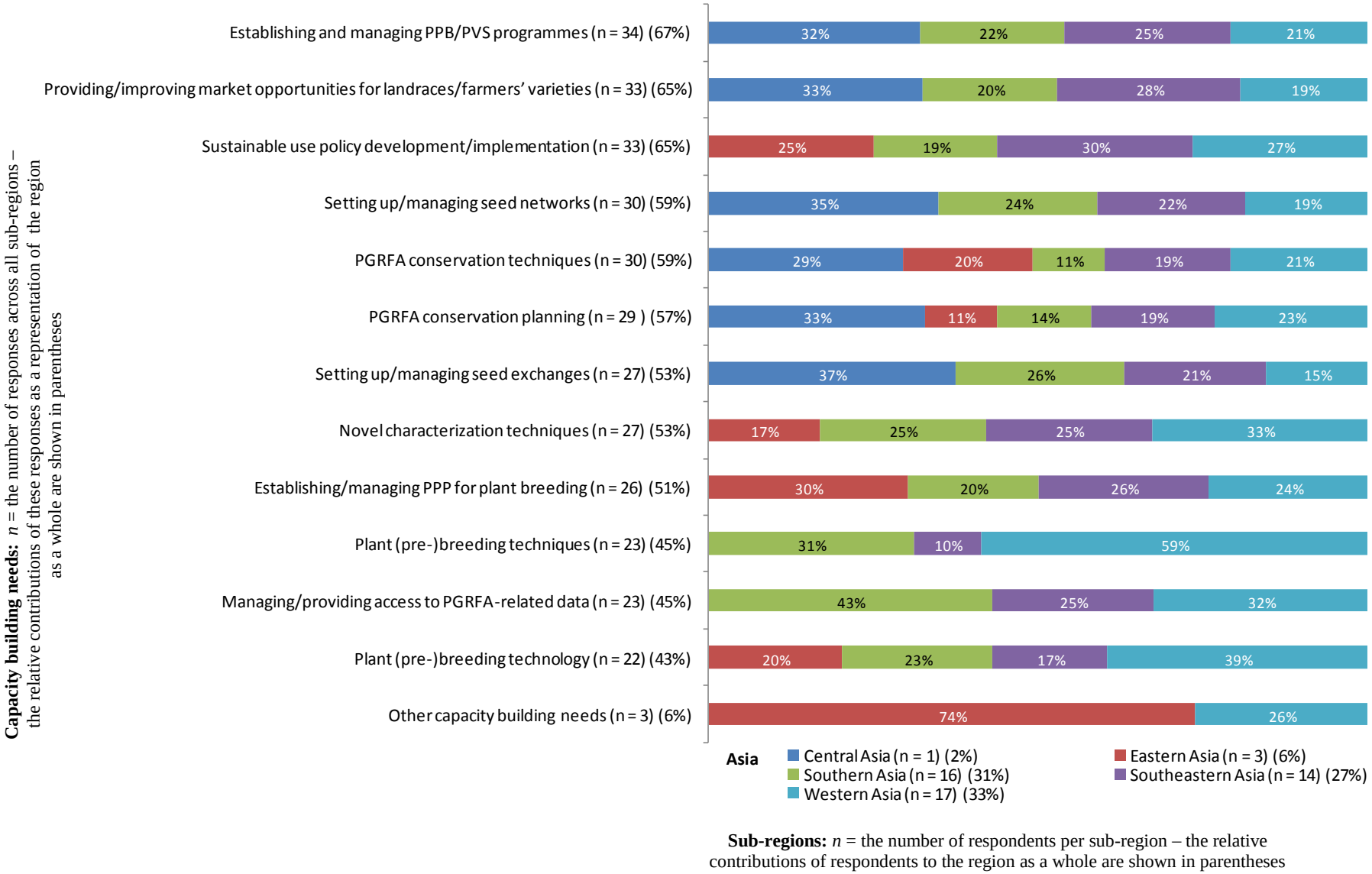


Figure c. Relative contributions to the capacity building needs identified, by sub-regions – Asia (based on the responses of 51 survey participants)

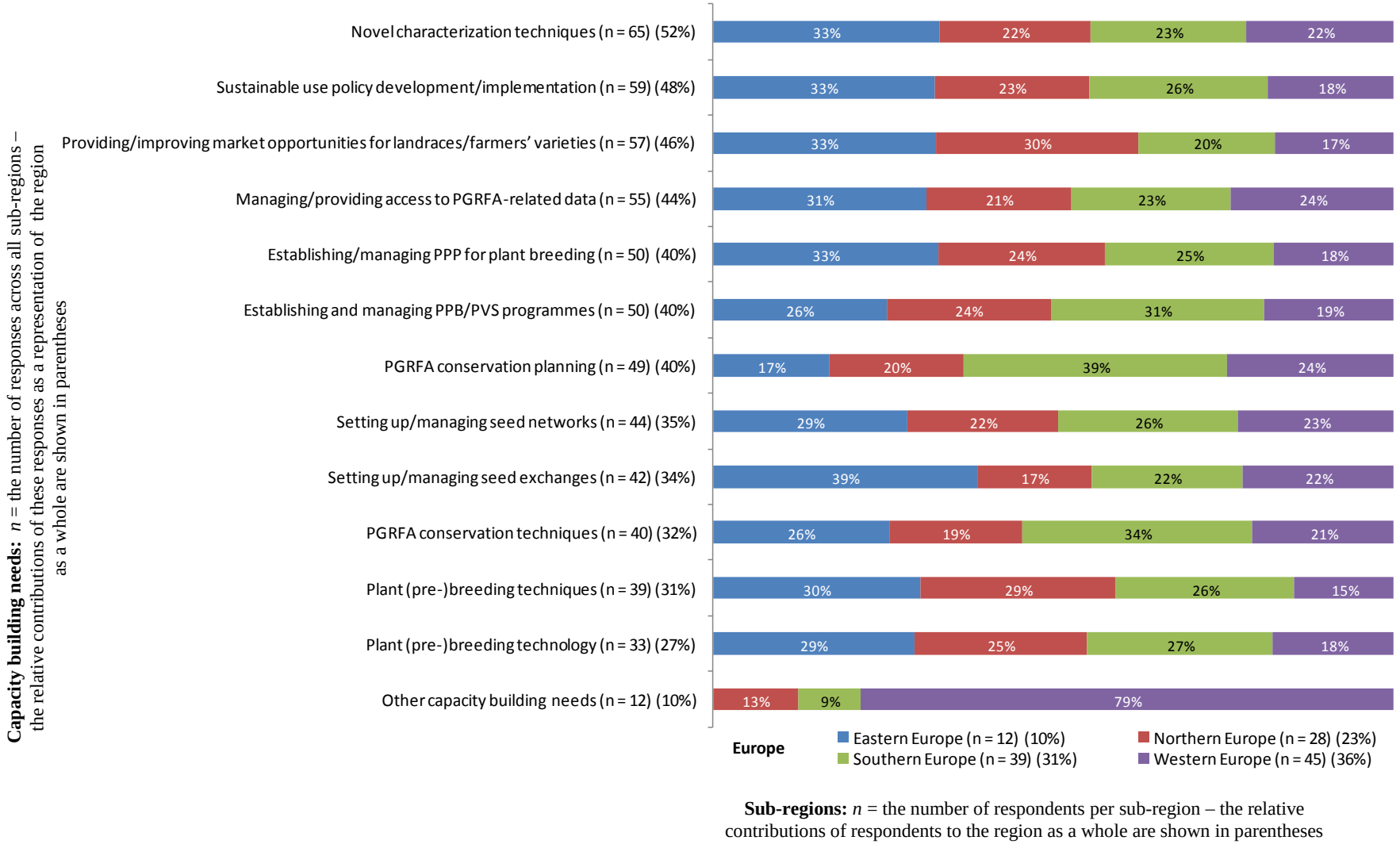


Figure d. Relative contributions to the capacity building needs identified, by sub-regions – Europe (based on the responses of 124 survey participants)

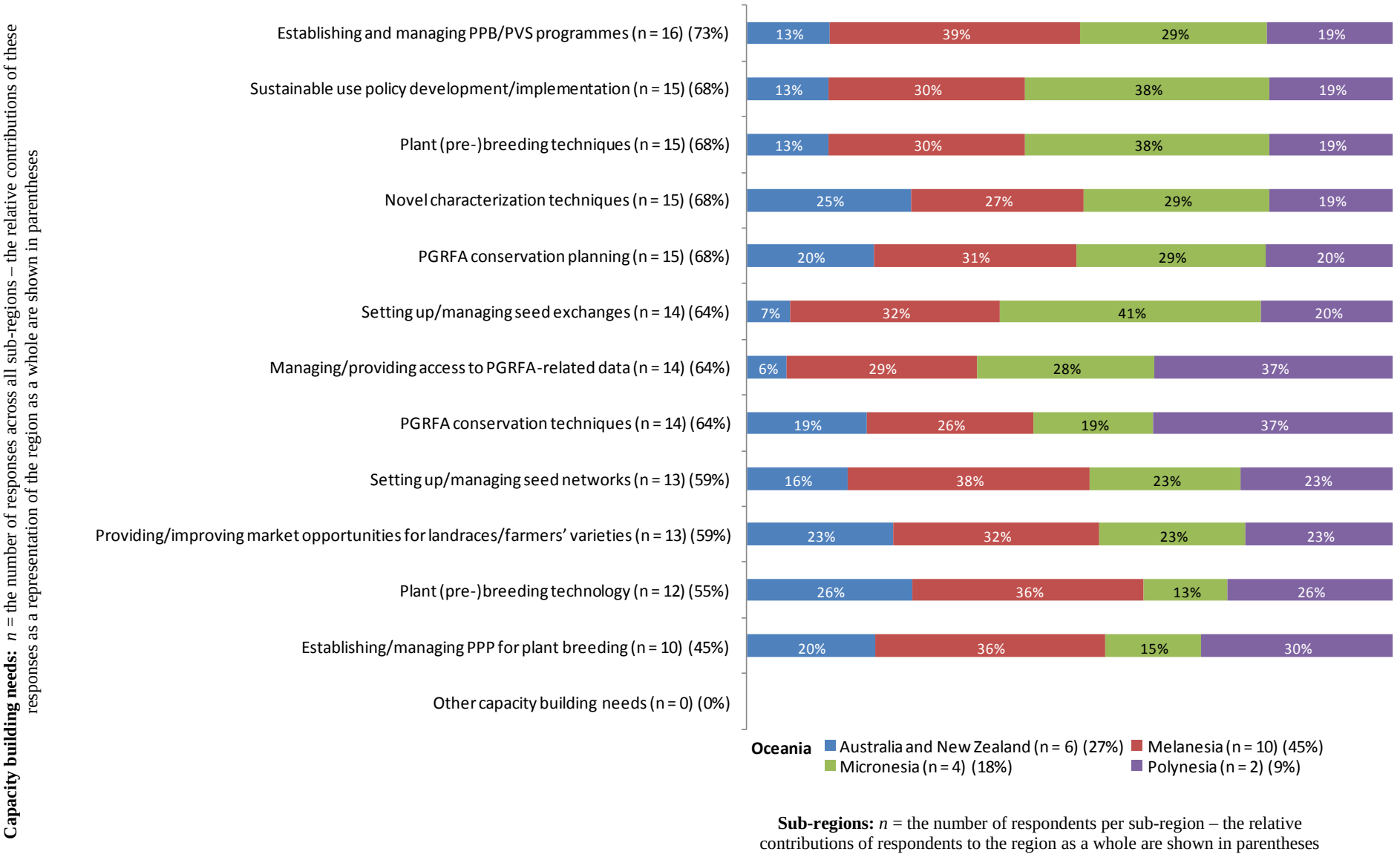


Figure e. Relative contributions to the capacity building needs identified, by sub-regions – Oceania (based on the responses of 22 survey participants)