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Generation Challenge Programme

Partnerships in modern crop breeding for food security

DRAFT FOR DISCUSSION

IV. White papers on GCP communications and knowledge sharing:

Paper No 8: GCP's scientific and social network

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Acronyms, short names and abbreviations

<i>Alt_{SB}</i>	major Al tolerance gene in sorghum cross BR007 × SC283
CAPs	Coordinated Agricultural Projects, USA (of the United States Department of Agriculture)
CEO	Chief Executive Officer
CGIAR	No longer an acronym but a name <i>(formerly Consultative Group on International Agricultural Research)</i>
CGIAR Consortium	CGIAR Consortium of International Agricultural Research Centers <i>(also Consortium; one of two bodies of CGIAR)</i>
CoPs	communities of practice
CRPs	CGIAR Research Programmes
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuária, Brazil <i>(Brazilian Agricultural Research Corporation)</i>
FAO	Food and Agriculture Organization of the United Nations
GCP	Generation Challenge Programme (of the CGIAR)
GIPB	Global Partnership Initiative for Plant Breeding Capacity Building (of FAO)
IBP	Integrated Breeding Platform (of GCP)

Background and process

A series of white papers are being drafted by the CGIAR Generation Challenge Programme (GCP) team in collaboration with external experts. The goals are to communicate the outputs and deliverables from each research component during 2004–2014 and to explore options for enabling and ensuring that the potential benefits of these components will be fully realised in the future. At this stage, the white papers are really a first analysis for internal use.¹ They are expected to evolve over time, shaped by progress made during GCP's remaining time and by the evolution of international agricultural research for development, particularly in terms of the 'moving landscape' of socioeconomic, political and environmental issues in which operate the research portfolio of the CGIAR Consortium of 15 Centres and the CGIAR Research Programmes (CRPs). Each white paper is designed to contribute to GCP's orderly closure in 2014 by considering the following three questions:

1. What assets will be completed by the end of GCP's lifetime in December 2014?
2. What assets can best continue as integral components of the new CRPs or elsewhere?
3. What assets may not fit within existing institutions or programmes and may require alternative implementation mechanisms?

This paper focuses on the outputs and options for GCP's scientific and social network component. Outputs have been achieved through (a) collaborative work among three sets of actors: a broad network of partners in regional and country research programmes, the CGIAR and academia; and (b) through capacity enhancement to assist developing-world researchers to tap into new genetic diversity and access modern breeding tools and services. GCP research activities have produced the research products described below².

Introduction

GCP links basic science with applied research through a broad network of plant scientists from diverse backgrounds, working in regional and country research programmes and at CGIAR Centres, in academia and other research institutes. This network generates knowledge, explores new allelic diversity and develops practical tools (eg, molecular markers for desirable traits) to increase the efficiency of plant breeding in developing countries. Through this network, GCP achieves its mission of using genetic diversity and advanced plant science to improve crops for greater food security in the developing world.

The first GCP External Programme and Management Review conducted in 2007 captures this 'people' essence of GCP in its conclusion:

Perhaps the most important value of GCP thus far, is the opportunities it has provided for people of diverse backgrounds to think collectively about solutions to complex problems and in the process to learn from one another.

Indeed, formal presentations by, and informal conversations with, GCP collaborators have both clearly confirmed that these partnerships initiated and nurtured by GCP are greatly valued. In fact,

¹ This GCP white paper, like the others in this series, is not a conclusive static document. Rather, it will continue to grow and evolve as the processes of evaluation and deliberations advance toward GCP's closure in 2014.

² GCP is supported by [an array of funders](#). See also [descriptions of products](#) and of [the institutions that produced them](#).

some consider partnerships to be the most enduring legacy of the Programme; they bring together players in crop research that may otherwise never have worked together, and infuse them with what was described at the 2011 General Research Meeting as ‘the GCP spirit’.

Activities and project outputs

Partnerships

The premium placed on partnerships is reflected in GCP’s Phase II tagline: ‘Partnerships in modern crop breeding for food security’. This is affirmed by a series of interviews with five people who traced GCP from its early days; ‘partnerships’ consistently appeared as a [recurring theme](#).

GCP’s work has evolved through time, moving from discovery and exploration, which defined Phase I, to emphasising application and impact, which describes Phase II. Project implementation has evolved in tandem, with developing-country partners taking on project leadership as the CGIAR and developed-country partners assumed mentorship and support roles, with corresponding realignment in budget allocation. This shift has only been possible as a result of the enhanced technical capacity and professional exposure facilitated by the collaborative networks that GCP promotes.

The collaborative partnerships and networks primarily aim to achieve the following objectives, and have done so to varying degrees:

- Promote the application of molecular breeding techniques, and use of the related information management technologies.
- Enhance data and germplasm sharing.
- Generally facilitate and accelerate a paradigm shift to a more collaborative approach to breeding that is outward looking and technology enhanced.
- Promote interaction between scientists working on a common crop, help build alliances and facilitate coordination and synergy of research initiatives by members.
- Map existing knowledge and identify gaps for proactive interventions, and promote innovation by creating new knowledge and developing new capabilities.
- Facilitate the sharing of both information and experience for problem solving.
- Promote the building of a shared repertoire of resources, tools and methodologies.
- Standardise professional practices by promoting and supporting best practice.

The GCP scientific and social networks coalesce around several nodes. The resulting overlapping functions serve to advance modern breeding capacity and adoption by linking developing-country breeding programmes and research organisations with CGIAR Centres and advanced research institutes.

Productive, project-based, crop-research partnerships

A typical GCP research project brings together partners from the CGIAR, developing countries and developed countries. This includes partners in regional and national programmes, as well as from academia. The partnerships and networks thus created revolve around the specific projects, and effectively continue through the project’s lifetime.

As an example, in GCP Phase I, partners at EMBRAPA in Brazil and Cornell University in USA, working on sorghum, successfully identified contrasting genotypes for aluminium tolerance. They then cloned a major gene for aluminium toxicity resistance by screening a diverse panel of lines and landraces. Elite alleles for this gene, *Alt_{SB}*, were identified and introduced into Brazil’s elite sorghum.

Efforts are now underway, in collaboration with national agricultural research institutes, to transfer these same alleles into African germplasm.

The Integrated Breeding Platform user cases

The user cases comprise 14 marker-assisted breeding projects for eight crops in 32 developing countries in Africa and Asia. These projects, as with other GCP projects, bring together transnational, multi-institutional and interdisciplinary teams. These pioneer users of the Platform exemplify cross-crop, cross-project partnerships and networks. They help develop a common repertoire of tools, services and knowledge resources – useful to all – collaborating in the design and testing of IBP's services and informatics tools.

Their work, both on their primary objectives and on IBP-related tasks, is illustrative of the power of collaborative networks, ensuring that the Platform's informatics tools and services are optimised for different crops, different operational environments and different user requirements. Their feedback in the design stage was pivotal for developing (a) the user-friendly Integrated Breeding Configurable Workflow System, which enables users to access data management; and (b) analysis and decision-support software at different stages of the breeding process. The software provides a customisable decision roadmap, thus enabling efficient and convenient use of standardised structures and protocols.

Hosted online crop-based communities and professional networks

GCP has established nascent crop-based communities, which are hosted on the IBP Portal because it provides purpose-built and customised community-interaction tools. These communities are intended to be project-independent and a long-term means for promoting the application of molecular breeding techniques and use of facilitative information management technologies. They will hopefully enhance the sharing of data and germplasm, and generally facilitate and accelerate a paradigm shift to a more collaborative approach to breeding that is also outward looking and technology enhanced. Thus far, and even before the public launch, the IBP Portal already has 364 members in its crop and professional communities (details in Annex below).

The communities are designed to promote long-term organic or spontaneous interaction between scientists working on a common crop (rather than a common project), that is, to help build alliances and facilitate coordination and synergy of research initiatives. At present, the core of these communities is the Platform's user cases, but the circle is gradually broadening beyond these pioneers. More details are given in *Annex 1 – Breeding Information and Communities of Practice* in the white paper on the Integrated Breeding Platform.

One professional network, for research data management, is similarly hosted on the Portal – and will, in coming months, be joined by another on agricultural genomics. As with the communities, these professional networks aim to facilitate mutually beneficial long-term interaction between crop scientists from a common discipline but who may not be working on a common project or even geographical region.

Social media communities

As well as hosting online communities, as described above, GCP is reaching out to new audiences through social media. This new venture was initiated in 2012 and is therefore still in its infancy. Prospects are promising, as discerned from marked increase in GCP web traffic, as reported in more detail in the white paper on GCP Institutional memory.

These social media communities are expected to broaden and overlap with the IBP-hosted communities once the Platform is officially launched and opened up to all users. The IBP Portal is

designed as a virtual workplace for breeders and other crop professionals and has much more dynamic content. Thus, the activity of one and the dynamism of the other would reinforce each other, building vibrant partnerships and collaborative networks.

Preliminary statistics demonstrate the potential of this positive development of mutual reinforcement happening between the website and social media: using Facebook as an indicator, the demographics of who 'likes' us shows that GCP is reaching professionals in their prime productive age (the 25–54 age group; for comparative statistics, see the Annex at the end of this paper).

Post-GCP sustainability and projected impact

Several project-based partnerships that GCP engineered to meet Programme objectives have turned 'organic'. That is, the diverse partners that GCP brought together are now collaborating in other joint ventures, independent of GCP. This is profoundly appreciated by GCP collaborators, as evidenced by this comment from a participant at the 2011 General Research Meeting:

The networking opportunities were an outstanding part of the meeting. For example, I got to meet a number of my potential African partners for the first time. And to reconnect with colleagues. This resulted in a number of new potential research collaborations – some of them even beyond the scope of GCP.

Such partnerships may possibly continue post-GCP under their own steam, provided that opportunities continue to be provided and facilitated for mutually beneficial interactions between current and potential collaborators.

The IBP-hosted crop communities and networks are particularly targeted to benefit breeding programmes in developing countries, where their impact is potentially large in the area of knowledge-sharing, information dissemination and capacity building. Given the relatively small numbers of crop scientists in developing countries, the CoPs are expected to draw advantage from economies of scale to secure resources and opportunities for members. CoPs are also expected to engage in advocacy to build a positive environment – in policy-making, statutory and regulatory terms – that promotes food security and improved livelihoods for agriculture-dependent households.

Most developing-country research or breeding programmes are under-resourced. Thus, for the foreseeable future, resources may need to be specifically allocated towards building these partnerships and networks, a task that the CGIAR Consortium is willing to undertake. The Consortium, however, may need to underpin this task firmly with policies that are deliberately designed and implemented to facilitate developing-country partners' greater participation in international agricultural research initiatives. These policies should also put developing-country partners on an equal footing with their colleagues in the CGIAR Centres, CRPs and developed-country institutes.

A vibrant molecular breeding research community would be a significant impact indicator for the 10 years of GCP work. The ideal would be a community of developing-country breeders who routinely use molecular breeding to improve crop productivity and contribute to food security and poverty alleviation. This would be GCP's added value: communities that can bring together into a more valuable whole GCP's various outputs, including its genomic and genetic resources, improved germplasm, comprehensive and conveniently accessible crop breeding information, informatics tools, breeding and support services, learning resources, and enhanced human resource capacity and infrastructure.

One of GCP's major objectives – and now a major achievement – was to bring scientists from different horizons, and with different skills, to work together in unity. Thus, the Programme bridged the well-known gap that can arise between upstream research conducted by advanced research institutes including academia on the one hand, and applied research on the other hand. By doing so, the Programme enabled biotechnology to create concrete impact on plant breeding efficiency in developing countries. GCP's social capital assets are difficult to quantify objectively and identifying impact indicators to evaluate success is therefore challenging. Possible questions for assessing the value of the GCP-brokered partnerships include:

- Will the teams continue working together after GCP?
- As a result, have they been able to source new funding, separate from GCP funding?*
- Does conducting research through partnerships bring about distinct advantages that otherwise would not have been obtained?
- Have all the collaborators generally gained from the association?
- Have individual, ambitious, talented researchers had significant upward and career-altering outcomes?*
- Has there been institutional or national recognition of the individual researcher's international links and enterprise?*

(Note: Assessing those factors marked with an asterisk () above can be extremely complex, as candour can be compromised at the institutional level – through fear of losing 'secured' future GCP or other future funding – and at the individual level, through jealousy and hostility from peers or administrators.)*

That the impact of GCP's successful scientific and social networks is, without doubt, large is borne out by anecdotal feedback from the current GCP community, the scientific achievements made possible through collaboration across institutes, the dedication and willingness of people from universities and CGIAR Centres to help and mentor colleagues in developing countries, and the way these self-same colleagues are now emerging as leaders in most GCP research activities.

On a relative scale of 1 to 5, where 5 represents the largest impact across all kinds of GCP products, regardless of activity or crop, and 0 no impact, all GCP's efforts in network-building are estimated to have an impact factor of 4 to 5. Such a high score indicates that this activity is a 'must-have' to promote adoption of, access to and use of modern breeding in developing countries in a sustainable way.

Analysing the post-GCP placement of networks and communities

What will have been completed by December 2014

By December 2014, six crop communities of practice (on beans, cassava, chickpeas, cowpeas & soya beans, rice, sorghum) and two discipline-based professional networks (data management and genomics) will have been launched, and taking their first steps. These crop communities are expected to grow once the IBP Portal is officially launched and the Platform opened to a wider public. After the public launch, a strategic, structured and sustained campaign will be conducted to promote these communities, including through social media.

Extending activities to CRPs, Centres or other institutes

Any crop research projects undertaken under the aegis of GCP and not completed by the Programme's closure in 2014 will be incorporated into the CRPs. Measures to ensure this have already been implemented. Such incorporation will also absorb the GCP research partnerships and networks built around those projects, sustaining them for as long as those projects continue to run.

As observed in the previous section, self-propelling 'organic' partnerships may then grow from those projects.

The IBP user cases will have completed their mission at the end of the IBP project in 2014. However, the crop information, informatics tools and services available on the Platform will need continuous development and upgrading to meet new and emerging needs and technologies. To ensure continued focus on the practical needs of the target groups, a close relationship with real-life breeding projects – similar to the present relationship with the user cases – is highly desirable.

The crop-based communities, which as explained, are project-independent and target the longer term, could probably also find a home in the respective crop CRPs or CGIAR Lead Centres. However, this would work only where the Centres or CRPs implement deliberate policies and resource allocation practices that would promote the establishment and development of these communities. This is especially true for the incorporation and active participation of developing-country scientists who are in greatest need of them and stand to benefit the most. This would include establishing both online and offline facilities and structures to enable collaboration, interaction and exchanges between community members.

However, given the envisioned close relationship between these communities and the IBP, their successful placement will depend on the post-GCP placement of the Platform. Indeed, the idea is to build the communities around the development and use of Platform resources – the recommendation is therefore that both communities and Platform be placed together. If they are placed separately, significant benefits would be lost, as described in the white paper on the Integrated Breeding Platform.

The thematic and discipline-based communities or professional networks, being crosscutting in nature, could find a home in the CGIAR Consortium. However, once again, they would best be served wherever the IBP and crop communities would be placed – as they would then have seamless access to both their research clients and community-building and interaction tools.

A bridge or link to the social media networks that GCP is building will also need to be sustained because of the networks' enriching overlap with the hosted communities. Again, how this bridge or link is maintained will be determined by the post-GCP placement of the hosted communities and the Integrated Breeding Platform.

Embedding the work in a new entity

Another alternative for the GCP scientific and social networks is to assume that the IBP will survive beyond December 2014 in an integrated and comprehensive way. Thus, an entity can inherit the Platform's accumulated information and community-building and interaction tools, incorporating them as part of its core functions. The entity can then both add to the stock of information while broadening the audience that this information reaches. Being part of the entity's core functions, these activities would benefit from the most efficacious technologies and optimal allocation of resources.

Conclusion

Critical sections of the GCP website will be archived as appropriate and social media accounts cease to be active, as has been outlined in the paper.

GCP's partnerships can be segmented in different ways, with each way having a slightly different perspective for evolution beyond December 2014. Partnerships at the project level will most likely

be extended through the CRPs or any new projects that will be natural extensions of current GCP activities. Crop-based partnerships, including CoPs, can find a home at the CRP level if active partnerships are a core requirement (which is likely, according to the CEO of the CGIAR Consortium). Other possibilities include moving these crop communities to other large crop-breeding initiatives, such as those supported by the Bill & Melinda Gates Foundation, or hooking up with existing crop research networks such as the CAPs of the US Department of Agriculture. The undergirding idea is to enable and ensure that the potential benefits of these partnerships will be fully realised in the future.

The more thematic partnerships – mainly the molecular breeding community that is today at the heart of the GCP research network – will need to find a home at some crosscutting platform with strong capacity-building and networking components within or outside the CGIAR. Of course, the IBP would be a perfect fit here. Other options like universities or platforms such as FAO's GIPB should also be considered. However, the lack of a direct and dedicated connection to a large research component might be an issue.

Finally, should IBP evolve towards a lively and comprehensive platform, serving a broad and diverse community of users and focusing on scientists in developing countries, it would become an obvious and natural home for most of GCP's current communities and networks. It would have a research component that includes specific CB activities targeted at scientists from developing countries to enable them to participate more in the arena of modern breeding (see the white paper on IBP). Such a community would be a real and invaluable outcome, with substantial benefits for individual and institutional growth and all contributing to improved food security in developing countries.

Further analysis will only be possible once it is clearer what the post-GCP era would look like.

Annex: IBP online communities and Facebook demographics on 'likes'

IBP online communities and professional network

As at August 2012, the IBP Portal had a total of 364 members registered in its nine crop communities and one professional network.

Breakdown of membership to the online communities and professional network

<i>Community</i>	<i>Members (no.)</i>	<i>Community</i>	<i>Members (no.)</i>
Beans	37	Maize	33
Cassava	47	Rice	42
Chickpeas	46	Sorghum	33
Cowpeas	35	Wheat	28
Groundnuts	23		
<i>Network</i>			
Data management	40		

Facebook demographics

The peak point of the demographic curve, as represented in red boldface in the table below, indicates that, of all the 'likes' on Facebook, 84.3% come from the 25–54 age group. This indicates that GCP is reaching individuals at their professional height.

Facebook demographics for the period 16 February to 15 May 2012

<i>Age group (in years)</i>	<i>Facebook users who 'like' GCP (%)</i>		
	<i>Female</i>	<i>Male</i>	<i>Total</i>
13–17	0.8	0	0.8
18–24	2.5	5.0	7.5
25–34	21.5	20.7	42.2
35–44	10.7	14.9	25.6
45–54	5.8	10.7	16.5
55–64	2.5	2.5	5.0
65+	0	0	0
	Total	Total	Total
	43.8	53.7	97.5

SOURCE: Facebook