Independent Science for Development Council

CGIAR

Identifying and Using CGIAR's Comparative Advantage

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Credit: CGIAR IRRI

Contents

About the Independent Science for Development Council

The Independent Science for Development Council (ISDC) is a standing panel of impartial, world-class scientific experts who provide rigorous, independent strategic advice to the CGIAR System Council and other stakeholders. Membership was established in October 2019 and 2022 membership consisted of Holger Meinke (chair), Nompumelelo H. Obokoh (vice chair), Fetien Abay Abera, Andrew Ash, Chris Barrett, Magali Garcia, Suneetha Kadiyala, and Lesley Torrance. In order to operate, ISDC receives operational support from its secretariat, which is part of CGIAR's Independent Advisory and Evaluation Service (IAES) and hosted at the Rome, Italy, office of the Alliance of Bioversity International and the International Tropical Agricultural Research Center.

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Executive Summary

Comparative Advantage (CA) is one of the most powerful theoretical insights in economics. It provides a useful framework for identifying areas where CGIAR's efforts are most crucial to achieving its mission—to deliver science and innovation that advance the transformation of food, land, and water systems in a climate crisis.

CA centers on consideration of the relative costs of different types of deliverables, and it is determined by the relative trade-offs in producing outputs between organizations. It should not be confused with absolute advantage or competitive advantage.

CA analysis allows organizations working together to expand their overall effectiveness, by having each organization specialize—at least relatively—in the part of the project that it can accomplish at the lowest cost in terms of the project's other components. The more different the organizations are in terms of their relative capabilities to produce different deliverables, the more they stand to gain from collaborating and specializing in their areas of CA.

What does CA have to offer CGIAR?

'One CGIAR' transition facilitates and promotes the use of portfolio approaches to research and innovation. In that context, the Independent Science for Development Council (ISDC) aims to put the concept of CA to effective use in research portfolio management at all levels of the System. Applying a CA analysis can produce a more streamlined, purposive, and intentional research portfolio. It is designed to harness the various competencies of CGIAR entities, and other organizations with which the system interacts, to make the 'sum of its parts' as large as possible.

Beyond portfolio management, pushing CA thinking can help with positioning CGIAR at the frontier of Agricultural Research for Development (AR4D). Disciplined consideration of the goals and capabilities of other actors strengthens the System's understanding of its position in the broader ecosystem of organizations with related goals. Concluding that an outside entity has a CA in some area is not an admission that their capabilities are superior; rather, it is a key step in minimizing the trade-offs between a set of competing goals, by focusing on efforts that CGIAR is relatively best placed to deliver.

Actively using CA approach can better capture strategic opportunities and synergies across the System, and with partners. It also makes collaboration more systemic with diverse actors (e.g., academics, research and development practitioners, farmers' associations, etc.); strengthens capacities of key partners (e.g., community-based organizations, national agricultural research and extension systems, multi-stakeholder platforms, etc.); and can help to mitigate the growing divide in science and innovation between the Global North and South.

How should CA be applied at CGIAR?

There is considerable potential to increase CGIAR's effectiveness by considering CA during project design process and implementation, which can lead to mutually beneficial partnerships, specialization, and the redirection of scarce resources toward the System's relative strengths. This is critical to consolidating investor confidence and maximizing impacts at scale from available funding targeted at international public goods.

During the ISDC's reviews of CGIAR Initiative proposals, it became apparent that the term 'CA' continues to be applied in a number of different ways across the System. When the approach is well-understood, two key insights emerge about how organizations with different capabilities can gain from collaboration. The first insight is that while it is possible to have absolute advantage in all deliverables, it is not possible to have CA in all deliverables so long as there are other possible producers: a CA in one area implies a comparative disadvantage somewhere else. Thus, an efficient allocation of activities across organizations does not necessarily involve doing everything at which one is 'the best.' A second insight is that while productivity can be identified purely by looking within one's own organization, analyzing CA necessarily requires assessing the competencies of other actors in multiple areas. A CA analysis must consider the capabilities of other organizations in producing multiple types of output.

CA analysis can and should be pursued at different levels of aggregation, from specific objectives of individual work packages up to the level of an entire research venture such as a CGIAR Initiative. As an analysis moves from narrower to broader efforts, it becomes more important to consider possible economies (or diseconomies) of scale and scope. These may justify broad partnerships that would not appear worthwhile at a more disaggregated level; conversely, they may undermine the case for partnerships in cases where specialization leads to rapidly diminishing returns. A similar logic may apply when looking across time horizons for deliverables. Importantly, a decision to invest in developing new

CA must ensure that CGIAR invests in building new capabilities only in those domains in which it holds a relative advantage in obtaining them vis-à-vis partners.

How can CA be identified?

There are four main categories in a CA analysis. While these are listed sequentially here, in practice they can occur in parallel. The process should also be viewed as iterative—that is, the analysis from any given step may necessitate revisiting earlier steps until an appropriate action plan is identified.

Describing desired deliverables: identifying the pieces that need to be brought together to achieve the development objectives. Deliverables must be sufficiently concrete that the inputs needed to produce them can be clearly identified.

Identifying potential partners: finding other organizations that have the potential to produce some of those necessary deliverables. These may be known organizations currently active in the AR4D space, or organizations not yet active in these areas that nevertheless have the resources and characteristics necessary to produce a deliverable.

Assessing relative trade-offs: using the best knowledge available, identifying the relative costs of the key deliverables among the identified organizations, including CGIAR. Even if one organization is not as capable as another in an absolute sense, its differing relative strengths may justify a partnership—because the partnership might free up resources that CGIAR can deploy more effectively elsewhere.

Planning partnerships, refining proposals: reaching out to the identified potential partners, clearly establishing responsibilities within the project, and ensuring project resilience.

CA approach should be dynamic, with updates and reassessments conducted in response to the evolution of institutional capabilities and the changing landscape in which they are situated. Making dynamic a static approach is challenging, but necessary to take into consideration vibrant CA, common when delivering science and innovation. A functioning Monitoring, Evaluation, and Learning (MEL) system can help to keep informed about evolving CA. Insights from retrospective applications of the approach can help to use CA proactively in research portfolio management, such as in the funding of new Initiatives, or stage-gating and expansion or extension of existing ones.

This Technical Note first introduces the CA concept, its aims and benefits, and illustrates how gain from specialization occurs. Then, it reflects on possible sources of CA, and how broad categories (i.e., incentives, human capital, biophysical capital (such as labs, genetic material, and equipment), and social capital) can help identifying outputs in which CGIAR is likely to have CA. The four key steps of a CA analysis are then described, and retrospectively applied to specific deliverables from the Livestock Genetics Flagship of the CGIAR Research Program on Livestock. The final section summarizes these insights.

1 Introducing Comparative Advantage

With the One CGIAR transition initiated in late 2019, there has been an emphasis on fundamentally restructuring the System to maximize its effectiveness. CGIAR strives to make progress in five impact areas:

1. Nutrition, health, and food security
2. Poverty reduction, livelihoods, and jobs
3. Gender equality, youth, and social inclusion
4. Climate adaptation and greenhouse gas reduction
5. Environmental health and biodiversity

Over the period 2021-2022, CGIAR has assessed the Quality of Research for Development (QoR4D) of its various Initiatives to ensure that the System is making as much progress as possible toward its mission of "ending hunger by 2030 through science to transform food, land, and water systems in a climate crisis." [1] Initiative proposals are key to evaluating and prioritizing projects to optimize the use of the System's resources. The first QoR4D principle, "relevance," calls for efforts to be "associated with CGIAR's comparative advantage to address the problems" dealt with by Initiatives.

As a result, recent rounds of CGIAR Initiative proposals have each included a section on Comparative Advantage (CA). When understood and used properly, CA can be a key input in evaluating and prioritizing projects to maximize CGIAR's effectiveness. CA is one of the most powerful theoretical insights in economics and provides a lens that allows CGIAR planners to focus on areas where the System's efforts are likely to generate the most targeted impacts. However, in practice many proposals use this section to emphasize sources of their productivity in that area (such as the qualifications of the researchers or existing relationships with partners) rather than evaluating their absolute advantage, much less their CA relative to other possible service providers (ISDC, 2022). Importantly, CA should not be confused with competitive advantage, which is a term of business strategy.

Careful stewardship of CGIAR's scarce resources requires determining how to achieve desired development goals most efficiently, which may include partnering with other organizations to provide products or perform activities that are not CGIAR's CA. Thus, claims of CA that lack sufficient justification may risk suggesting to proposal assessors and funders that the proposing team may have overlooked some ways to put the System's resources to their most effective use. This Technical Note is intended to guide the formulation of Initiative proposals and provide a methodology for assessing CA in order to more firmly ground the CA section of the proposal. The Technical Note can also be used to think about how to divide responsibilities across CGIAR entities and non-CGIAR partners within a particular Initiative. Finally, the framework offers a useful tool for continually assessing CA within the CGIAR research portfolio.

Why Analyze Comparative Advantage

CA analysis is a tool that can help define the appropriate scope of work for CGIAR Initiatives and uncover opportunities for partnerships with outside organizations or with other CGIAR Research Entities. CGIAR recently updated its processes for identifying and working effectively with partner organizations, as described in the 2022 Engagement Framework for Partnerships & Advocacy (CGIAR, 2022). These improved processes for building and maintaining relationships should increase opportunities to improve efficiency and enhance impact through a concentration of effort on areas where CGIAR holds CA. Over and above the direct gains in efficiency from (partial) specialization at the Initiative level that CA analysis can unlock, the System as a whole can benefit from an improved and evolving understanding of the capabilities and goals of other entities in the Agricultural Research for Development (AR4D) space and allied areas. More dynamically, it can also help guide investments in new domains where CGIAR would like to build capabilities and is in the best position (i.e., has a CA) to attain them. In this sense, the process of performing a CA analysis may be as important as the findings regarding any particular project or Initiative. A CA analysis can help CGIAR refine Initiative design, especially the assignment of roles and responsibilities within CGIAR; identify partners with complementary capabilities; and clarify their roles. The process can enable CGIAR to focus its in-house resources on areas where it can make the greatest strides in advancing the five Impact Areas, given financial and other constraints. Ultimately, a CA analysis promises a more streamlined, purposive, intentional research portfolio.

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[1] QoR4D was initially developed in 2017, adopted in 2018, and revised in 2020. It was designed to help, (i) develop research strategies and programs, (ii) build a new research portfolio, (iii) establish monitoring systems, and (iv) design performance management standards. QoR4D was established through a consultative process involving representatives from entities across CGIAR involved in managing or assessing science quality. In 2021, ISDC operationalized QoR4D to make it fit-for-purpose for Research Initiative proposal reviews—a major step in the One CGIAR reform that put in practice the 2030 Research and Innovation Strategy (ISDC, 2021)

What Comparative Advantage Is (and Isn't)

CA is fundamentally about how costly one type of quality-adjusted deliverable is in terms of other desirable types of quality-adjusted deliverables, and how the trade-off between those deliverables differs between organizations. It is distinct from the concept of productivity, which expresses how much an organization can produce of a particular deliverable (say, pest-resistant maize varieties) with some set of inputs (say, funding and time) and does not concern other deliverables or other organizations. It also differs from absolute advantage, which compares different organizations' productivity in generating a given deliverable.

In this Technical Note, deliverables are sometimes referred to as "outputs." Here, "output" has a different meaning than it does in the theory of change diagrams in the 2022–24 Investment Prospectus. In that context, an "output" is a specific product of work (such as a climate risk profiling system or elite parental genetic material) that "scaling partners" help translate into "outcomes." In this Technical Note, we define outputs as the set of knowledge, products, and services that need to be brought together to achieve the intended development outcomes and impacts of the proposed Initiative. This includes inputs produced or activities performed internally by CGIAR or at any of the "intervention phases" described in the 2022 Engagement Framework for Partnerships & Advocacy (CGIAR, 2022). The consulting or planning services that might be provided by "demand partners" such as national governments and multilaterals, the intellectual and research inputs created by "innovation partners," and the extension services or policymaking that a "scaling partner" might provide—all are types of deliverable in which one organization or another will have a CA.

Comparative Advantage in a Nutshell

Suppose that CGIAR wants to ensure that two tasks, X and Y, are both accomplished. The fundamental goal of a CA analysis is to answer a succession of three questions:

1. Is there another organization that has the capacity to work on X or Y?
2. If CGIAR were to leave it up to this other organization to perform task Y, how much would that partner organization's progress on task X necessarily suffer?
3. Could CGIAR more than compensate for that decline in progress on X with the internal resources it has freed up by not working on task Y itself?

If the answer to the third question is "yes," then greater progress can be made on both tasks by partnering with the outside organization. In such an arrangement, each (relatively) specializes in the task for which it has a CA. The result is that CGIAR specializes in the production of X and the other organization in the production of Y, even if CGIAR is absolutely the best at producing both X and Y. The example in section 2 illustrates how this gain from specialization occurs.

Box 1: CGIAR's Platform Technologies and Comparative Advantage

Platform technologies provide a shared foundation for multiple additional technologies created by a variety of agents. Prominent examples of platform technologies include microprocessors (the underlying technology for everything from word processing to video games) and the internet (upon which are built email, video streaming, and blog sites). Platform technologies are distinguished by network externalities; they become more valuable to each user as the number of users increases. As a result, from society's perspective it is desirable for platform technologies to be widely accessible at low cost to maximize use and innovation.

To ensure this wide access, the entity that controls a platform technology needs to be one that will refrain from charging high access fees or limiting access to create difficulties for particular users (for example, by changing access protocols). Some assets of CGIAR, including its Genebank and certain of its intellectual assets, may qualify as platform technologies, and CGIAR's credible commitment to providing open access to these public goods may give it a CA in making such assets available to the largest possible number of outside researchers and development partner organizations.

2 An Illustrative Example

Imagine a hypothetical nonprofit called CureOrg, which works to combat malaria.[2] CureOrg's program consists of two key parts: production of insecticide-treated bed nets and production of antimalarial drugs (specifically, artemisinin-based combination therapies, ACTs, a curative medicine). CureOrg produces both bed nets and doses of ACTs more efficiently than any other organization. But they observe that another charity, TreatFree, also has the capacity to produce both nets and ACTs. TreatFree does not produce ACTs as efficiently as CureOrg, and it also has no expertise in bed nets; it is costing them many worker-hours to produce their first nets, and their ACT production has declined significantly in the process. Each organization has a fixed pool of resources and characteristics that limit the combinations of nets and ACTs it can produce.

CA analysis shows us how to treat the existence of the less efficient TreatFree as an opportunity. TreatFree must sacrifice millions of doses of ACTs to produce a single bed net. But seen another way, this means that TreatFree can produce millions of ACT doses at almost no cost to its net production. If CureOrg outsources production of a million doses of ACTs to TreatFree, CureOrg can produce significantly more nets in house with the resources it is no longer spending on ACT production. CureOrg's extra production of nets more than offsets the slight decline in net production that results from TreatFree's abandoning its relatively costly bed net production efforts (as measured by the number of doses it would have to forgo producing). The result is more total production of both bed nets and anti-malarial drugs.

Concretely, imagine that CureOrg has machinery and techniques that allow it to produce bed nets at a cost of $1 and doses at a cost of $0.20, while it costs TreatFree $2.50 to produce a net and $0.25 to produce a dose. It costs CureOrg, operating alone, 5 doses ($1/$0.20) to produce a single net. Clearly TreatFree is less efficient at producing both nets and doses (CureOrg has an absolute advantage in both), but it costs TreatFree 10 doses ($2.50/$0.25) to produce a net, rather than 5. So CureOrg has a CA in net production: it gives up fewer doses per extra net produced. If CureOrg produces doses itself, it "costs" 1/5 of a net to produce each dose; if it gets TreatFree to produce those nets instead, each net now costs only 1/10 of a dose in lost total production (combining the nets and doses produced by the two organizations).

Suppose that each organization has a budget of $1 million and that they want to collectively produce 2 million doses and as many nets as possible. If each organization makes only nets, together they can produce 1.4 million nets in total ($1 million/$1 + $1 million/$2.50). If they divide the task of making nets equally, it costs CureOrg 1/5 of a net and TreatFree 1/10 of a net to make a dose, so every two doses produced requires giving up a total of 3/10 of a net. To get to 2 million doses, they must reduce net production by 300,000 nets (1 million x 3/10), leaving them with 1.1 million nets. If, instead, TreatFree makes all the doses, total net production is reduced by only 2/10 of a net for every two doses, rather than 3/10. Thus, the two organizations can collectively produce 1.2 million nets (rather than 1.1 million) alongside their 2 million doses.

The key here is not that TreatFree is better at producing either bed nets or ACT doses (it isn't). The key is that TreatFree has a CA in ACT production: producing an additional million doses "costs" it fewer nets than producing an extra million ACT doses would "cost" CureOrg. The flip side of this is that CureOrg has a CA in net production: even though it can produce both nets and doses more efficiently than TreatFree (under the strong assumptions in this simplified model), it should specialize as much as possible in nets and partner with TreatFree to cover the resulting shortfall in drug treatments.

Figure 1 demonstrates the above point in graphical form. CureOrg faces a trade-off between producing nets and ACT doses; the green line passes through the set of combinations of nets and doses that it could choose to produce. TreatFree faces a different trade-off, with less capacity to produce either output. If they acted separately, each producing some nets and some doses (at points (DC,NC) and (DT,NT)), their total production would be at (DC + DT, NC + NT).

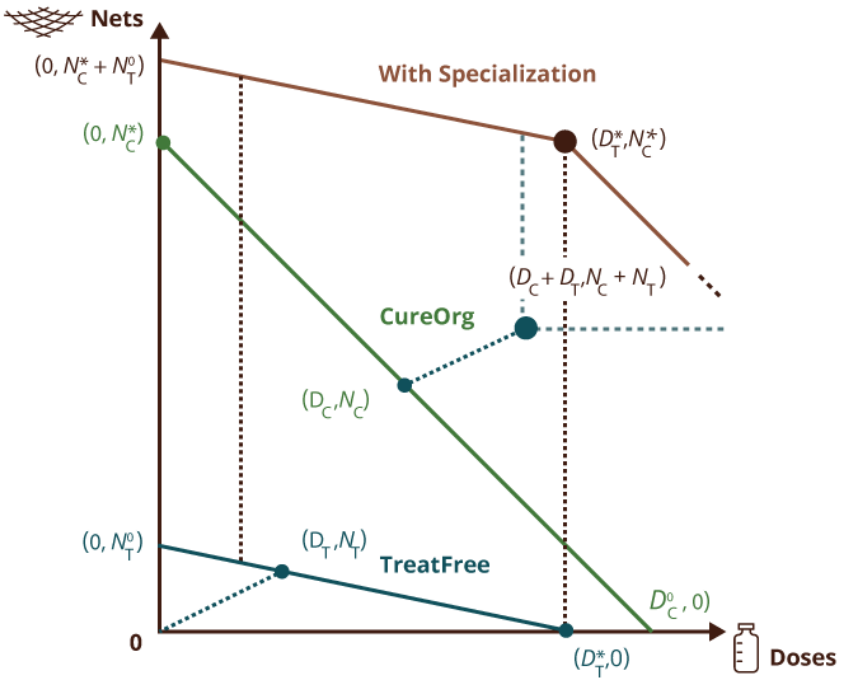
If instead CureOrg focuses all efforts on its CA, producing NC* nets, and allows TreatFree to produce only doses (at point (DT*,0)), their combined total production is at point (DT*,NC*). By each specializing in their CA, these two organizations have in total produced both more nets and more doses. Visually, with specialization, total production drops down from (0,NC* + NT0) at the flatter slope of TreatFree's production trade-off, since TreatFree produces more doses per net than CureOrg.

This production plan lies along the brown lines, which bound the set of (doses, nets) output pairs that the two organizations can achieve together. Points along this outer production boundary can be reached only if one or both of the organizations specialize completely in their own CA. All production plans that involve both organizations trying to produce both nets and doses are thus leaving output on the table, producing

[2] Here we intentionally use an example from outside CGIAR's domain so as to focus on the concepts and not invite speculation about ISDC's assessments of CGIAR CA in generating specific deliverables in its spaces.

fewer nets and doses than could be achieved through collaboration and specialization. The underlying reason for this is that as long as the organizations face different trade-offs internally between nets and doses, they can increase total output by swapping some production from the organization with the higher relative cost to the organization with the lower relative cost in each good. The opportunity for this "free lunch" disappears only when either the internal trade-offs become equalized across organizations[3] or when further specialization is impossible because one organization is specializing completely.

Figure 1: Comparative advantage illustrative example



Note that although CureOrg is better at producing doses than TreatFree, some points along the brown boundary (such as [DT*,NC*]) represent plans in which it does not produce any doses. That stark division of activities is a result of the somewhat unrealistic assumption of an unchanging trade-off between outputs. In a more realistic case, the gains from specialization may run out before complete specialization is reached (as noted above).

But the broader message of this stylized example holds true even in more realistic settings. Even if an organization like CGIAR has better capabilities than some other AR4D organization in all areas, CGIAR should not attempt to simply produce some of everything. Rather, it should, at least partially, specialize in its CA and collaborate with other organizations, even if partners have lesser capacities. The focus here is deliberately on deliverables that CGIAR does not work on to make a general point about CA, without making any statement regarding the particular capabilities of CGIAR or other AR4D organizations. Discussion of how to assess CGIAR's CA, and some possible areas of CA, follow in subsequent sections.

Key Conceptual Insights for Comparative Advantage Analysis

The illustrative example above is highly stylized but demonstrates two fundamental insights about CA analysis. The first insight is that while it is possible for some organization to have an absolute advantage in all deliverables, it is not possible to have CA in all deliverables so long as there are other possible producers—having a CA in one area implies having a comparative disadvantage somewhere else. As a result, an efficient allocation of activities across organizations does not necessarily involve pursuing the full set of activities at which one is "the best"—rather, efficient allocation decisions require distinguishing other possible producers of each type of deliverable and considering whether they could be used to produce that output at a lower relative cost. Thus, concluding that one is "best equipped" to produce

[3] Imagine a case where CureOrg becomes less relatively productive in net production as it produces more of them; if it starts producing more nets, eventually it will face the same nets/doses trade-off as TreatFree.

some good, service, or innovation is not sufficient to demonstrate CA in that area. CureOrg could truthfully say that it is the best at producing both doses and nets; that does not mean the organization has CA in both.

A second insight is that while productivity can be identified purely by looking within one's own organization, analyzing absolute or comparative advantage necessarily requires assessing the competencies of other actors in multiple areas. Claims about CA that do not discuss more than one deliverable (such as "our organization is the most productive source of advances in X") are fundamentally claims about absolute advantage rather than CA. Similarly, claims about CA that do not state anything about the capabilities of other organizations (such as "our ability to produce X far exceeds our capacity to produce output Y") do not answer the question of whether X or Y is the organization's CA. These statements are claims about absolute advantage in X and the opportunity cost of X in terms of Y, but to establish CA, these opportunity costs must be compared with those of other organizations. Without considering the capabilities of TreatFree, CureOrg cannot analyze its CA; CureOrg only knows its own trade-off between the two deliverables, not whether TreatFree could deliver them at lower relative cost. This explicit comparison of CGIAR's opportunity costs relative to those of other organizations has been absent from most Initiative proposals to date.

3 Possible Sources of Comparative Advantage

CA is fundamentally about comparing the trade-off between different deliverables (how many doses does a net "cost"?) across organizations, not about the trade-off between inputs and outputs (how many dollars does it take to produce a single net?). In the absence of detailed knowledge about the full set of possible production plans, the best way to learn about CA may be to consider an organization's characteristics and their implications for potential production. Those sources of comparative advantage (SCAs) can be broadly grouped into four categories:

1. Incentives (the degree to which an organization is willing to pursue particular goals)
2. Human capital (the skills and knowledge of the organization's workforce)
3. Biophysical capital (such as labs, genetic material, and equipment)
4. Social capital (the set of existing relationships and agreements with other actors that might help synergize research efforts in similar areas as well as facilitate the take-up and impact of research outputs in the field).

Looking at each of these SCAs in turn can help identify broad types of outputs in which CGIAR is likely to have a CA.

Incentives

In terms of organizational incentives, CGIAR and other nonprofits likely have a CA relative to for-profit actors in creating goods with high social value but low commercial value. The monetary cost of hiring a for-profit firm to produce some output is not necessarily the cost of producing that output; the cost is at least equal to the monetary value of the most profitable output that firm could be producing with the same resources. For this reason, hiring a for-profit firm to produce a public good that is socially valuable but does not produce meaningful profits may be very expensive. This financial expense may be extremely costly to CGIAR and its funders in terms of the other goals that could be achieved with those funds, even if the for-profit firm could produce that output using fewer resources. But if investors have nonprofit objectives that at least partially overlap with CGIAR's five Impact Areas, there may well be scope for partnerships that capitalize on the CAs of each organization.

One key area where incentives are likely to play a prominent role is in the production and provision of platform technologies (see Box 1) such as databases and seed banks. Their value to society increases if the cost to access them is kept low because the platform value increases with the number of users. Incentives may also include intellectual assets that provide a foundation for later discoveries. If such platform technologies or intellectual assets are held by for-profit companies, their incentive to limit access to these assets (e.g., through secrecy, expensive subscriptions, or patenting) may reduce the overall pace of technological progress (Williams, 2013; Murray & Stern, 2007; Galasso & Schankerman, 2015), although the exact type of intellectual property protections may matter for the size of the impacts (Sampat & Williams 2019). Thus, nonprofits may have a CA in managing platforms or intellectual assets in a way that maximizes their social value, especially in cases where the asset's applications are of high social value but where that value is difficult or undesirable to extract commercially. Along the same lines, nonprofits may have a CA in producing research that will have benefits far in the future if they are less focused on short-term performance metrics than their private-sector peers.

Within the nonprofit sector, larger organizations and those with relatively stable funding may have a CA in pursuing novel research projects with large possible benefits but uncertain prospects of success. Such an organization does not have to worry that its own overall success or failure depends on the outcome of any one project. In contrast, a smaller organization may require very costly inducements to take an all-or-nothing gamble on its future. An organization that is sufficiently resourced to fund a diverse range of research avenues may thus have a CA in pursuing ambitious "moonshots" with a nontrivial likelihood of failure relative to more fiscally constrained organizations, which must limit themselves to a smaller set of programs that must promise more predictable but incremental progress.

Human Capital

Human capital in this context refers to the skills and knowledge of the organization's employees. What types of skills and experience do they have, and how readily can their efforts be redeployed from one activity to another? For example, if the team consists mostly of experts on crop breeding, the cost of deploying these workers to spend part of their time on seed delivery may be high in terms of forgone development of new crop varieties. That alternative activity might best be performed by another team within CGIAR, or even an outside entity, whose cost of delivery in terms of new varieties is not as high.

Biophysical Capital

Biophysical capital encompasses the genetic material, buildings, equipment, and other physical assets of the organization. What labs, machinery, testing sites, and biological samples does CGIAR own or have access to? Are those assets useful only for a single purpose, or can they be used in multiple ways? Is it possible and/or desirable to give others access to these biophysical resources so as to boost others' productivity in advancing shared objectives?

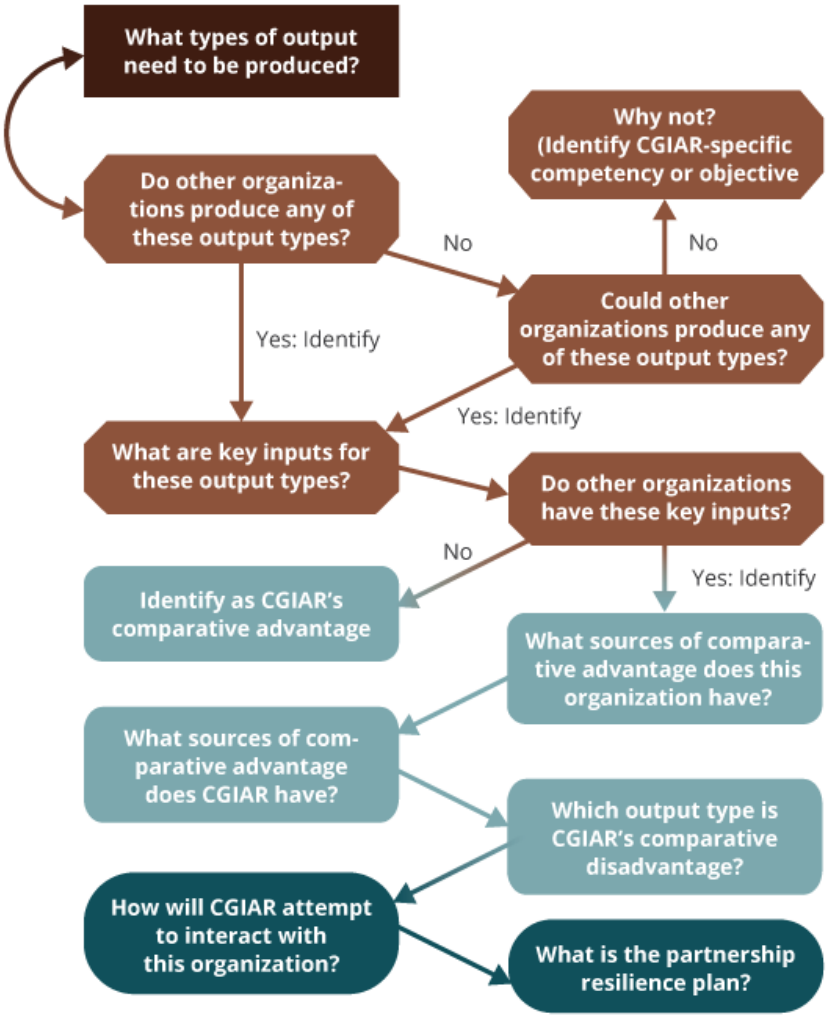
Social Capital

Social capital refers to the set of existing relationships and agreements that CGIAR can draw upon, as well as the System's reputation within key stakeholder communities. What relationships and arrangements does the CGIAR team have that would be costly for other organizations to replicate, in terms of achievement of those organizations' other goals? CGIAR may have CAs grounded in its relatively long history of operations in particular geographic regions, such as existing relationships with governments, contacts and data-sharing agreements with local seed innovators, or a reputation for trustworthiness among farmers in particular countries that would be difficult and time-consuming for others to establish. If so, CGIAR's CA may be in structuring partnerships where it provides access to this set of connections to other existing organizations that would produce additional benefits from such access.

4 Identifying Comparative Advantage

A CA analysis involves four key steps, listed below and described in detail in the following section. The section headers are colored to match the corresponding sections of the flowchart representation of a CA analysis in Figure 2. Note that while "Identifying Potential Partners" is sequentially second (as it relies on analysis from step 1), this is not meant to discard the involvement of existing partners in step 1 or in formulating proposals more broadly; such partners may have valuable insights into what kinds of deliverables are necessary to achieve particular development objectives. The process should also be viewed as iterative: the analysis from any given step may necessitate revisiting earlier steps until an appropriate action plan is identified. It should also be dynamic, with updates and reassessments conducted in response to the evolution of institutional capabilities and the changing landscape in which they are situated.

Figure 2: Comparative advantage analysis (colored by step)



Step 1: Describing Desired Deliverables

First, in order to think concretely about CA, it is necessary to ask which "knowledge, products, and services" the project aims to produce in order to achieve its desired development impact. Once the set of distinct deliverables is clearly defined, understanding the relative capabilities of other players working in related areas becomes easier. Identifying the project deliverables (intermediate and final outputs) is the first step in the CA analysis and is also helpful for clarifying how specifically the project relates to one or more of the five Impact Areas and to the overarching CGIAR goals.

Step 2: Identifying Potential Partners

The second step is identifying other organizations working in related areas. These are called potential partners, but note that the partnerships may be established at arm's length: as in the example, each organization should be focused on its own set of deliverables. If two partners are producing what seems to be a single deliverable (for example, a plant genome database), it is worth considering whether there are in fact distinct inputs to that deliverable that could be pursued separately (for example, genome sequencing and database management) or whether economies of scope or scale require the bundling of activities.

How "related areas" are defined, and how best to perform this search, will vary by project. "Related areas" are determined here in terms of types of deliverables and not necessarily types of organizations. Furthermore, it is important to think in terms of potential for production rather than actual production: an organization may have the ability to produce some desired deliverable even if it is not currently doing so.

Step 3: Assessing Relative Trade-offs

The third step is to ask how the capabilities and incentives of the individuals and organizations identified in step 2 compare with those of the proposing team, as they relate to project objectives and each of the deliverables required to achieve the planned outcome. Remember, the fundamental question to be asked is, what trade-off does this organization face between deliverables?

Organizations always face build-or-buy decisions based on trade-off assessments. In most cases, the answer to this question will not be as clear and quantifiable as it was in the example. Rather, the goal is to use quantitative information where possible and qualitative assessments where necessary to arrive at a best judgment of which organization has a CA in each deliverable. The question of what inputs each organization has, and how effectively it can use those inputs, is useful for comparing the trade-offs it faces across project deliverables relative to those faced by CGIAR.

Step 4: Planning Partnerships, Refining Proposals

The fourth and final stage of the CA analysis involves refining the scope of project proposals to focus on project objectives that align with the team's in-house CA, and identifying which providers might be best positioned to create deliverables that align with their CA. If there are other organizations that could be involved as partners, the proposal should clearly delineate the division of labor between the CGIAR team and the outside organization and explain how they might be brought on board. This stage of the process should comport with the "Prospecting" phase of the partnership lifecycle delineated in the 2022 Engagement Framework for Partnerships & Advocacy (CGIAR, 2022). There may be cases in which a potential partnership's benefits are not large enough to overcome the time or other costs of cultivating and maintaining the partnership. This issue is discussed in greater detail in a later section.

5 Comparative Advantage Analysis in Detail

This section reviews each of the stages in greater detail, providing suggestions for how CGIAR can find potential partners and identify both their CAs as well as its own. Figure 2 provides a series of questions that can guide the CA analysis. The colors of the boxes represent the four stages of the analysis. This process is here described sequentially, but in practice it is interactive: each step can influence the others in a semi-circular process until the output and goals of each stage are consistent with one another.

Step 1 Detail: Describing Desired Deliverables

When describing desired deliverables, it is important to consider what steps need to be accomplished to achieve the outcomes described in the section of the proposal on the projection of benefits. These deliverables need not all be produced at the same time. For example, a hypothetical intervention designed to improve nutrition in a particular region may be thought of as having at least three deliverables that must be produced in sequence: an analysis of which crops make the most promising candidates for variety improvement, production of a biofortified variety of one such crop, and distribution and marketing of the improved variety to ensure successful adoption. In this example, each of the output types corresponds closely to one of the partnership types and intervention phases outlined in the CGIAR Partner Typology described in the 2022 Engagement Framework for Partnerships & Advocacy (CGIAR, 2022).

In general, comparative advantages and disadvantages are likely to be most pronounced between output types that are very dissimilar; for example, CA in one narrow area of research compared with another may not be as pronounced as CA in that area of research compared with scaling and delivery.

Step 2 Detail: Identifying Potential Partners

Because CA is ultimately about the trade-offs between deliverables, the first step in the search for potential partners or alternative suppliers is to consider who else produces similar deliverables. The first and easiest place to look is among the set of organizations with which CGIAR has existing partnerships, especially those that may have participated in step 1. No list of potential partners or alternate suppliers will be comprehensive or conclusive, but a review of existing CGIAR partnerships such as the 2017 Evaluation of Partnerships in CGIAR (CGIAR-IEA, 2017) or the partnership evaluations performed by individual CGIAR Research Programs (CRPs) may provide an initial set of candidate organizations. For example, the CRP on Policies, Institutions, and Markets (PIM) partnered with organizations ranging from universities and government agencies to local nongovernmental organizations (NGOs) and private companies.

After considering existing partnerships, consider the set of known organizations currently active in producing each of the project's deliverables. In the hypothetical example described above, other organizations that might produce analyses of important crops by region and their biophysical and economic prospects for expansion include multilaterals such as the Food and Agriculture Organization of the United Nations (FAO) and the International Fund for Agricultural Development (IFAD). Other organizations with the capability to produce improved varieties may include the national agricultural research and extension systems (NARES) of countries in the region, advanced research institutions (ARIs), or private sector agritech companies (such as Cargill or Syngenta). Potential partner organizations involved in seed distribution and marketing might include national or subnational governments, NARES, or private seed companies.

Beyond the set of familiar organizations, proposals should search for other agents currently active in the same output space. For example, producers of published research and intellectual assets might consider the authors of related research or cited patents. Producers of databases might consider other organizations publishing similar data, or major users of the data who might be willing to aid in data production or maintenance.

Another category of candidate organizations consists of other organizations that share funders with CGIAR. A funder seeking to advance a particular agenda (say, climate change resilience) may be funding multiple other organizations, some of which are likely work in related areas.

In addition, other organizations may be able to produce the same deliverables as CGIAR, even if they do not do so currently. Again, a focus on the four SCAs mentioned earlier (incentives, human capital, biophysical capital, and social capital) may help focus the search for potential colleague organizations.

First, consider incentives. Are there other organizations that share similar objectives and would likely be willing to collaborate? Other nonprofits in the AR4D space may be plausible candidates, but for-profit organizations may also share an interest in producing particular deliverables (expanding seed delivery networks, for example, or producing marketable crop innovations). These organizations' profit motive affects the set of outputs that they will realistically produce, but they may have a CA driven by other SCAs that justifies their involvement in producing a useful deliverable.

Next, consider human capital. What organizations employ people with similar skill sets? Where did CGIAR employees work before coming to CGIAR? Are there organizations that routinely employ CGIAR alums? Organizations employing the same kinds of workers may be able to produce similar deliverables and will have a CA in one those deliverables.

Third, consider biophysical capital. If the project involves improving the suitability of a particular crop to region-specific conditions, are there other organizations with access to fields for field testing in the region? If the project involves genetic sequencing, do other organizations have labs with the appropriate sequencing equipment? What about access to similar or related biological materials?

Finally, consider social capital. Are there organizations that have existing relationships with the same entities and organizations that CGIAR routinely interacts with? For example, what other organizations also interface with national governments to help them prepare for the effects of climate change? Are there organizations that CGIAR teams currently partner with to provide particular deliverables or services, and who else is partnering with those organizations? For example, if a CGIAR team uses an outside organization to conduct spatial modeling of crop yields under various climate scenarios or demand modeling for a new storage technology, what other organizations also partner with that provider, and do they have shared objectives with CGIAR? The example used thus far revolves around plant breeding, but the same core logic and questions would apply in any research domain in which CGIAR considers investing. Table 1 surveys the approaches for identifying potential partners described above and provides examples of the types of steps that may be used to identify them.

Because the search for other potential providers will differ based on the specific project under consideration, the proposal should explain how the team defined "related areas" and identified the relevant actors. If no organizations can be found working on related areas, the proposal should discuss why no other organizations are active in this sphere. Are the varieties that CGIAR aims to improve not of value to large-scale commercial farmers? Does an analysis require context-specific background knowledge not possessed by outside academic researchers? Is this type of project viewed as not promising by others with the technical capacity to pursue it? If so, the project proposal should include a detailed analysis of why this is the case, and how CGIAR's goals or capabilities differ from those of other potential producers who have implicitly eschewed investing in this line of research.

Step 3 Detail: Assessing Relative Trade-offs

As noted, considering relative trade-offs is fundamentally about the quality and quantity of deliverables of different types that can be produced. The ideal thought experiment is a question such as, if we redeployed resources away from providing seeds to 100,000 farmers, how much could we improve crop yields? This question may be complicated in some cases by economies of scope (where producing one deliverable makes producing another deliverable less costly) or economies of scale (where the cost of producing one deliverable changes as the quantity produced in house grows).

Economies of scale and scope may be internal (within an organization) or external (reflecting spillovers across organizations). Strong positive internal economies of scope may justify assigning related deliverables to the same organization even if the deliverables could be produced separately.[4] This possibility highlights the importance of assessing potential spillovers across activities, projects, or CRPs. On the other hand, strong external economies of scope (where one organization's production enhances other organizations' ability to produce a different type of output) may justify some external partnerships by raising the relative effectiveness of another organization in some area, increasing its CA. Platform technologies are a likely source of such external economies of scope because the platform expressly brings different partners together to share material and learning.

[4] For example, in-house improvements in modeling irrigation uptake likely improve in-house modeling of fertilizer use; if so, it makes less sense for an organization to specialize in modeling one or the other.

Table 1: Criteria to identify potential colleague institutions

Category	Steps to identify	Possible examples
Known current producers of related deliverables	**Institutions familiar to CGIAR employees** • Examine overall and CRP partnership evaluations • Consider known organizations with similar mandates • Consult sample partners listed in Engagement Framework	Food and Agriculture Organization of the United Nations (FAO), International Fund for Agricultural Development (IFAD), French Agricultural Research Centre for International Development (CIRAD), Japan International Research Center for Agricultural Sciences (JIRCAS), Rothamsted, national governments, advanced research institutions (ARIs)
Active in same deliverables space	**Intellectual asset producers** • Conduct keyword search based on proposal objectives • Identify prior cited patents and publications • Review backward/forward citations for key related work • Identify institutions hosting coauthors on CGIAR-authored papers • Conduct keyword search in U.S. Patent and Trademark Office (USPTO) and World Intellectual Property Organization (WIPO) databases to find relevant patents	National agricultural research and extension systems (NARES), ARIs
	Users of datasets or products • Review user manuals to identify key inputs • Identify key skills of platform producers • Identify key users of platforms; consider their capacity to maintain and expand the resource	NARES, ARIs, University of Minnesota GEMS
	Service and scaling providers • Identify sources of products/services used by CGIAR • Examine prior external partnerships • Evaluate seed suppliers covered by Access to Seeds Index	National Centre for Atmospheric Science, Indian Council of Agricultural Research, HyVeg
	Funding sources • Consider organizations with shared donors	Transform Rural India Foundation, International Fertilizer Development Center, Donald Danforth Plant Science Center
Possess similar SCAs	**Incentives** • Consider organizations with related goals and specialization • Consider other attendees at AR4D summits • Examine other Global Forum on Agricultural Research and Innovation (GFAR) partners	World Bank and UN agencies, international nongovernmental organization (INGOs)
	Human capital • Identify sources of new hires and destinations of departing staff	African Development Bank (AfDB), ARIs, UN agencies, INGOs
	Biophysical capital • Identify materials used in "methods" section of related published research (e.g., experimental farms)	NARES, ARIs
	Social capital • Identify other organizations with similar ongoing relationships with national and international partners • Identify partners of partners, examine for shared objectives	FAO

Internal economies of scale necessitate thinking about the quantities produced by each actor. For example, gene sequencing may have a high opportunity cost at low quantities but a low opportunity cost of additional throughput once the costs of the equipment and staff have already been paid. External economies of scale are harder to find but do exist. For example, the effectiveness of extension efforts tends to decline as adoption rates rise (leading to the famous S-shaped adoption curve) regardless of who is doing the work.

Because many desired outputs are difficult to measure, it is likely infeasible to establish with high precision the cost of producing a unit of each type of deliverable. However, in the absence of clearly quantifiable trade-offs, judgments about trade-offs often have to be made on the basis of organization-specific SCAs (incentives, human capital, biophysical capital, and social capital), which are easier to measure and quantify. Such judgments are always being made implicitly; it is desirable to make them explicitly and transparently, as befits an organization committed to using evidence-based approaches to producing international public goods.

Evaluating incentives requires considering the nature and objectives of the organizations identified. What are their organizational missions? Are the desired deliverables within the scope of their agendas? Do they have the scale and permanence to pursue risky or long-horizon investments? To what degree does the profit motive affect the set of outputs that they will realistically produce?

Next, consider human capital. The best means of evaluating skills and knowledge again depends on the nature of the type of output being considered. For example, proxies for applied research capabilities might include patenting activity or the frequency and quality of publications. Evaluating the capacity to provide platform technologies might involve assessing the popularity and ease of use of open access data. Once again, a key part of the process is explaining how this evaluation is performed, which casts light on the connections between organizations' characteristics and the trade-offs they face between different deliverables.

Next, consider whether there is some type of relevant biophysical capital to which only one organization has direct access. For example, the CGIAR Genebank Platform houses biophysical assets that make it easier for CGIAR to quickly access germplasm with particular traits, while the physical presence of its Entities gives it the ability to conduct field trials in varied agro-environments. Other relevant types of biophysical capital might include specialized equipment or labs, computing resources, or equipment for warehousing and storage of seeds.

Finally, investigate social capital. For example, as noted in the 2017 Evaluation of Partnerships in CGIAR (CGIAR-IEA, 2017), "There has been a long relationship between Centers and their host countries, which have provided the Centers their legal status to operate as international institutions, granting them the requisite privileges and immunities, and often land and facilities." This set of relationships would be difficult and time consuming for other organizations to replicate. It thus serves as evidence in favor of CGIAR's having a CA in deliverables that require the ability to operate in multiple countries, perhaps especially those in which CGIAR has longstanding, privileged relationships with key public and private stakeholder organizations.

After gathering information on the SCAs of the candidate organizations identified, the final step is to consider the relative trade-offs that each organization faces across the output types identified for the project, and how those trade-offs compare with those of CGIAR. This analysis should consider the SCAs of each potential partner, how they relate to the desired outputs of the Initiative, and how the trade-offs across the identified output types differ among CGIAR and the identified potential partners.

Step 4 Detail: Planning Partnerships, Refining Proposals

This stage of the process should align with the "Prospecting" phase of the partnership lifecycle delineated in the 2022 Engagement Framework for Partnerships & Advocacy (CGIAR, 2022). Not all candidate organizations will necessarily make for productive partnerships. When evaluating whether a partner organization should be brought on board, the team should consider whether the potential partner organization has the capacity to maintain long-term relationships, incentives to deliver the assigned deliverables, and willingness to share information transparently.[5] Another important consideration is the time and other costs of maintaining communications and working with partner organizations. If one or more of these considerations preclude a partnership that seems justified on the grounds of CAs, the proposal should briefly explain why. The proposal should also include a partnership resilience plan to

[5] If inclusivity is an implicit goal of this investment, then that goal should be made explicit to ensure that a dispassionate assessment of potential partners does not exclude a particular partner who may not seem ideal unless those broader considerations of inclusivity are considered. In this case, additional steps may be required to assess the relative trade-offs of productivity and equity and how to best manage what may prove to be a difficult but necessary relationship.

clarify whether and how the project should proceed if the partner organization proves unwilling or unable to produce the deliverables that the team has deemed to be its CA. If performed uniformly, this planning need not reflect poorly on CGIAR's expectations of its partners; it merely prepares for unexpected contingencies.

6 Case Study

To illustrate the CA analysis, we consider the example of the community-based breeding program for small ruminants in Ethiopia, a part of the Livestock Genetics Flagship within the former Livestock CRP. This example was chosen for its ability to convey the key features of the CA analysis in a succinct and straightforward manner. The example represents the most disaggregated level at which CGIAR might apply the CA analysis framework and as such may miss important synergies or redundancies within and across flagships, CRPs, and even outside organizations and partners. As one aggregates up, one needs to pay increasing attention to economies and diseconomies of scope and scale that may lead to changing one's assessment of CA beyond that which would hold from a simple summation of the individual pieces. This is especially important when funding decisions are made on the basis of a broad research venture (rather than specific work packages), as it can help to define and refine the aspects of that effort that are most sensible for CGIAR to undertake.

The goal of the Livestock CRP was to create a well-nourished, equitable, and environmentally healthy world through livestock research for development. Within this CRP, the overarching objective for the Livestock Genetics flagship was to use genetics research to improve livestock fitness in systems of smallholder dairy, small ruminants, smallholder pig, and backyard and small-scale poultry. Specifically, the Flagship aimed to help national and private sector partners implement genetic improvement strategies and business models for the improvement of livestock genetics in multiple countries, and to ensure that the adoption by livestock keepers was sustainable. Within this Flagship, the program for small ruminants in Ethiopia was focused on improving the genetic stock of small ruminants (sheep and goats) by introducing and spreading improved breeding practices.

Step 1: Describing Desired Deliverables

In the retrospective analysis, the Livestock Genetics Flagship team leaders identified four specific deliverables for the small ruminant program:

1. Breeding selection: A tool to guide breeding selection
2. Community-based breeding program (CBBP) framework: A framework for community-based small ruminant breeding strategies
3. Certification scheme: A small ruminant sire certification program guide
4. Support to scaling: A guide to and training for replicating CBBPs across Ethiopia

Step 2: Identifying Potential Partners

After identifying these deliverables, the program undertook a search for potential partners. It found that another CGIAR Entity (the International Center for Agricultural Research in the Dry Areas [ICARDA]), Argentina's National Institute for Agricultural Technology, and regional agricultural research centers in Ethiopia were already producing some of the relevant deliverable types. Other organizations, such as FAO, several Northern universities, local Ethiopian universities, and international nongovernmental organizations (INGOs) had the potential to produce them but were not currently doing so.

In expanding the search for other potential partners, the case study identified the SCAs corresponding to each deliverable. All deliverables required trained geneticists (human capital) and the ability to sustain long-term engagement with local farmers, researchers, and extension agents (social capital). Deliverables 2, 3, and 4 also required expertise on reproductive health as well as social scientists to advise on the sociological and economic feasibility of the sire certification and CBBP schemes. Physical capital requirements varied significantly across deliverables (see Table 2). By considering other organizations known to possess these SCAs, the team identified other potential producers, including local public and INGO extension agents.

Table 2: SCAs for small ruminant program deliverables

Deliverable	Human capital	Physical capital	Social capital	Incentives
Breeding selection tool	Geneticists with statistical and programming skills	Computing	Collaboration with local farmers, researchers, extension agents	International public good that can be applied elsewhere
CBBP framework	Geneticists, reproductive health experts, social scientists	Field sites, transport, research equipment	Long-term collaboration with local farmers, researchers, extension agents	International public good that can be applied elsewhere
Certification scheme	Geneticists, reproductive health experts, social scientists	Field sites, transport, research equipment; existing breeding program	Long-term collaboration with local farmers, researchers, extension agents	Needed to build in sustainability; international public good that can be applied elsewhere
Support to scaling	Geneticists, reproductive health experts, social scientists		Government ownership; collaboration with local extension agents, researchers	International public good that can be applied elsewhere

Step 3: Assessing Relative Trade-offs

Considering the relative trade-offs among deliverables for the organizations identified, the best estimates of the Livestock Genetics team suggested that deliverables 1 and especially 2 within this program were the CA of the CGIAR team. Deliverable 4 was an area where NGOs, national and local governments, and local extension services appeared to have clear CA. Their estimated capabilities for support to scaling, while lesser in absolute terms than those of CGIAR, were high relative to their capabilities for breeding selection in particular. It would cost these potential partners less, in terms of forgone progress on breeding selection, to provide support to scaling than it would CGIAR, indicating the possibility of meaningful gains from specialization and partnership. The relative capabilities profile of local university researchers was estimated to be similar to that of CGIAR though at a lower level, implying that specialization of deliverables between CGIAR and these organizations would not be a fruitful source of gains from a CA perspective (although it may have been desirable for other reasons).

Step 4: Planning Partnerships, Refining Proposals

As this case study was retrospective, questions dealt with how the program might have been modified given the findings of the earlier stages of analysis. Respondents indicated that FAO and local universities might have been able to supply some research inputs for deliverable 2, but, owing to institutional incentives, they would not have been well suited to provide ongoing project management. For deliverable 4, the assessment was that the public sector or INGOs, which, prima facie, appeared to be well suited to specializing in these areas, might face difficulties in adapting their approaches to the local context. Ultimately, then, they did not have CA in this domain. Concluding that FAO and local universities do not have incentives to provide ongoing management suggests that something akin to "long-term planning horizon" was an unstated institutional SCA relevant to producing deliverable 2. Meanwhile, the assessment found that other organizations that appeared (based on the identified SCAs) to have a CA in deliverable 4 in fact lacked the ability to adapt to the local context (i.e., public sector, INGOs or less likely private sector). This result suggests that "staff knowledge of local conditions" may have been an additional form of human capital necessary to produce deliverable 4.

Rather than conclude that these unstated SCAs pose an obstacle to specialization across deliverables, it is worthwhile to examine whether deliverables 2 and 4 (CBBP framework and support to scaling) can be further divided into deliverables for which other organizations that appear (from the analysis in step 3) to have clear CA in these areas possess all the needed SCAs for that more narrowly defined deliverable. For example, if the "support to scaling" deliverable could be thought of as a "program dissemination and implementation" and a "strategic support and local context adaptation" deliverable, then the analysis in step 3 suggests that a partnership in which INGOs or local governments produce the former and CGIAR provides the latter deliverable could prove beneficial.

7 Summary

Thinking about CA during the project design process can potentially lead to mutually beneficial partnerships, increasing CGIAR's effectiveness through specialization and redirecting scarce resources toward the System's relative strengths. A CA analysis is designed to harness the differing competencies of the organizations with which CGIAR interacts in a way that makes "the sum of its parts" as large as possible, maximizing the impact of available funding targeted at international public goods.

The very same tools outlined here and applied retrospectively in the empirical example from the Livestock CRP can also be applied in a dynamic and forward-looking manner to identify areas in which CGIAR investments to build CA in particular areas of increasing importance would greatly increase the effectiveness of the combined AR4D ecosystem. Keep in mind, however, that expanding CA in one direction necessarily requires sacrificing it in some other area. Investing in future capacity also takes away resources from current production of desired deliverables. Because of this, research managers attempting to expand CA in a particular direction should explain why this is an area that CGIAR should increasingly invest in and how the projected benefits can be assessed, both prospectively and retrospectively, as well as clearly identify what alternative uses of resources must be sacrificed in order to make the investment. Moreover, the decision to invest in developing new CA should ensure that CGIAR invests in building new capabilities only in those domains in which it holds a relative advantage in obtaining them vis-à-vis potential partner organizations.

While any analysis of CA may not be entirely conclusive or fully quantitative, a disciplined consideration of the goals and capabilities of other actors strengthens the System's understanding of its position in the broader ecosystem of organizations with related goals. Concluding that an outside entity has a CA in some area is not an admission that their capabilities are superior. Rather, it is a key step in minimizing the trade-offs between a set of competing goals by focusing on efforts that CGIAR is relatively best placed to deliver. In an organization committed to producing international public goods to advance shared, noncommercial objectives, disciplined stewardship of scarce system resources is important to build investor confidence as well as CGIAR impacts.

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