

Costing of CGIAR and NARES Breeding Pipelines using the University of Queensland (UQ) Breeding Costing Tool: A training of trainers' workshop report.

The Accelerated Breeding Initiative (ABI) of the CGIAR Genetic Innovations (GI) Action Area has been supporting CGIAR and NARES breeding programs to cost out their operations since 2018. The main goal of this effort has been to support public breeding programs to better understand their costs, optimize resource allocation and accurately cost key activities such as trialing or on farm testing using a standard tool. To-date, several costing workshops have been conducted throughout East and West Africa involving over 100 scientists from the CGIAR and NARES. To further scale out costing support to public breeding programs, ABI organized a Train the Trainers Costing workshop in Nairobi for CGIAR and NARES partners from across Africa and Latin America in Nairobi from the 13th to 16th of May 2024.

Costing of operations supports breeding programs to develop accurate budgets and make evidence-based decisions on resource allocation and prioritize activities to maximize return on investment. Attaining cost-effectiveness in breeding is envisaged to translate into a rapid release and availability of more resilient crops for the climate-change-threaten farming systems. ABI advocates the use of the University of Queensland Breeding Costing Tool (UQ-BCT) to cost out CGIAR and NARES breeding program. This is a free standalone software which was developed by the sorghum breeding program at the Queensland Alliance for Agriculture and Food Innovation (QAAFI) of the University of Queensland (Figure 1 <https://aussorgm.org.au/downloads/breeding-costing-tool/>). The tool had been used effectively by sorghum breeding programs in Australia and thereafter deployed within the Ethiopia Institute of Agricultural Research (EIAR). In 2023, the tool was endorsed for deployment in CGIAR-NARES breeding networks by senior GI management including Drs. John Derera and Sharifah Syed. Prior to the deployment of the UQ-BCT to cost out CGIAR and NARES breeding programs, breeders did not have any standard or common method for costing the stages of their breeding pipelines. “When I asked CGIAR and NARES breeders how much it would cost to expand early-stage testing by a certain percentage, none were able to provide any firm cost estimates and none were using a standardized means to cost their operations,” said Biswanath Das (NARES coordinator and ABI-Transform lead).

The goal of the workshop was to build capacity among the trainees to support the costing of breeding operations in their institutions and crop networks whilst costing out an actual pipeline for their institutes. Through the training, the participants were expected to attain proficiency in using the UQ Breeding Costing Tool, and hence support scaling of costing of the breeding programs within their institutions and crop networks. This would help develop a community of practice for costing whilst also easing the demand for support from the ABI-Transform team which has been inundated with requests for support. In his workshop opening remarks, Dr. Michael Quinn (CGIAR director of Breeding Innovations and Modernization) said that building capacities across the institutions is a way of scaling up the costing of breeding operations innovation. “ABI is focused on building institutional capacity to cost out breeding operations and will continue to provide technical backstopping as required,” said Biswanath Das.



Figure 1: A screenshot of the University of Queensland Breeding Costing Tool The ABI-Transform team designed a data capture template to ease entry and calculation of unit costs for the costs of items, labor and fixed costs.

The participants of the workshop were nominated and sponsored by various CGIAR centres including CIMMYT, CIAT, ICARDA, IRRI, IITA, CIP, CGIAR gene banks and the Kenya Plant Health Inspectorate Service (KEPHIS) (Table 1). The participants consisted of both CGIAR and NARES staff from critical regional crop breeding networks from Africa and Latin America. The participants were required to be knowledgeable about breeding operations, and therefore, consisted of research scientists, research associates, research coordinators, technicians, and junior scientists. Upon nominations, the participants were to undergo a mandatory online preparatory training of split 4-hour biweekly sessions to enable them to gather the required data and to calculate the unit costs for items, labor, and capex items, and the personnel salary rates for their breeding programs, as this information was required for the workshop. Each participant was required to gather the data that would enable them to complete the costing of at least one breeding pipeline by the end of the 4-day workshop period. The biweekly online preparatory meetings were supported by the ABI-Transform core team, including Dr. Samuel Mutiga, Olivia Odiyo and Sammmmy Madahana. “The online preparatory meetings were important, and the workshop could not succeed without them,” said Dr. Lennin Musundire (the ABI-Transform Costing Lead).

Table 1. Crops and the institutions represented in the 13th to 16th breeding operations costing workshop.

Crop	Sponsor	Institution of origin	Number of participants
Sorghum	CIMMYT-Dryland Crops program	EIAR, NARO, ZARI, and TARI	8
Finger millet	CIMMYT-Dryland Crops program	TARI and NARO	4
Groundnuts	CIMMYT-Dryland Crops program	NARO, TARI and DCP	5
Common bean	CIAT	CIAT Uganda, Malawi and Tanzania	3
Brachiaria (forage)	CIAT	CIAT Kenya	1
Chickpea	ICARDA	GHU Lebanon	1
Durum wheat	ICARDA	ICARDA Morocco	1
Rice	IRRI	IRRI Kenya	1
Wheat	CIMMYT and KALRO	CIMMYT East Africa network	2
Plantain banana	IITA	IITA Nigeria	1
Cassava	IITA and CIAT	IITA Tanzania and Malawi, and CIAT Uganda	3
Sweet potato	CIP	CIP Mozambique and Uganda	2
Irish potato	CIP and CGIAR gene banks	CIP Africa and Latin America, and CGIAR gene banks- Peru	3
Germplasm Health and Conservation	KEPHIS	KEPHIS and CIP	3

The current East African workshop took place exactly a year after a similar one was held in West Africa at IITA Ibadan, Nigeria. Although there were overwhelming requests for participation in the current workshop, the workshop limited participation to 36 participants who were selected to strategically represent different CGIAR crop networks, mainly from across East and Southern Africa and Latin America (Figure 2). Based on the category of the organizations represented, the majority (58%) came from the NARES, while the rest (42%) were from the CGIAR centers. Based on the crop networks, the participants working on dryland crops (groundnuts, millet, and sorghum) were the majority, while brachiaria (a forage crop), rice and plantain banana had one participant each (Table 1). Besides organizations working directly on breeding, institutions working on germplasm health and conservation (KEPHIS and CGIAR gene banks) were interested in customizing the tool for use in their projects and were therefore represented (Table 1).

The four-day workshop was mainly focused on enabling the participants to be able to use the UQ-BCT for costing of the activities of different stages of the breeding pipelines (see the itinerary in Appendix Table 1). The major topics covered during the training were: 1) the utility of breeding schemes and the associated experimental designs in the costing of activities of the breeding pipelines, 2) data capture and calculation of unit costs, 3) uploading of the data into the UQ-BCT, 4) creating of projects, activities, and reviewing of costs, and 5) reporting of cost summaries. All members acknowledged the need to ensure accuracy in data capture for the items, labor, and fixed costs from the program. It was also observed that the step of data capture requires interactions with the procurement, human resources, and finance departments and thus its time of collection may vary depending on institutional policies. Although not all participants had clean data, it was agreed that this would be cleaned up later to ensure the reports were accurate.



Figure 2. A group photograph of the participants of the 13th to 16th May 2024 CGIAR Initiative on ABI-Transform breeding operations workshop. Photo was taken on the 3rd day of the workshop at the Concord Hotel, Parklands, Nairobi, Kenya.

Costing of operations considers the tasks and consumables for specific stages aligned with a crop cycle. On the first day of the workshop, the participants were grouped based on the crops they were working on to enhance efficiency and accuracy in the identification of the activities and tasks for different breeding stages of each crop. It was very exciting to see the group activities, particularly when they discussed the breeding schemes on the first day of the workshop. The groups worked together and were supported by the ABI core team in each step of the workshop (Figure 3). “When we started working on the breeding schemes, it was not looking clear, but now we have gotten why it is important to identify the stages (or the components) of the breeding pipeline in costing,” said Ruth Magaletta (a research associate working on common beans in Malawi).

The workshop's first and second days focused on data clean-up and uploading into the UQ-BCT. The groups appreciated the importance of the Excel data capture template developed by the ABI-Transform core team, as it made it easy to capture the data in a way that aligns with the features that allow the upload into the UQ-BCT (Figure 1). On the third day, the participants were trained in how to create activities for each of the breeding stages and how to review the costs to ensure that they reflect the actual expenses in a season (biannual) or a year (for annual crops). Upon uploading the data into the UQ-BCT, the training became intense and exciting as the participants skipped tea breaks to ensure they learned how to create activities for the breeding stages. On the final day, the participants continued reviewing the costs for the activities and made the final presentations of the outputs for the costed pipelines. During the final presentations, each presenter showed the results of the costs of their pipelines and outlined their plan to apply the skills they had acquired to support costing within their institutions and other crop networks (Figure 4). The groups were advised to work together as communities of practice which was to be established through ABI-

Transform to enhance regular engagements (Figure 5). Based on the successful completion of the costing of the stages of the pipelines and the presentations of individual participants, the ABI-Transform team rated the success of the training of the trainers' workshop at 80%. Lastly, each participant received certificates and a mug with the ABI label for completing the training successfully (Figure 6).

Organizing the East African workshop at the Concord Hotel in Nairobi was a learning experience for both the learners and the trainers. Online engagement was useful but the participants agreed that meeting physically was key to success as participants were able to interact amongst each other and facilitators and were able to work effectively without distraction over the course of four days. Working in crop clusters enabled participants to share information and build relationships and connections. As a follow-up, the ABI-Transform team has initiated regular virtual weekly meetings to ensure each participant reviews their costing activities to obtain actual pipeline costs. Owing to the overwhelming demand, ABI-Transform will organize similar workshops in other strategic regions to ensure that there are enough trainers to support the costing in different parts of Africa, Asia, Latin America and beyond.



Figure 3. Participants working in groups are guided on how to cost the breeding operations for cassava (supported by Dr Lennin Musundire, Figure 3 A) and sorghum (supported by Dr Samuel Mutiga, Figure 3 B).



Figure 4. Workshop participants working in crop-specific groups. Individuals within a group supported each other, but each participant was to present their costing outputs.



Figure 5. The participants received training from the ABI core support team and guidance and encouragement from the ABI-Transform Lead. On the fourth day of the workshop, Dr. Biswanath Das addressed the participants and emphasized the importance of post-workshop group engagements by forming communities of practice for costing breeding operations.



Figure 6. Sample photographs of the participants and the support team of the CGIAR initiative on Accelerated Breeding (ABI) workshop received completion certificates and mugs on 16th May 2024 at the Concord Hotel, Nairobi. The awarding ABI team personnel were Dr. Dragan Milic and Ana Oliveira.

Appendix Table 1. Costing of breeding operations using the University of Queensland Breeding Costing Tool

Date: 13th-16th May 2024; Venue: Concord Hotel, Nairobi, Kenya.			
Day	Time	Topic	Presenter/Moderator
Monday, 13th May 2024	08:30 – 08:45	Registration	Annie Karago
	08:45 – 09:00	Participant introduction	Samuel Mutiga/Lennin Musundire
	09:00 – 09:10	A statement on the goals of the workshop	Biswanath Das
	09:10 – 09:30	Workshop opening remarks	Michael Quinn
	09:30 – 9:50	PowerPoint Presentation: Costing of Breeding Programs	Biswanath Das /Lennin Musundire
	09:50 – 10:30	Grouping (A=maize & pearl millet; B: Wheat & Rice; C: RTB crops; D: Beans, Groundnuts and Cowpea). Presentations for breeding schemes (10 mins per group) plus feedback.	Samuel Mutiga
	10:30 – 11:00	Coffee / Tea break/Group photo	Annie Karago
	11:00 – 13:00	Overview of data capture and uploading of data into the University of Queensland Breeding Costing Tool (UQ-BCT): demonstrate and upload two-unit costs (item, labor and fixed costs)	Samuel/Sammy/Olivia
	13:00 – 14:00	Lunch	Annie Karago
	14:00 – 15:30	Creating and calling activities into components within a project	Olivia Odiyo
	15:30 – 16:00	Coffee / Tea break	Annie Karago
	16:00 – 17:00	Creating and calling activities into components within a project, (Cont.)	Group support by OO=group A&B; SM=group C SKM=group D
	08:30 – 10:00	Costing of breeding operations: review of the groups' progress in a plenary	Samuel, Olivia, and Sammy
	10:00 – 10:30	Coffee / Tea Break	Annie Karago
Tuesday, 14th May 2024	10:30 – 12:45	Costing of breeding operations - group work: creation and calling of activities for projects	Group support by OO=group A&B; SM=group C SKM=group D
	12:45 – 14:00	Lunch	Annie Karago
	14:00 – 15:45	Costing of breeding operations- group work: creation and calling of activities for projects	Group support by OO=group A&B; SM=group C SKM=group D
	15:45 – 16:00	Coffee / Tea break	Annie Karago
	16:00 – 17:00	Review of activities costs within the UQ-BCT (groups present the costs for components; plenary discussion to fix shouting figures)	ALL
	08:30 – 10:00	Costing of breeding operations - group work: review of the costs of activities across components	Group support by OO=group A&B; SM=group C SKM=group D
	10:00 – 10:30	Coffee / Tea Break	Annie Karago
	10:30 – 11:15	Exporting summary costs from UQ-BCT to the Excel Summary file	Samuel and Olivia
Wednesday, 15th May 2024	11:15 – 12:45	Group work: cost summary calculations in Excel summary file	Group support by OO=group A&B; SM=group C SKM=group D
	12:45 – 14:00	Lunch	Annie Karago
	14:00 – 15:00	Group work: reporting of cost output in MS Word	Group support by OO=group A&B; SM=group C SKM=group D
	15:45 – 16:00	Coffee / Tea break	Annie Karago
	16:00 – 17:00	Group work: Finalizing of reporting of cost output in MS Word	Group leads (moderator = Sammy Madahana)
	19:00-20:00	Group dinner	Annie Karago
	08:30 – 10:30	Group presentations for their costing outputs and prospects of scaling-up within their institutions and crop networks	Group support by OO=group A&B; SM=group C SKM=group D; Ana Oliveira=ALL Groups
	10:31 – 10:45	Coffee / Tea Break	Annie Karago
Thursday, 16th May 2023	10:45 - 11:30	Group presentations for their costing outputs and prospects of scaling-up within their institutions and crop networks	Group support by OO=group A&B; SM=group C SKM=group D; Ana Oliveira=ALL Groups
	11:30 – 13:00	Joint costing exercise using shared data from ABI-Transform	Group support by OO=group A&B; SM=group C SKM=group D
	13:00 – 14:00	Lunch	Annie Karago
	14:00 – 16:00	Moderators' comments	Moderators and then group leads
		Closing remarks	Bish/Lennin
		Awarding of certificates	Bish/Lennin
		Vote of thanks	One participant
		End of the meeting program	
	16:00 - 16:15	Coffee / Tea break	Annie Karago