INCLUSIVE AGRICULTURE

Kampong Chhnang, Cambodia 2017

Project Summary

Andrew Drain

60 participants
11 designers
4 workshops
3 projects
June 2017 - January 2018

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

engineers without borders australia

LIGHT FOR THE WORLD
DISABILITY INCLUSION LAB

ngile

OVERVIEW

Inclusive Agriculture

The Inclusive Agriculture Project aimed to work with a community of people with disability (PwD), in rural Cambodia, to co-design technology that gives them better access to agricultural livelihoods. Participants were aged between 17 and 80 years old and had a range of impairments such as hearing, vision, mobility and cognition.

Aims & Objectives

1. **Improve ability of people with disability to access agricultural livelihoods**
   a. Creation of new technology for use in the community
   b. Development of innovation and problem solving skills in the participants (creative capacity building)
   c. Improved social inclusion for people with disability in the community
2. **Increase organizational knowledge about the challenges faced by people with disability in rural Cambodia**

OVERVIEW

Partners

Massey University is a university, based in Wellington, Palmerston North and Auckland, New Zealand. The School of Engineering & Advanced Technology were involved in this project. Our contribution was supported by the New Zealand Aid Programme and the Asia New Zealand Foundation.
www.massey.ac.nz

Engineers Without Borders Australia is a member-based, community organisation that creates social value through humanitarian engineering. Our contribution was supported by the Australian Government through the Australian NGO Cooperation Program (ANCP).
www.ewb.org.au

Light For The World is promoting the inclusion of people with a disability in education, in the labour market and in all other aspects of society, with a focus on developing countries. We work to create innovative solutions that empower people with disability to engage in wider society and have the opportunity for a meaningful life.
www.lightfortheworld.nl

Agile Development Group is a business with experience in grassroots community development, international development, international business, social enterprise development and corporate social responsibility.
www.agiledg.com

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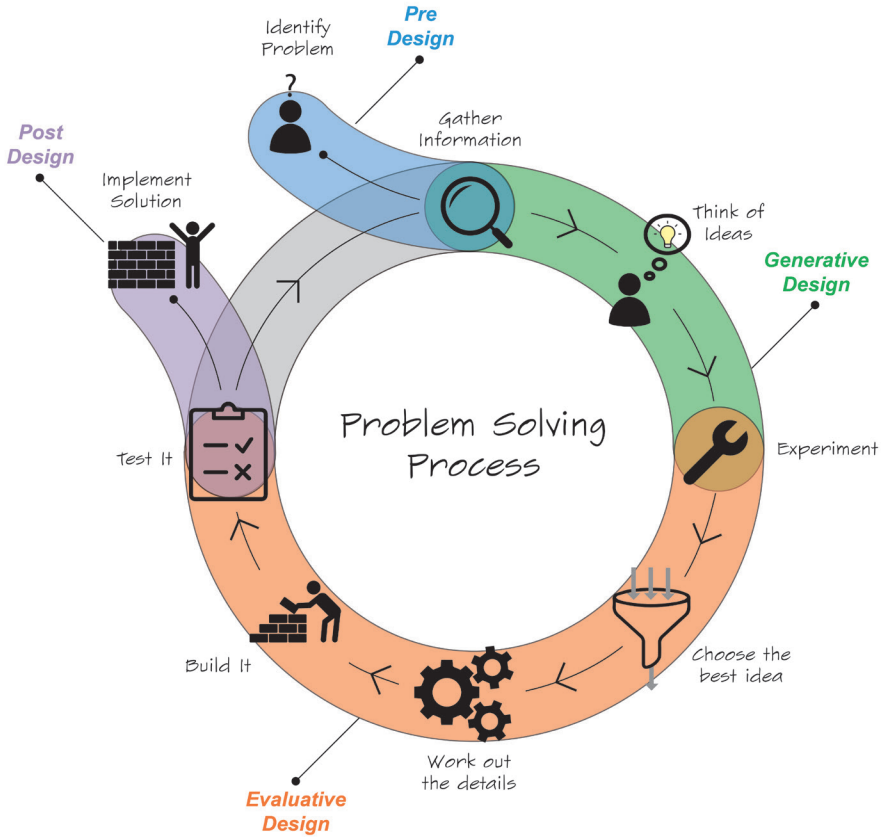
METHODOLOGY

Design Process

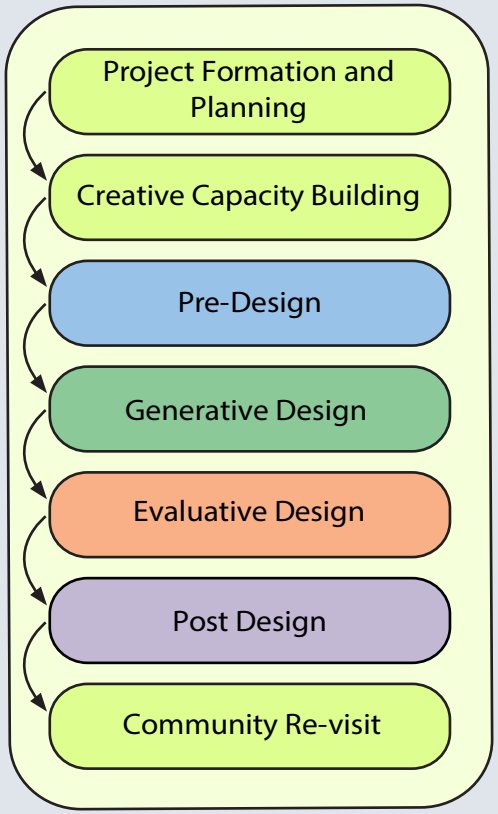
The project used a five stage design process, known as the Adapted Making Framework, to structure planning, workshop activities and evaluation. The stages were *Creative Capacity Building, Pre-Design, Generative Design, Evaluative Design* and *Post Design* (Sanders & Stappers, 2014).

For ease of understanding, a more descriptive, step-by-step, design process was also adopted. This drew inspiration from the design process used by the MIT D-Lab (Taha, 2011). The diagram on the right shows both processes and how they align.

To access the participatory design handbook developed for this project please see:
https://www.researchgate.net/publication/326357229_Participatory_Design_Handbook_Inclusive_Agriculture_Cambodia_2018



Project Stages



METHODOLOGY

Research Methodology

The project was monitored and evaluated as part of a PhD research thesis by Andrew Drain. The researcher used a qualitative, multi-case study design to investigate the role of creative capacity building and designer-participant collaboration in effective participatory design.

The research resulted in the following data being collected:

- *19 designer interviews*
- *32 participant short interviews*
- *9 participant long interviews*
- *59 designer field diary entries*
- *100 pages of observational notes from workshops and planning sessions*
- *380 photos from workshops*
- *Workshop documents (models, prototypes, posters, templates)*
- *3 technology evaluations*
- *4 workshop reflection documents*

For further research generated from this project please see:
https://www.researchgate.net/project/Participatory-Design-in-rural-Cambodia

PROJECT STAGES

PROJECT STAGES

Creative Capacity Building

The first stage involved conducting four training sessions with participants. These sessions aimed to introduce important concepts for innovation and problem solving and align these concepts with existing local practices.

Sessions

Session 1: What is design? *- A group discussion about problem-solving concepts and examples of how the community already uses these concepts in their everyday lives*

Session 2: The design process and mango picker *- A presentation of the design process, discussion about each stage and a practice activity designing a mango picker product*

Session 3: The banana boost *- A practice activity using paper and cardboard to design a new structure for holding bananas above flood waters*

Session 4: Transition to Pre-Design *- A group discussion about how this process could now be used to address challenges in the local community*

Insights

Designer - *"They [participant] think, 'oh they're already old', they're not going to think, they cannot come up with all this type of thing"*

Designer - *"They already did design, but they do not follow the design process that we had. Most of them, when we talk about the design process, they don't understand. But when we come up with an example, they understand because that is the work that they have already done before"*

Designer - *"Currently, if they create it and it does not work they throw it away"*

PROJECT STAGES

Pre-Design

This stage involves the use of activities which probe for information and insights about the user, their environment and potential problems to address. The goal of this stage is to collaboratively formulate the opportunities which the project will focus on, to ensure buy-in from the involved community and to gain insights to help inform the rest of the project.

Insights

It is difficult for mobility-impaired individuals to pump and carry water each morning

People with disability spend a large amount of time each day sitting idly, waiting for their carer to return home from work

It is difficult for elderly people to complete the tasks required to farm rice and other vegetables

People with disability aspire to fill their days with meaningful work and to contribute to their family's livelihoods

Project Briefs

Project 1. ***The design of a solution to assist the elderly in direct seeding rice seed onto a field***

Project 2. ***The design of a solution to assist mobility impaired individuals to prepare their fields before sowing***

Project 3. ***The design of a solution to allow the visually impaired, to engage in small-scale chicken farming***

PROJECT STAGES

Generative Design

This stage is focused on generating concepts that address the opportunities identified in the pre-design stage. This can be done through investigating existing solutions, both locally and internationally, understanding participant aspirations and working with participants to generate ideas and prototypes. These prototypes can be used to experiment and combine ideas to form new more detailed concepts.

Insights

The traditional process for sowing rice seed (broadcasting) is labour-intensive and diffcult for people with disability to do

Some families already engage in farming, however, it is currently too difficult to involve their family members with disability

Participants had heard of novel technologies but had no access to them in their local area

Concepts

Project 1. ***A low cost drum seeder to allow mobility and vision impaired individuals to sow rice seed more effectively***

Project 2. ***A cart that can attach to an existing ox-drawn plough to allow mobility impaired individuals to plough their fields more effectively***

Project 3. ***Modifications to a chicken coop to enable vision impaired individuals to navigate the coop, and interact with chickens more effectively***

PROJECT STAGES

Evaluative Design

This stage is focused on testing ideas, getting feedback about prototypes and selecting the concepts that seem to best meet the needs of the community. This can be done through co-constructive prototyping, testing and evaluation.

Insights

Participants had strong construction skills but relied on designers for creative input and technical decisions

Participants were highly motivated to create, test and refine prototypes independently

Male participants tended to dominate construction activities, with female participants engaging more during feedback and refinement activities

Prototypes

Project 1. ***A low cost drum seeder to allow mobility and vision impaired individuals to sow rice seed more effectively***

Project 2. ***A cart that can attach to an existing ox-drawn plough to allow mobility impaired individuals to plough their fields more effectively***

Project 3. ***Modifications to a chicken coop to enable vision impaired individuals to navigate the coop, and interact with chickens more effectively***

Project 1.

Project 2.

Project 3.

PROJECT STAGES

Post Design

This stage is focused on implementation of developed solutions, support and fine-tuning after implementation and monitoring of long-term adoption and effectiveness.

Insights

Participants who were dominant during construction activities were also motivated to own the prototypes and continue independent improvements

Participant - "I have a plan with four people. I was the one who initiated the idea to make a tool. Then, we mentioned to the group that we wanted a rice seeding tool"

Certain technical aspects of the prototypes still required refinement. Participants felt unable to refine some of these aspects independently due to complexity

Project Success

Project 1. ***A low cost drum seeder was developed and transferred to a motived participant for further development. Minor refinements required***

Project 2. ***A cart that can attach to an existing ox-drawn plough was created and transferred to a motived participant for development. Once prototyped, the intended use changed, resulting in major refinements being required***

Project 3. ***Planned modifications to a chicken coop were terminated due to lack of buy-in from participant's wider family***

EVALUATION

EVALUATION

Overview

The evaluation of the Inclusive Agriculture Project focused on both the technology created and the empowerment of the participants. Both components are described below.

Technology

The evaluation of technology focused on four criteria:

1. Whether the technology met the requirements developed during the project
2. Whether the community was satisfied with the solution
3. Whether the technology was likely to be adopted by the community
4. Whether the technology had potential to scale to other locations

Empowerment

The evaluation of empowerment focused on the creative capacity built in the participant group. Creative capacity was defined as the following six competencies:

1. An ability to express contextual insights (shorthand: *contextual insights*)
2. An ability to express design critique(*design critique*)
3. An ability to generate insightful ideas (*ideas*)
4. An ability to create insightful prototypes (*prototypes*)
5. An understanding of the design process (*design process*)
6. A motivation to contribute (*motivation*)

A description of each competency is provided on the right.

1. An ability to express contextual insights

Participant is able to contribute information about their general geo-socio-cultural environment and their specific daily lives.

2. An ability to express design critique

Participant is able to provide feedback when presented with a specific concept (idea, prototype or final product).

3. An ability to generate insightful ideas

Participant is able to expand on ideas presented by a facilitator and generate own ideas independently.

4. An ability to generate insightful prototypes

Participant is able to build basic prototype when directed by a facilitator and independently.

5. An understanding of the design process

Participant understands the current stage of the design process and is aware of the rationale behind the use of each design activity.

6. A motivation to contribute

Participant is engaged and is likely to continue involvement throughout the project and continue to work independently after project completion.

EVALUATION

Technology - Project 1

The design of a solution to assist the elderly in direct seeding rice seed onto a field

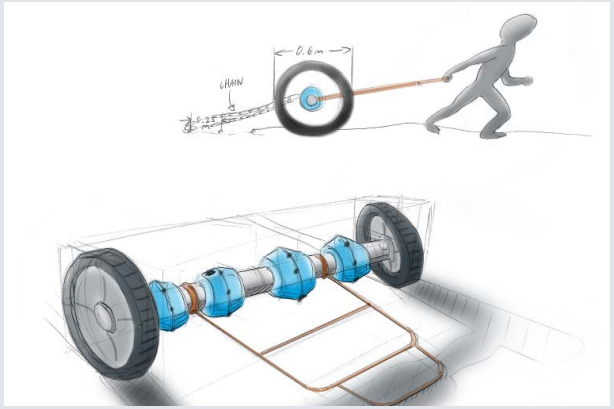
Effectiveness

Requirement	Achieved?
Must drop seeds 25cm apart	Yes
Must be pulled by one elderly user	TBA
Must be usable in flooded fields	TBA
Seed dispensing must work in dirty environment	Yes
Must hold 12 kg of seeds	Yes
Easy to transport to farm	Yes
Must be constructed and maintained locally	TBA
Must be affordable by community members	Yes
Universal design	Yes

Community Satisfaction

Very dissatisfied
Dissatisfied
Neither
--- Satisfied ---
Very satisfied

Community members like the design and continue to refine it outside of the workshop. However, the frame needs to be refined to ensure rigidity in use



EVALUATION

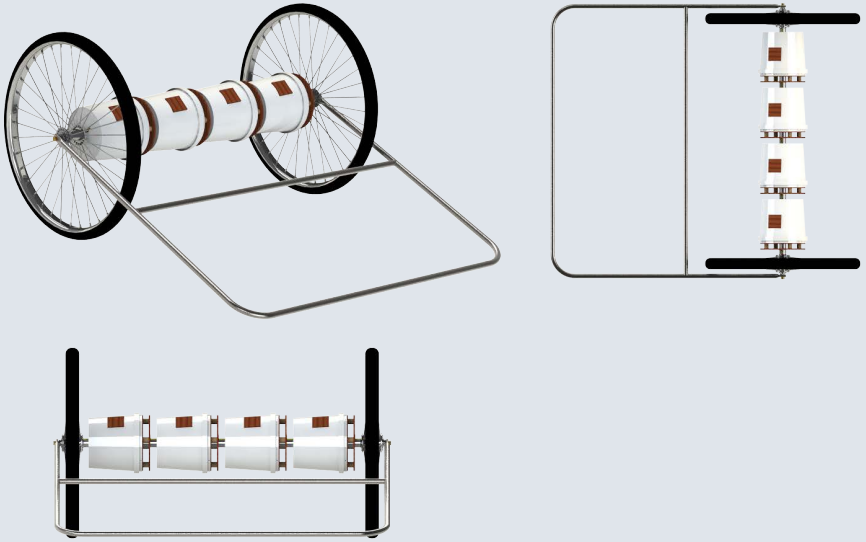
Technology - Project 1

Adoption of Technology

Timeframe	Achieved?
End of project transfer of ownership	Yes
Short-term adoption	TBA
Long-term adoption	TBA

Generalizability

Area	Appropriate?	Detail
Local	Yes	Local farmers use the same farming processes and have the same resources available locally
National	Yes	Small plot farmers most likely use the same farming processes and have similar resources available locally
Other: *Small plot farmers in rural communities in developing countries*	TBA	Dependent on local farming processes



EVALUATION

Technology - Project 2

The design of a solution to assist mobility impaired individuals to prepare their fields before sowing

Effectiveness

Requirement	Achieved?
Must be attachable to any existing plough	No
Must be able to be pulled, along with plough, by two ox	TBD
Must be usable in muddy fields	TBD
Must be able to stand, kneel or sit on the cart	No
Must maintain users level of plough control	No
Easy to transport to farm	Yes
Must be constructed and maintained locally	Yes
Must be stable during use	TBD
Universal design characteristics of the environment	TBD

Community Satisfaction

Very dissatisfied
Dissatisfied
---Neither---
Satisfied
Very satisfied

Feedback shows that the product could be useful but requires refinement. Community members showed strong engagement with the process and are motivated to continue refinement

EVALUATION

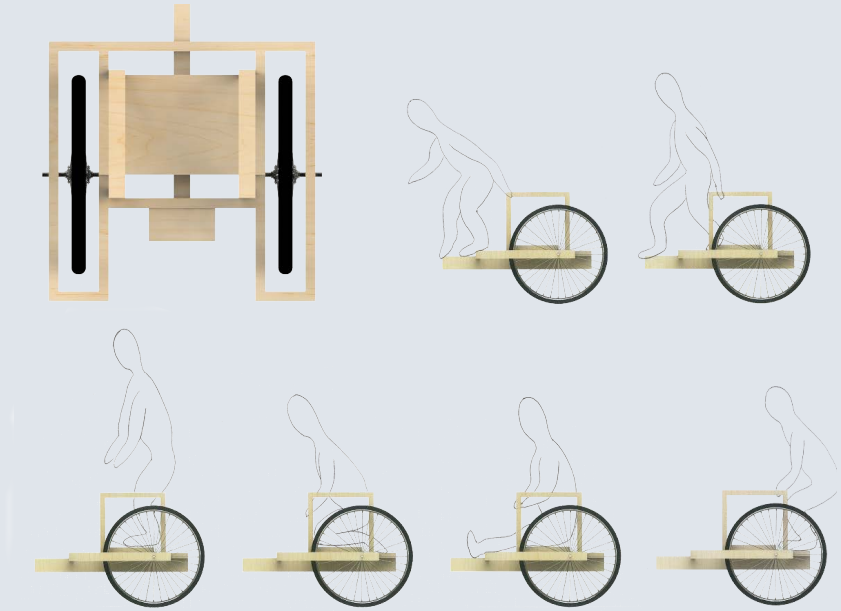
Technology - Project 2

Adoption of Technology

Timeframe	Achieved?
End of project transfer of ownership	Yes
Short-term adoption	TBA
Long-term adoption	TBA

Generalizability

Area	Appropriate?	Detail
Local	Yes	Local farmers use the same farming processes and have the same resources available locally
National	Yes	Small plot farmers most likely use the same farming processes and have similar resources available locally
Other: *Small plot farmers in rural communities in developing countries*	TBA	Dependent on local farming processes



EVALUATION

Technology - Project 3

The design of a solution to allow the visually impaired, to engage in small-scale chicken farming

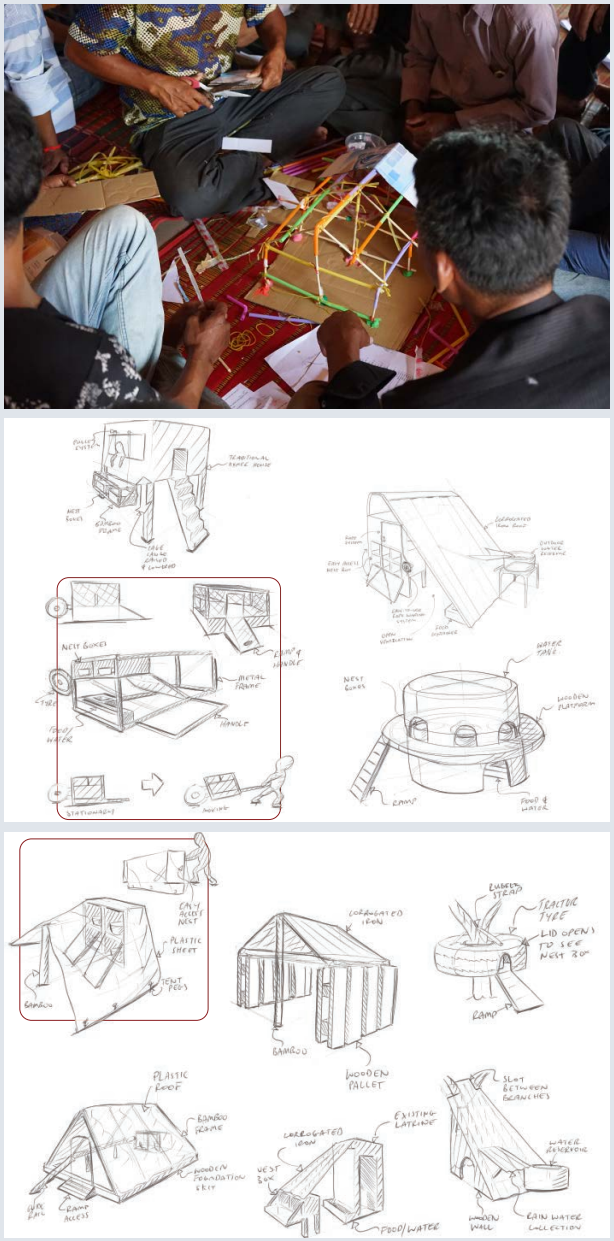
Effectiveness

Requirement	Achieved?
Must reduce occurrence of errors when entering the existing chicken coop	Yes
Must improve the time taken to enter the existing chicken coop	TBD
Must improve the satisfaction of the entry process to the existing chicken coop	Yes
Must maintain required functional components of existing chicken coop	Yes
Must retro-fit to existing chicken coop	Yes
Must be constructed and maintained locally	Yes
Universal design	Yes

Community Satisfaction

Very dissatisfied
---Dissatisfied---
Neither
Satisfied
Very satisfied

Family decision makers worried about risk of damage during modification and therefore rejected the design. Access for a people with disability was not perceived as valuable enough for the associated risk.



EVALUATION

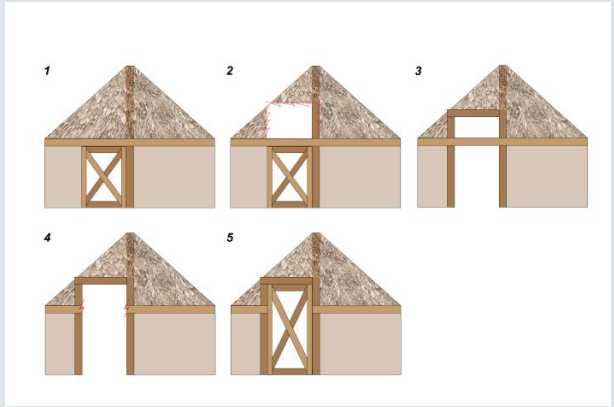
Technology - Project 3

Adoption of Technology

Timeframe	Achieved?
End of project transfer of ownership	No
Short-term adoption	TBA
Long-term adoption	TBA

Generalizability

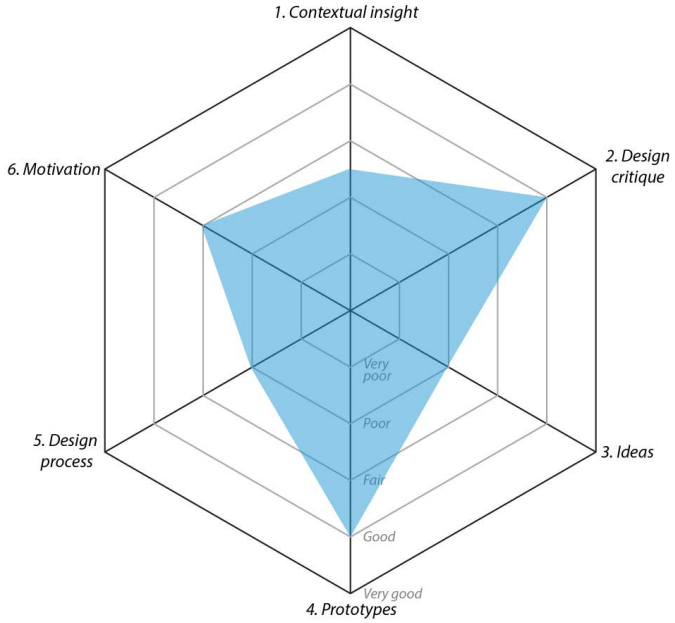
Area	Appropriate?	Detail
Local	No	The highly custom nature of the project means the challenges identified may not be present in other households
National	No	The highly custom nature of the project means the challenges identified may not be present in other households



EVALUATION

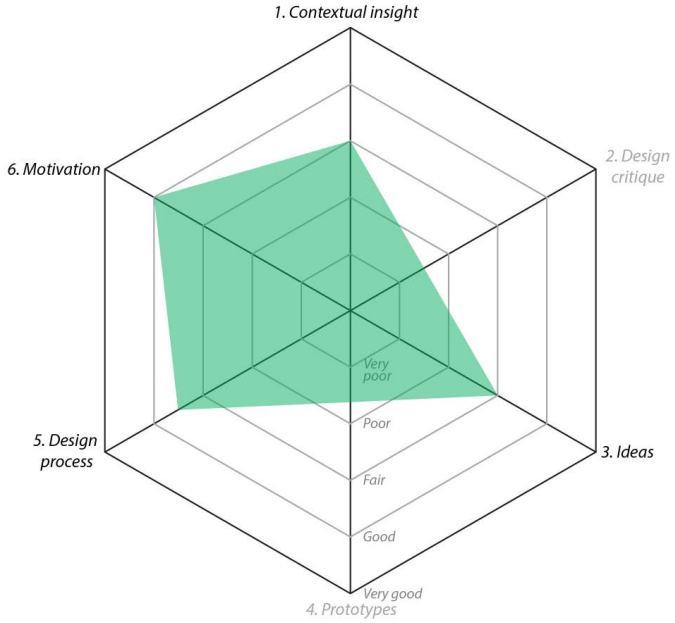
Creative Capacity Building

Each of the six creative competencies have been graded based on analysis of all available data. A five-point Likert scale ranging from *very poor* to *very good* was used to guide all data collection and analysis. A single grade for each competency was synthesized from all available data. These grades are presented using a spider diagram for each of the project stages. This visualization is meant to communicate the quality of collaboration at each project stage. Collaboration is impacted by a range of factors including designer and participant ability and relationship, workshop environment and activity planning.



Baseline

Participant group initial creative capacity before the Inclusive Agriculture Project

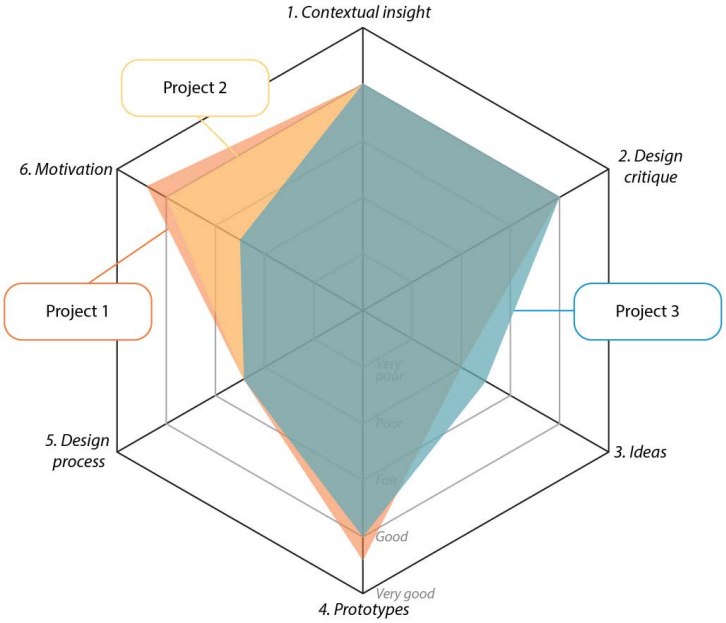


Pre-Design

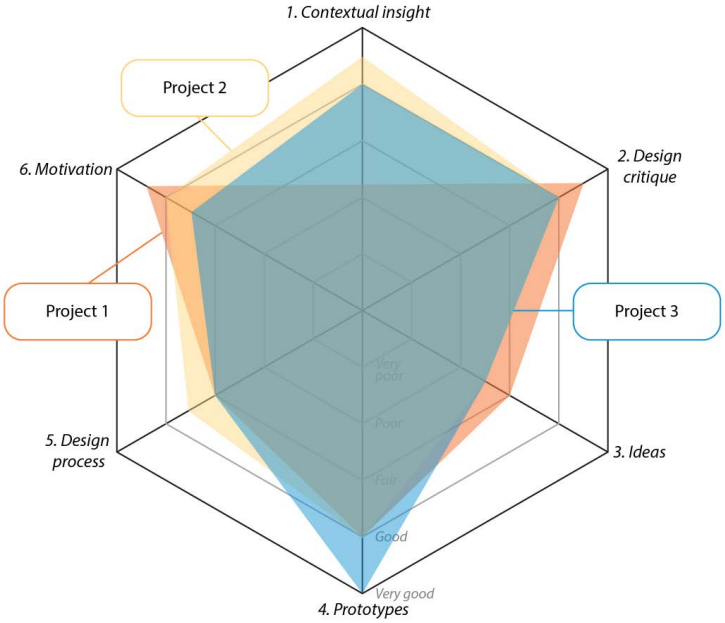
Note: If competency was not demonstrated in a stage it is shown in grey

EVALUATION

Creative Capacity Building



Generative Design

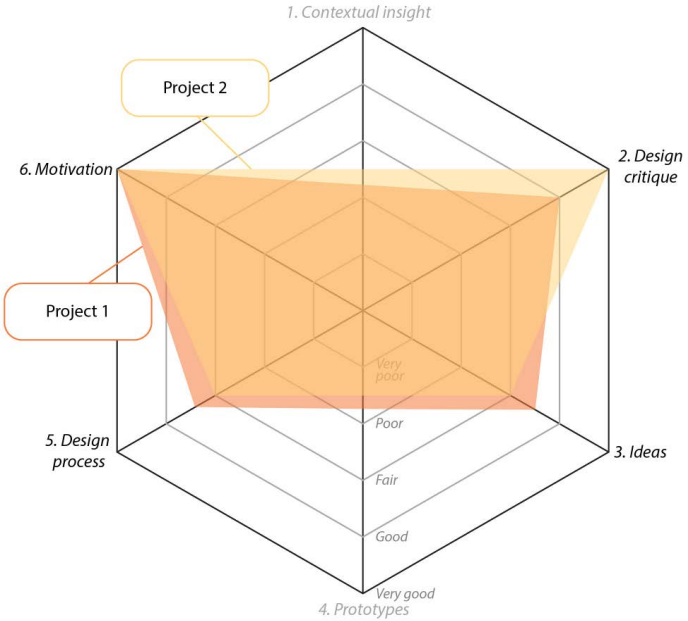


Evaluative Design

Note: If competency was not demonstrated in a stage it is shown in grey

EVALUATION

Creative Capacity Building



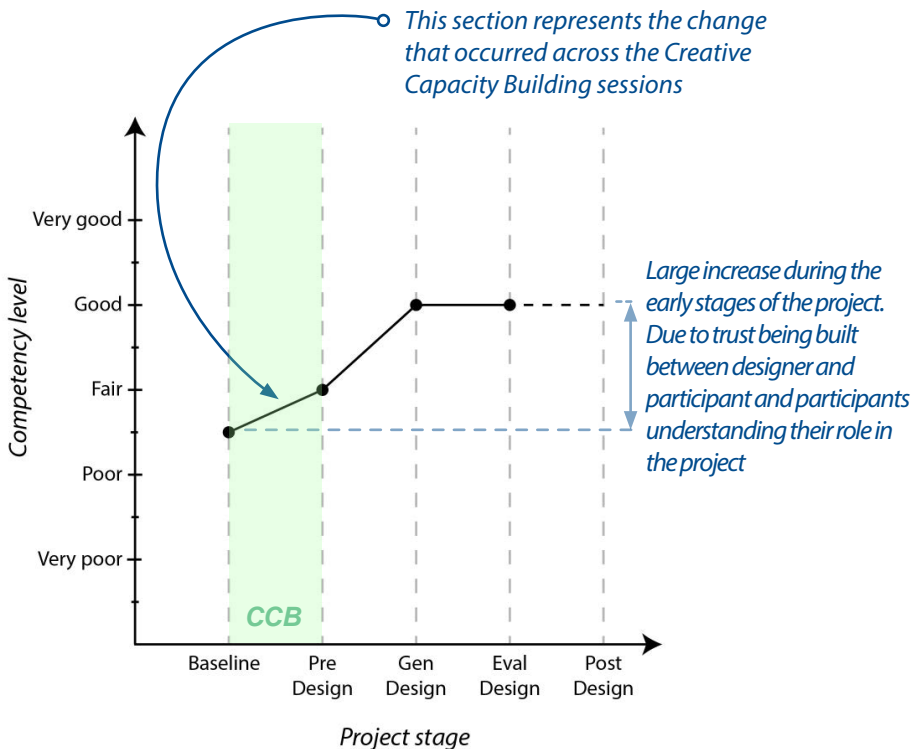
Post Design

Note: If competency was not demonstrated in a stage it is shown in grey

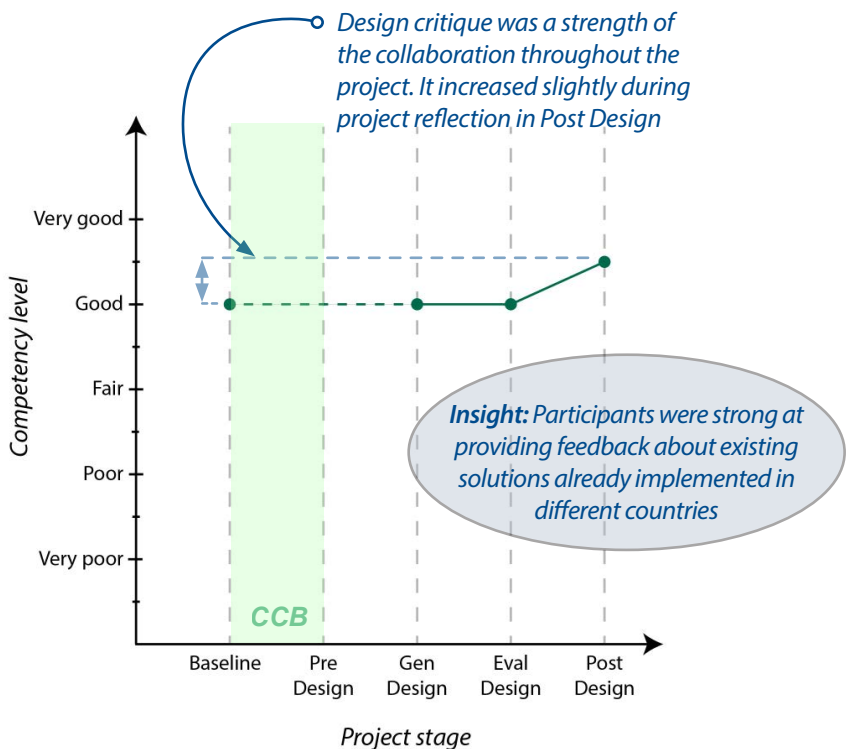
EVALUATION

Creative Capacity Building

Once each project stage was evaluated, the six creative competencies can be viewed longitudinally, to show their changes over time. The following section shows each of the six competencies along with annotations highlighting interesting findings.



1. Contextual Insights

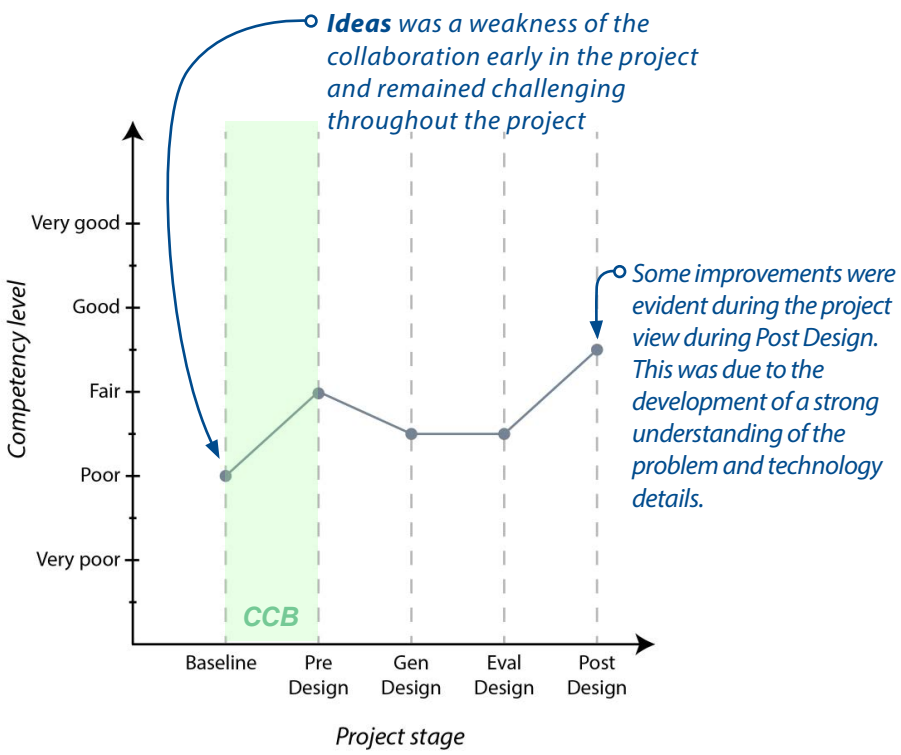


2. Design Critique

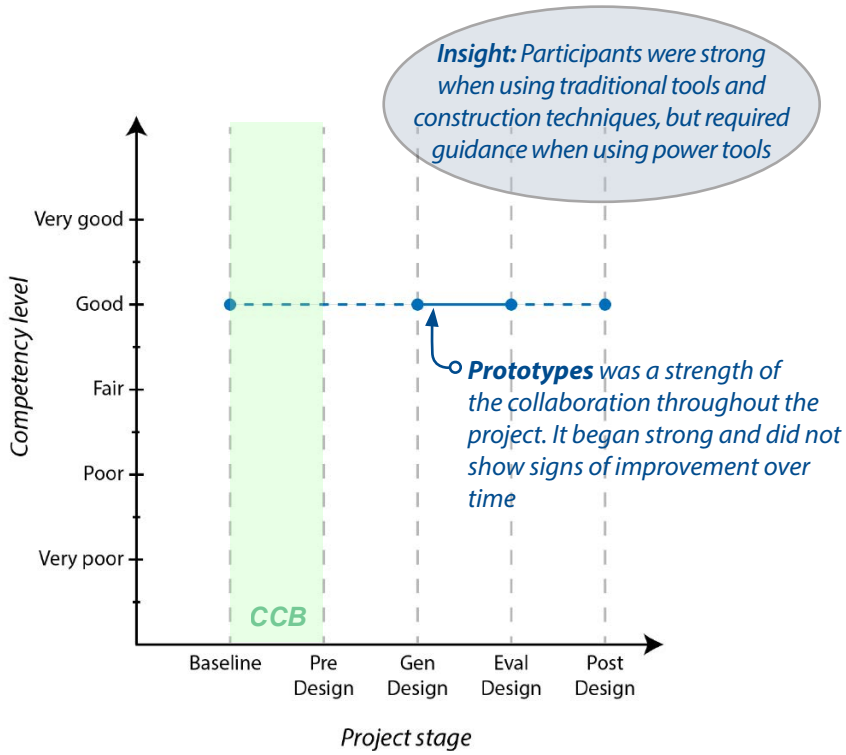
Note: If competency was not demonstrated in a stage it is shown with a dotted line

EVALUATION

Creative Capacity Building



3. Ideas



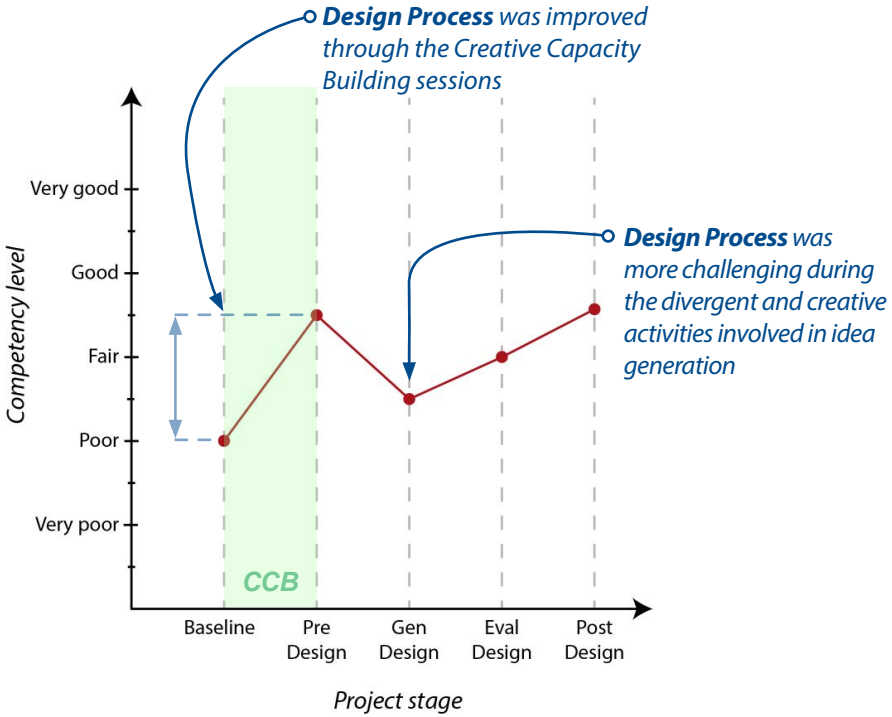
4. Prototypes

Note: If competency was not demonstrated in a stage it is shown with a dotted line

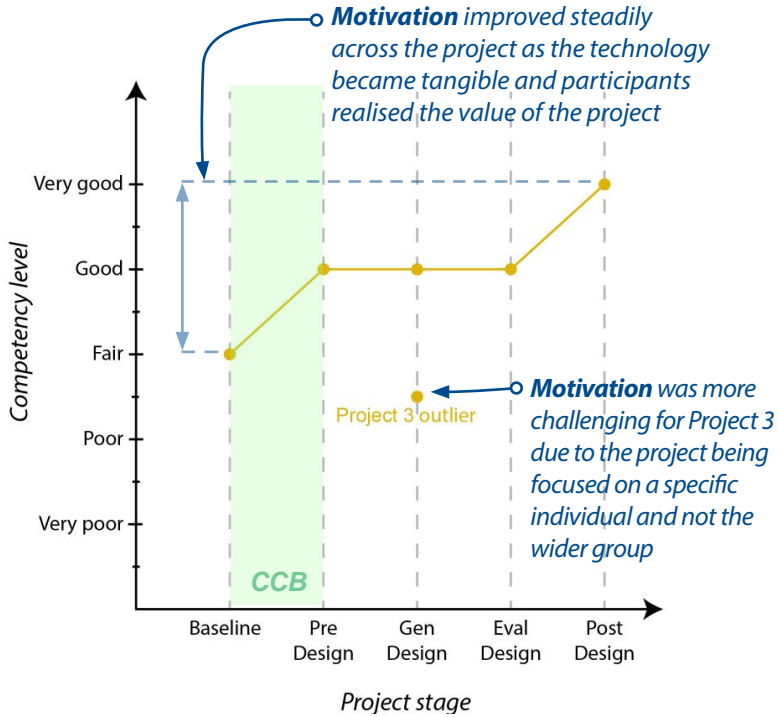
EVALUATION

Creative Capacity Building

***Insight:** Participants were more engaged when activities used hands-on or visual methods as opposed to discussion and written methods*



5. Design Process



6. Motivation

Note: If competency was not demonstrated in a stage it is shown with a dotted line

EVALUATION

Participant Enjoyment

Participant feedback was gathered throughout the project using both anonymous feedback and one-on-one interviews.

Anonymous feedback (five-point Likert scale voting)

Anonymous feedback was gathered from all participants at the end of each day of workshops

FREQUENCY TABLE: Participant feedback

	CCB	Pre-Design		Gen. Design		Eval. Design		Post Design	
	Day 1	*Day 1*	*Day 2*	*Day 1*	*Day 2*	*Day 1*	*Day 2*	*Day 1*	*TOTAL*
Very happy	24	22	33	42	37	43	33	35	**269**
Happy	6	20	0	1	2	2	5	2	**38**
Neutral	4	0	0	0	0	1	0	2	7
Unhappy	1	0	0	0	1	0	1	0	3
Very unhappy	1	0	0	0	4	0	0	0	5

One-on-one interviews

One-on-one interviews were conducted with 16 of the participants at various stages before, during and after the project

Participant responses during interview after project completion

Interviewer - "*Do you think we have any weaknesses that you want to suggest we should adjust? Regarding the seminars, their teaching, their attentiveness, and materials*"

Participant 1 - "*No, I don't think there is any weakness. I am totally satisfied*"
Participant 2 - "*No, I don't. I don't have any things I don't satisfied or like. I completely satisfy*"
Participant 3 - "*I have said that I am happy and satisfied because making such tool is what I have wanted long ago*"
Participant 4 - "*I feel that it's modern and very good*"

EVALUATION

Collaboration Enablers

Projects which benefit all involved participants enhance motivation

Evident when comparing project 1 and 2 with project 3. Project 3 was focused on a specific individual and their property. The participants began the project with good levels of motivation; however, this decreased during the evaluative design stage.

Technical training sessions enhance participant prototyping and motivation

Most participants were not experienced with tools such as electric drills, angle grinders and drop-saws. This resulted in only the more confident participants using them. Running a formal technical training would ensure all participants have the opportunity to learn about the tools safely before using them during the project.

Small group sizes enhance ability to express opinion

CODING TABLE: Opinion competency vs. group size

	Very poor	Poor	Fair	Good	Very Good
Large group	0	6	1	4	0
Small group	0	4	4	**15**	**1**

Designer - "*I think they're not really there to talk with the big group, because when we ask them into the big group, some of them they feel very shy and they said they're not there to talk in front of the whole group*"

EVALUATION

Collaboration Enablers

Through the analysis of all available data, several important enablers were identified for effective designer-participant collaboration during participatory design.

A strong relationship between designer and participant enhances collaboration

Designer (During CCB) - *"So from the first time we went we are strangers, because our team, it is the first time for them. They feel not confident to say it out"*

Designer (During Evaluative Design) - *"I feel the participants they feel very closely to us and our teams, and they feel confident, but for the first time, they are a bit silent after, we explain more, they can understand"*

Making-style activities enhance participant motivation

CODING TABLE: Motivation competency vs. activity style

	Very poor	Poor	Fair	Good	Very Good
Enacting	0	1	4	14	3
Making	0	4	5	**37**	**19**
Telling	0	12	6	26	5

Designer - *"Making things in this session helped people think through their ideas better and also helped facilitators understand them better. Allowed for probing questions about solutions"*

EVALUATION

Collaboration Trade-offs

Engaging a larger number of participants vs. engaging specific people with disability

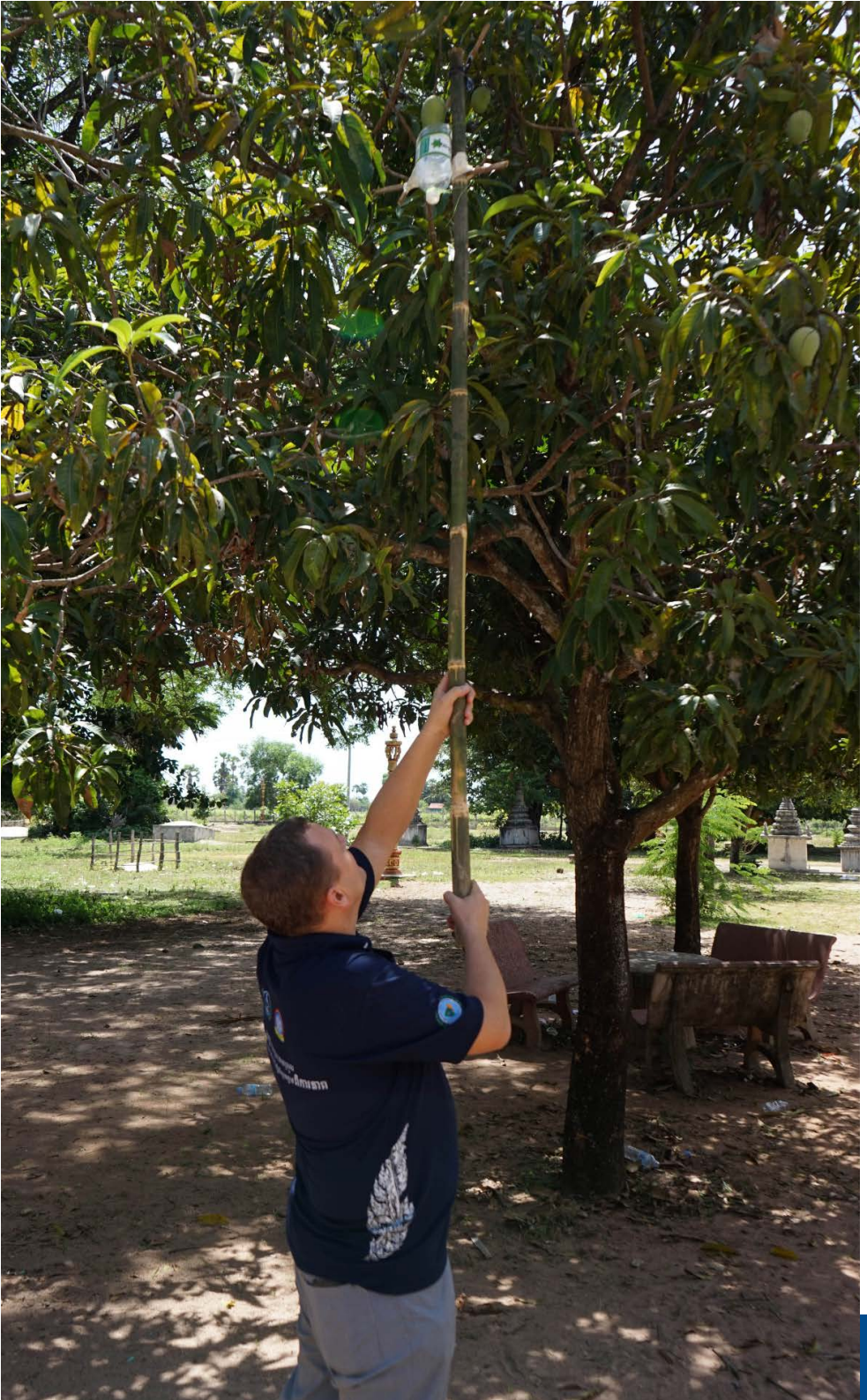
It is important to have a variety of and balance between making, telling and enacting-style activities. This balance will provide an opportunity for all participants to contribute their ideas and opinions and ensures the strengths of all participants are utilised and supported

Effectiveness of final solution vs. true community-led design

There are times in which the participants will direct the project towards less technically-effective solutions. Reflect on the objectives of the project; is empowerment, and creative capacity building the goal, or is the development of scale, innovative technology the goal?

Efficiency of design process vs. true community-led design

Participatory design is slow. It involves the collaboration of many people, some of whom have never been part of a design project before. The activities used vary in complexity and can sometimes feel overly-simple for an experienced designer. Ensure the project has planned for slower progress than a traditional project. The value of this in more meaningful, appropriate solutions and the empowerment of participants.



Thank you!

Special thanks to all participants, designers and supporters of the Inclusive Agriculture Project 2017

Designers and support staff:

Melissa McCreery, Ian Jones, Longhan Choeun, Dalen Kong, Khim Bun, Sokmeas Uy, Natalia Krokowska, Nick Williams, Nora Chum, Emily Ward, Sreypov Oung, David Curtis, Virak Kheng & Andrew Drain

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