INCLUSIVE AGRICULTURE

Pursat, Cambodia 2018

Project Summary

Andrew Drain

31 participants
6 designers
5 workshops
3 projects
May 2018 - August 2018

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

engineers without borders australia

LIGHT FOR THE WORLD
DISABILITY INCLUSION LAB

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 20 and 94 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**

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OVERVIEW

Partners

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

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

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 Massey University Research Fund.
www.massey.ac.nz

Agile Development Group was contracted to facilitate participatory design workshops with the partner community as well as provide technical and logistical support.
www.agiledg.com

Correspondence
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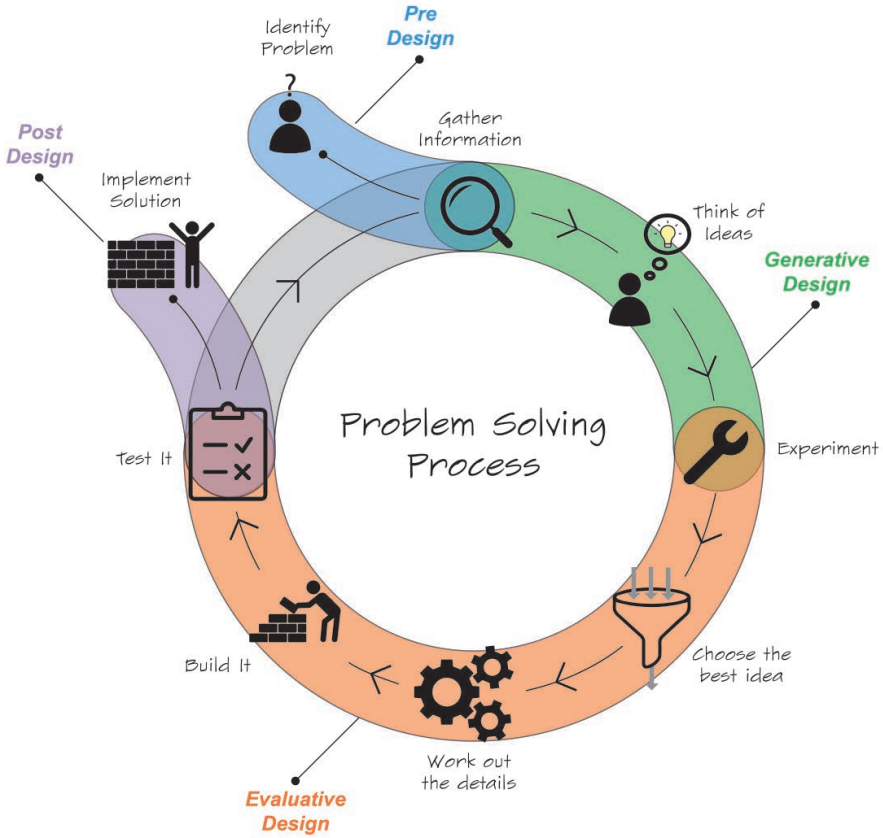
METHODOLOGY

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

- Project Formation and Planning
- Creative Capacity Building
- Pre-Design
- Generative Design
- Evaluative Design
- Post Design
- Community Re-visit

METHODOLOGY

Research Methodology

The project was monitored and evaluated 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:

- *18 designer interviews*
- *84 participant short interviews*
- *9 participant long interviews*
- *64 designer field diary entries*
- *30 pages of observational notes from workshops and planning sessions*
- *300 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

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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 the banana boost *- A presentation of the design process, discussion about each stage and a practice activity using paper and cardboard to design a new structure for holding bananas above flood waters*

Session 3: Design a mango picker *- A practice activity designing a product to assist people to pick mango from tall trees.*

Session 4: Refine mango picker design *- A practice activity to test, evaluate and improve the mango picker design and discuss how it could be implemented in the future.*

Insights

Designer - *"They [participant] are very engaged and sharing their ideas just like 'oh we should put like this to make them and put a little bit color on the place that's for the mango' and then they test it with the people in the wheelchair and also with the old people"*

Designer - *"In the smaller groups, people were more much more likely to express opinions"*

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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 wheelchair users to collect and carry water from source to farm each day

People with vision impairments find it difficult to feed and care for chickens

People with disability find it difficult to sell produce at the local market due to communication barriers and stigma to buy from people with disability

People with mobility impairments find it difficult to carry tools to their fields and find it slippery when it is wet or muddy

Project Briefs

Project 1. ***The design of a universal solution to assist individuals to harvest cassava more efficiently***

Project 2. ***The design of a universal solution to assist individuals to keep their chickens healthy***

Project 3. ***The design of a universal solution to assist individuals to transport water from source to farm more efficiently***

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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

Participants do not have access to the machinery required for effective field preparation, harvest or post harvest processing of cassava

Similarly, the bending, pulling and heaving lifting during cassava harvesting is difficult for individuals with mobility impairments

Participants had heard of novel technologies but most were expensive, or not available their local area

Concepts

Project 1. ***A cart and lifting system to reduce physical effort required during the collection and transporting of cassava***

Project 2. ***Modifications to a chicken coop to keep the environment hygienic and chickens healthy***

Project 3. ***A cart that can carry water tanks and that can be pulled by a wheelchair user to transport water from source to farm***

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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 relied heavily on individuals with high-levels of technical knowledge. In some groups this was the designer, in other groups it was a specific participant

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

Male participants tended to dominate the use of power tools, during construction activities, with female participants engaging more during feedback and refinement activities. Technical training of female participants helped to equalize this power dynamic

Prototypes

Project 1. ***A motorized cart and pulley system to reduce physical effort required during the collection and transporting of cassava and other vegetables***

Project 2. ***Windows and ramps added to a chicken coop to improve ventilation and movement of chickens***

Project 3. ***A cart that can carry water tanks and that can be pulled by a wheelchair user to transport water from source to farm***

Project 1.

Project 2.

Project 3.

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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

Each team decided to store the products at the home of the family for whom the product would have the most impact. This ensured access for the most needy individuals but made it difficult for others to borrow the product for their own use

Project 1 Participant - "The community has ideas for the design and they can do it by themselves. There are some issues when testing. The front is a bit low"

Project 3 Participant - "If there is a chance, I would like to create more and attach a water pump to the carriage. It can solve a lot of problems"

Project Success

Project 1. ***A motorized cart and pulley system was developed and ownership was transferred to the local NGO. The product is now used for produce transportation but requires further improvements***

Project 2. ***Windows and ramps added to chicken coops and ownership transferred to participants***

Project 3. ***A water cart was developed and ownership was transferred to local wheelchair user. The product is now maintained and used by this individual***

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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.

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EVALUATION

Technology - Project 1

The design of a universal solution to assist individuals to harvest cassava more efficiently

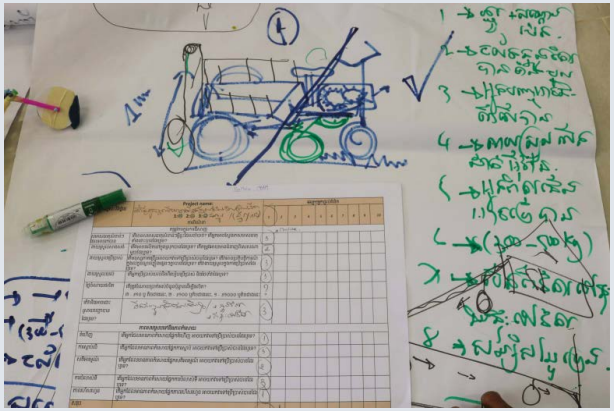
Effectiveness

Requirement	Achieved?
Can be used everywhere around the farm?	TBA
Can the driver can sit on it comfortably?	Yes
Is it easy to load produce onto cart?	Yes
Can people with an amputated leg can use it?	Yes
Must carry 300-500kg	Yes (on a good road)
Can it be driven from home to the farm and back again	Yes
Is it fuel efficient?	Yes
Does it reduce effort to collect and move vegetables	Yes

Community Satisfaction

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

Community members like the design and have gained ownership of the product. However, on revisit the cart was being used for general produce transportation and not specifically cassava harvest.



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EVALUATION

Technology - Project 1

Adoption of Technology

Timeframe	Achieved?
End of project transfer of ownership	Yes
Short-term adoption	Yes (not used for intended purpose)
Long-term adoption	TBA

Generalizability

Area	Appropriate?	Detail
Local	Yes	Appropriate for mobility impaired farmers with access to motorized hand tractor. Valuable for harvest and transport of many types of produce
National	Yes	Appropriate for mobility impaired farmers with access to motorized hand tractor. Valuable for harvest and transport of many types of produce
Other: *Cassava farmers in rural communities in developing countries*	TBA	Dependent on local farming processes and availability of motorized hand tractor

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EVALUATION

Technology - Project 2

The design of a universal solution to assist individuals to keep their chickens healthy

Effectiveness

Requirement	Achieved?
Chicken manure in the sleeping area dries quickly	Yes
There is air flow in the sleeping area	Yes
Easy to clean (can clean with water and broom)	Yes
Chickens and babies get into sleeping area without help	Yes
No eggs drop out of the hens before they are ready	Yes

Community Satisfaction

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

Feedback shows that the chicken coop modifications are helpful and have been adopted by the participants

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EVALUATION

Technology - Project 2

Adoption of Technology

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

Generalizability

Area	Appropriate?	Detail
Local	Yes	Local farmers with chicken coops could easily implement these simple modifications
National	Yes	Farmers with chicken coops could easily implement these simple modifications
Other: *Small plot farmers in rural communities in developing countries*	TBA	Dependent on local farming processes

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EVALUATION

Technology - Project 3

The design of a universal solution to assist individuals to transport water from source to farm more efficiently

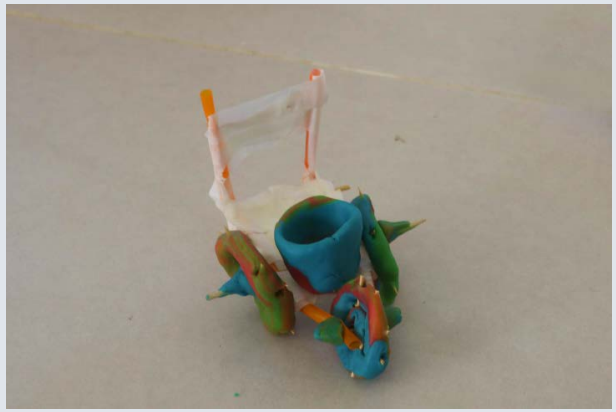
Effectiveness

Requirement	Achieved?
Is it easy to transport over the required distance and terrain?	Yes
Can it carry 6o litres of water?	Yes
Is it easy to fill the tanks with water?	Yes
Is it easy to empty water out of the tanks?	Yes
Can it be maintained by the local user?	Yes

Community Satisfaction

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

The specific participant who led the design process has taken ownership of the cart and was satisified with its effectivenes. On re-visit, she was using the product daily and had developed a plan for cleaning and maintaining the cart



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EVALUATION

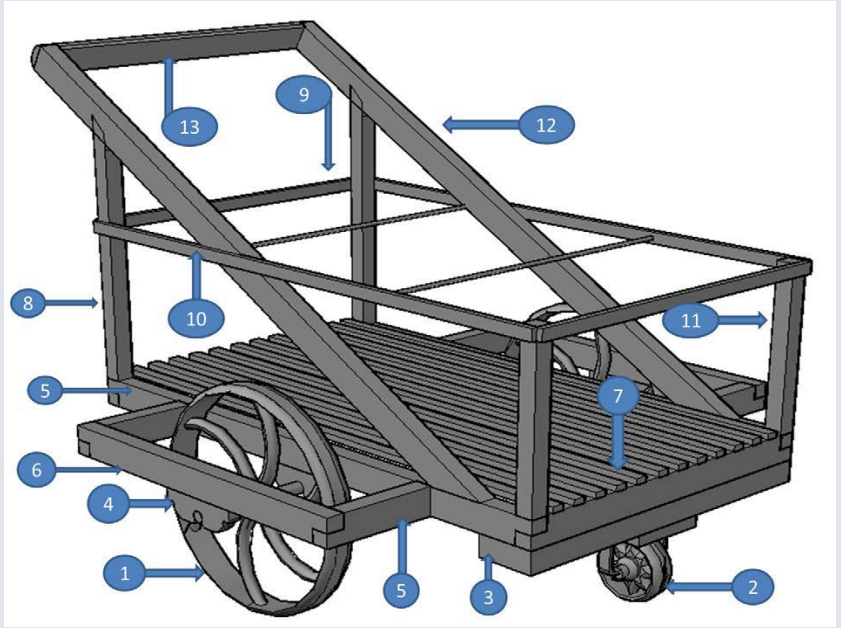
Technology - Project 3

Adoption of Technology

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

Generalizability

Area	Appropriate?	Detail
Local	Yes	Wheelchair users requiring a small payload trailer for transporting water or produce could use this cart
National	Yes	Wheelchair users requiring a small payload trailer for transporting water or produce could use this cart
Other: *Wheelchair users in rural communities in developing countries*	TBA	Dependent on local farming processes



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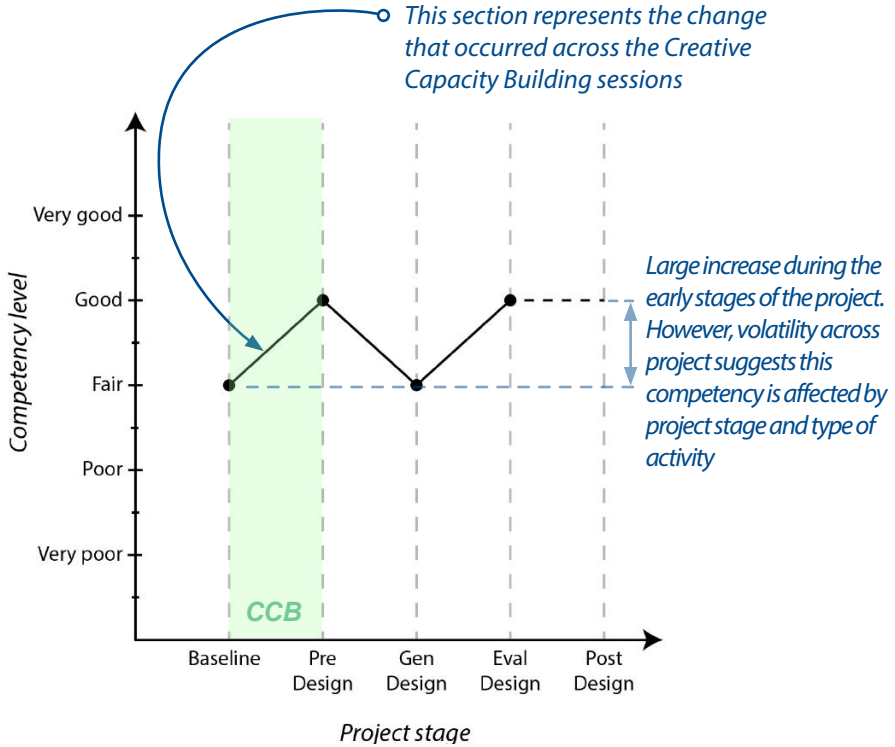
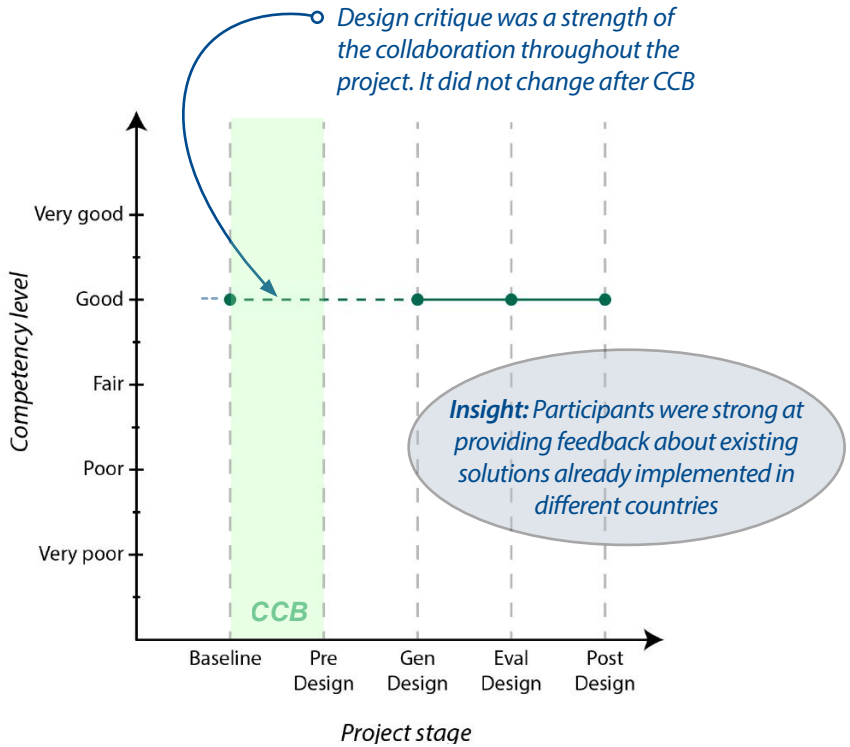
EVALUATION

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

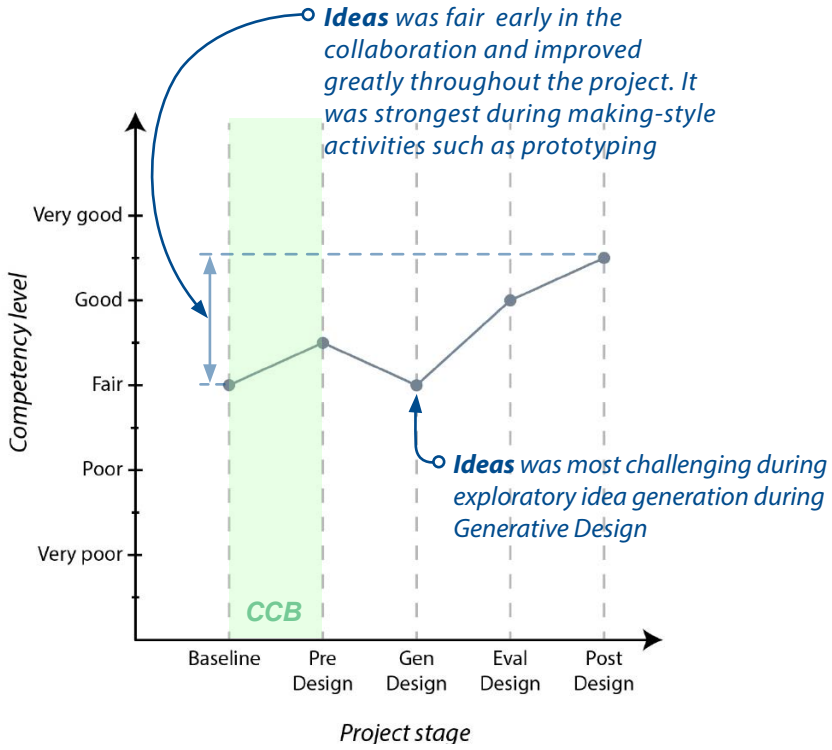


2. Design Critique

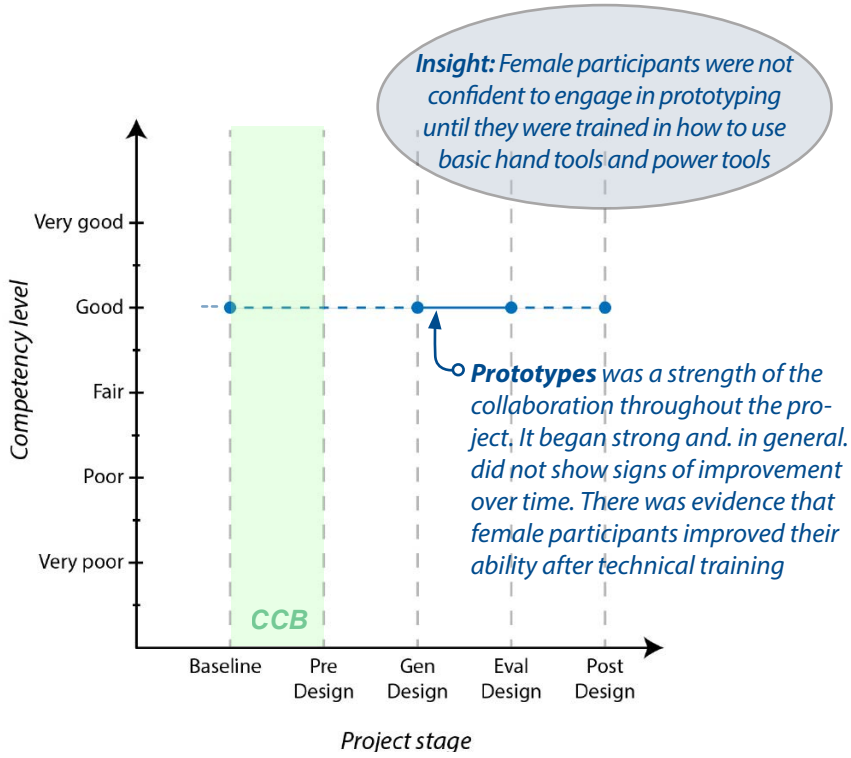
Note: If competency was not demonstrated in a stage it is shown with a dotted line

EVALUATION

Creative Capacity Building



3. Ideas



4. Prototypes

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

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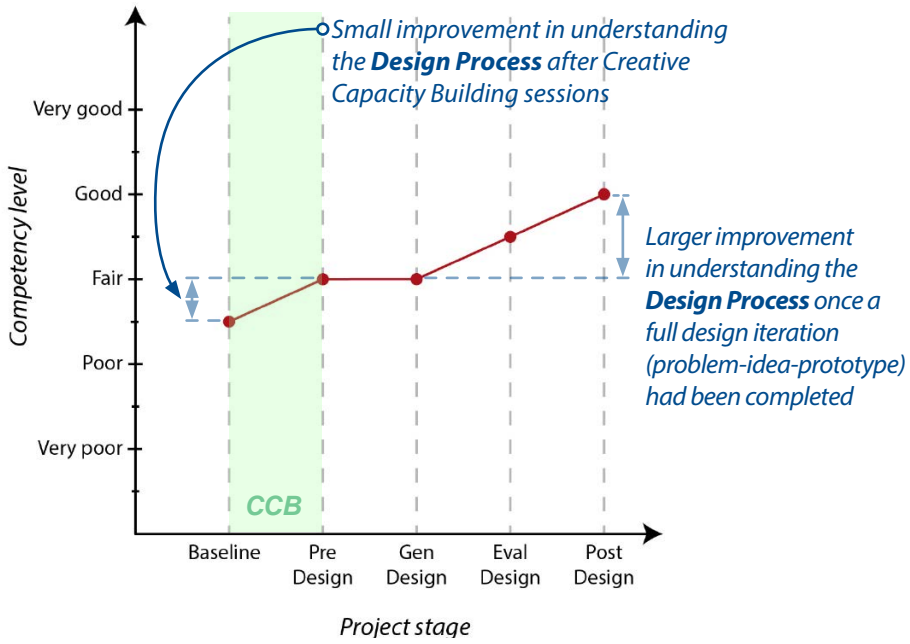
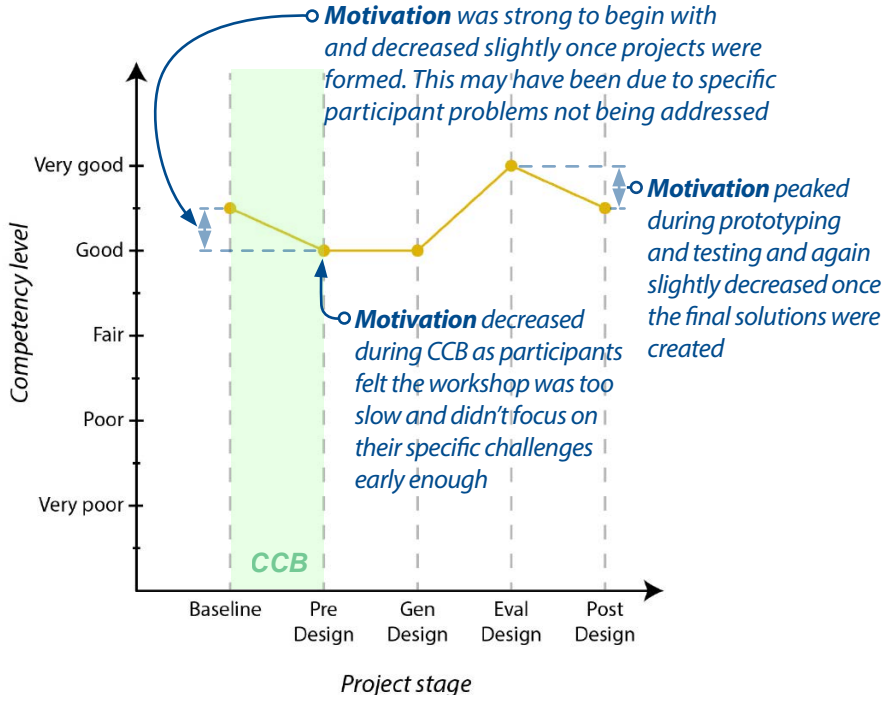
EVALUATION

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

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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 2*	*Day 1*	*Day 2*	*Day 1*	*Day 2*	*Day 1*	*Day 2*	*Day 3*	*Day 1*	*Day 2*	*TOTAL*
Very happy	19	24	16	11	16	16	13	14	14	14	7	**164 *(65.3%)***
Happy	6	4	6	4	3	5	6	5	3	5	2	**49 *(19.5%)***
Neutral	3	1	2	2	1	2	1	1	2	1	0	16 *(6.4%)*
Unhappy	1	0	1	3	2	0	0	0	2	0	2	11 *(4.4%)*
Very unhappy	0	0	0	5	0	0	0	0	1	1	4	11 *(4.4%)*

What did you enjoy being part of this project? - Participant Exit Interview

*"I enjoyed being a part of this project. I could **learn about designing various tools to help us as people with disability** without required any money"*

*"I enjoyed it because **I learnt to raise chickens** in a productive way"*

*"I enjoyed the workshops because **they taught theories and practices in making tools** for the people with disability"*

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EVALUATION

Participant Interviews

One-on-one interviews were conducted with 22 of the participants at various stages before, during and after the project. Responses during the exit interview are shown below.

What did you not like about this project?

"The facilitation was a bit fast for us"

How has your life changed since attending the workshops?

"I have made a chicken cage to raise my chickens in a more proper way. Before my chickens stay under trees"

"I feel great. I can fetch water by myself",

"I feel great to know other people with disability"

Do you think you could make the product again by yourself now?

"Yes, I can do it again by myself", *"If there are enough materials, I can do it by myself"*

"If there is a good plan and materials, I can make it by myself with helps from my kids"

Do you feel you could design new products by yourself now?

"I can make a water filter from oil containers", "I can make a water carriage"

"I can make a tool to feed chickens", "I can make a chicken cage"

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EVALUATION

Collaboration Enablers

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

The use of an iterative design process

During each of the three projects, new learning was generated once the products were physically created. In some cases this new learning contradicted assumptions made earlier in the process. For example, in Project 1 the dimensions and materials for the Cassava Cart were modified by the community due to locally available construction skills.

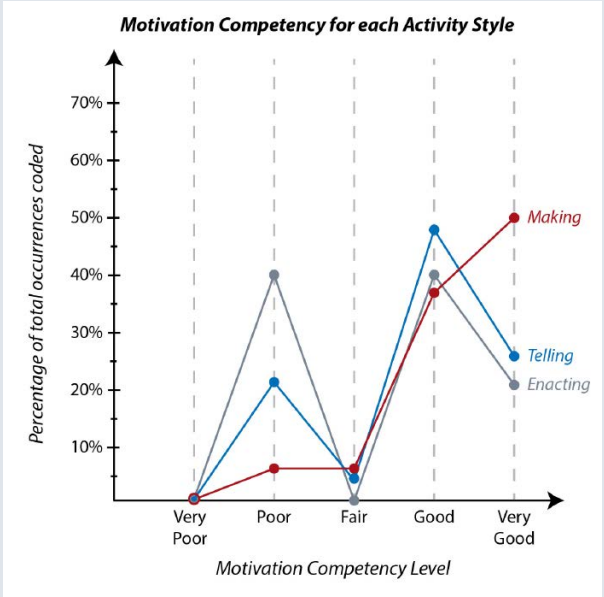
Making-style activities enhance participant motivation

CODING TABLE: Motivation Competency for each Activity Style

	Very poor	Poor	Fair	Good	Very Good
Enacting	0	2	0	2	1
Making	0	1	1	**6**	**8**
Telling	0	5	1	11	6

The same data is shown graphically on the right.

Designer - "*Especially during the making the prototype they were having fun joking around, having fun, talking to each other. Yeah even the most silent one in terms of their participation and engagement, it was good, and the product now two of them have been finished already*"



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EVALUATION

Collaboration Enablers

Projects which benefit all involved participants enhance motivation

There was evidence that some participants lost motivation to contribute then their specific project was not selected during Pre-Design. However, they remained active in the project and motivation increased during prototyping and testing.

Technical training sessions enhance participant prototyping and motivation

In particular, female participants showed an increase in confidence and motivation after they were taught how to use a range of hand and power tools.

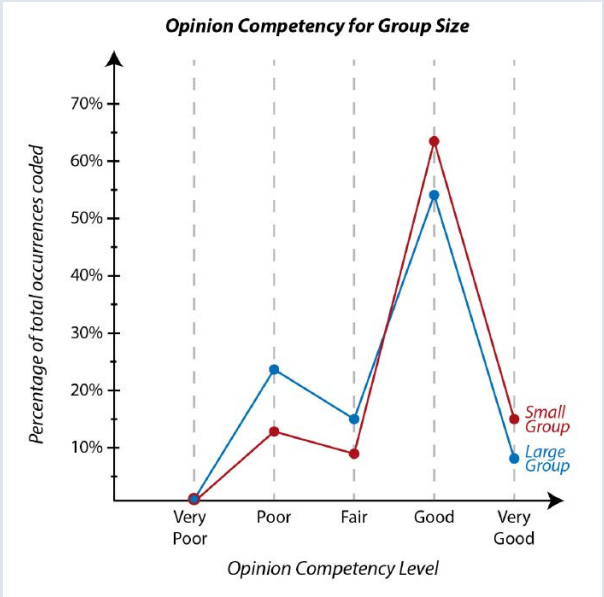
Small group sizes enhance ability to express opinion

CODING TABLE: Opinion Competency for Group Size

	Very poor	Poor	Fair	Good	Very Good
Large group	0	3	2	7	1
Small group	0	4	3	**21**	**5**

The same data is shown graphically on the right.

Designer - "*In the smaller groups, people were much more likely to express opinions, but generally I think there was only maybe two or three people in each group which I don't think were comfortable expressing opinions*"



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EVALUATION

Collaboration Trade-offs

Localized impact vs. generalizable innovation

It is important to create a solution that has meaningful impact in the specific partner community. However, there will be times when a slight change to the project could result in a more generalizable solution in the long term. It is helpful to reflect on the project objectives and, if possible, work towards a more generalizable solution.

Technical expert as facilitator vs. technical expert as co-designer

It is important that the technical expert understands their role in the project. Acting as a facilitator will ensure the project is driven solely by community skills and decision making, but may limit the novelty of the solution. Acting as a co-designer will allow for the expert to contribute insights and technical knowledge, but may create more challenging power dynamics between expert and community member. Of course, it is ideal if the expert can balance these two roles to ensure all voices, including their own, have the opportunity to contribute.

Clear, well-planned schedule vs. being highly responsive to participant needs

A well-planned schedule is easy for designers to follow, especially if they are new to using participatory approaches. However, this can result in unnecessary activities being undertaken and community needs being overlooked. It is wise to allow for flexibility in a schedule and to develop guiding principles to assist facilitators during decision making. These principles should reflect the project objectives and underlying participatory design values of *equalizing power relations, democratic practices, situation-based actions* and *mutual learning.*

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Thank you!

Special thanks to all participants, designers and supporters of the Inclusive Agriculture Project 2018

Designers and support staff:

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Khim Bun, Nora Chum, Somalin Cham,

David Curtis, Andrew Drain & Ian Jones

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