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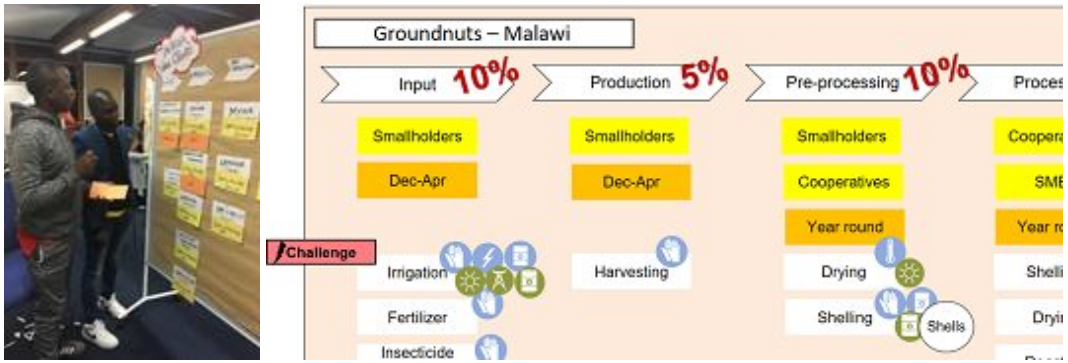
Energy Mapping along Agricultural Value Chains



ValueLinks Plus Webinar Vol. 10

May 29, 2019

Webinar Series on Agricultural Value Chains

13th June 2019

Date:	**29.05.2019**
Topic:	**Energy Mapping Along Agricultural Value Chains**
Speakers:	Hannah Posern, Jennifer Braun (GIZ Bonn), Alfons Eiligmann (IDC Aachen)
Resource persons:	Bastian Beege (GIZ Bonn), Johanna Zimmermann (GIZ Eschborn)
Moderators:	Carolin Voigt (GIZ Bonn), Alfons Eiligmann (IDC Aachen)
Participants:	35 participants, thereof 9 from GIZ projects in Africa and Asia

Webinar inputs

1. **Introduction: Environmental analysis of value chains in *ValueLinks 2.0*** (Alfons Eiligmann)
2. **Energy mapping in agricultural value chains** (Hannah Posern, Jennifer Braun)
3. **Feedback from projects applying the energy mapping** (Bastian Beege)

Main statements

1. Environmental analysis of value chains (VC) according to *ValueLinks 2.0*

- *ValueLinks* suggests a three-step approach: 1) Development of a conceptual model of interaction between the VC and the environment, 2) identification of environmental impacts, 3) valuation of the environmental impacts.
- Energy is assessed as one of five resource categories in the environmental impact matrix, which is the main tool used. In the environmental impact matrix, the VC functions are broken down further to technical processes, whose interactions with the five resource categories (water, electricity, soil, ecosystems and climate) are mapped.
- A hot-spot analysis is suggested as a valuation method that allows prioritizing urgent needs of improvement and adaptation. However, it is questionable how many GIZ projects really apply a hot-spot analysis. Webinar participants suggested a quick survey of GIZ projects in this regard.

2. Energy mapping along agricultural value chains

- The GIZ colleagues Kerstin Lohr and Robert Schultz developed the energy mapping in the framework of the project Powering Agriculture, conducted by the sector project Agricultural Trade, Agribusiness and Agricultural Finance as a specific tool to analyse all energy related aspects along the VC.
- Energy mapping allows for an understanding of the energy sources, energy access, energy reliability and intensity, as well as the respective impact for each step of the VC. It also permits stakeholders to identify potential solutions and to design customized interventions for energy-related challenges.
- In a first step of energy mapping, the current situation is mapped: Identification of the VC and relevant VC functions and actors, types of energy and energy sources used, assessment of untapped energy sources and estimation of energy consumption along the VC.
- In a second step, a barrier and opportunity analysis follows that shall allow identifying possible solutions and recommending interventions needed to identify challenges and opportunities along the VC.
- In a third step, data are refined, followed by a reflection on how to develop a future scenario of tailor-made solutions for energy use in the VC.

3. Feedback from projects applying the energy mapping

- Feedback from the application of the tool in seven Green Innovation Centers for the Agriculture and Food Sector projects showed that energy mapping was very helpful indeed for getting an overview on energy needs along the VCs.
- Suggestions for improvement were to differentiate energy consumption percentages according to sub-categories. It would also be helpful to show industrial processing and local processing separately from each other.

- The most relevant recommendation was to develop the energy mapping tool further in terms of the second step of the analysis, when it includes technical and business aspects.

4. Discussion

- All webinar participants agreed that optimizing energy efficiency and energy supply are important areas in VC upgrading. Participants underlined the need for more tools assessing energy efficiency and improving energy supply in value chains.
- Like *ValueLinks*, the energy mapping tool has been designed to be used participatory. Its true value is that it allows reflections about energy consumption in workshops with the VC actors using pinboards and moderation cards. Its main advantage is to make the different VC actors aware of energy aspects and development options. For this, one needs to look who the stakeholders are before starting the exercise. The tool can be used by consultants but is rather not recommended as a stand-alone tool.
- Energy mapping is particularly useful to get an overview in an early stage of project planning. If the project planning is already advanced and the project is already considering some energy options in more detail, it may not be so relevant anymore.
- Energy mapping should take a dynamic view, because innovations introduced in the VC often lead to an increased energy consumption. As we have to avoid additional emissions while upgrading the VC, we need to look at energy efficiency over time.
- The introduction of new energy solution often requires financing. One needs to be able to convince people that their current way of using energy sources can be replaced and that the introduction of new energy sources is financially feasible with a meaningful return on investment.
- The combination of energy, mechanization and digitalization aspects in agricultural production is considered an area of increasing interest, which could be discussed in future webinars.

Annex: Powerpoint presentation used in the webinar

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Statement S 1

Optimising energy consumption and improving energy supply are important areas in VC upgrading.

Agree Disagree Indifferent

Statement S 2

We need more tools for assessing energy consumption and energy efficiency in value chains.

Agree Disagree Indifferent

Any particular remarks or webinar expectations?

The link between value chains and the environment

Value chains may...		
…cause negative impact on climate and the environment (1)	**… be affected by climate change and environmental degradation (2)**	**…contribute to compensating emissions or contribute to creating a green economy (3)**
▪ Production, marketing and consumption cause environmental cost ▪ High, yet uncompensated GHG emissions ▪ Wasteful utilisation of scarce resources (especially water)	***Directly:*** ▪ Reduced productivity ▪ Increasing production cost ▪ Food insecurity ***Indirectly:*** ▪ Rising resource prices (water, energy, raw materials, waste disposal)	▪ CO2 sequestration and sale of carbon credits ▪ Products and services for the green economy (environmental technology, services and investment) ▪ Renewable energy

Environmental impact matrix

VC function	Technical processes	Water	Energy	Soil	Ecosystems	Climate
Primary production	Upland, rainfed rice production	↓		↑		↑
	Lowland / swamp production	↓		↑	↓	↑
	Irrigated rice	↓ ↑				↓
Intermediate trade	Bulking / storage					↑
Processing	Parboiling	↑	↓ ↑		↓	
	Milling		↓ ↑			↓
Trade	Transport					↓
	Storage / packaging				↓	
Consumption	Cooking		↓ ↑		↓	

↓ Impact of the VC (type 1)

Impact on the VC (type 2)

Table of environmental impacts

VC stage	Technical processes	Type 1 environmental impacts of the value chain	Type 2 environmental impacts on the value chain
Primary production	Upland, rain fed rice production	• Water pollution • Downstream silting	• Unreliable rainfall • Erosion, loss of soil fertility
	Lowland / swamp production	• Lowering of water tables • Loss of biodiversity	• Temporary flooding • Loss of soil fertility
	Irrigated rice	• Water scarcity aggravation • Methane emissions	• Inefficient irrigation, variable water supply
Intermediate trade	Bulking / storage	./.	• Increased variability of climate conditions
Processing	Parboiling	• Overexploitation of wood • Air pollution	• Rising fuel wood prices • Decreasing water availability
	Milling	• Inefficient use of energy • High carbon emissions	• High energy cost
Trade	Transport	• High carbon emissions	./.
	Storage / packaging	• Losses due to inefficient storage	./.
Consumption	Cooking	• Overexploitation of wood	• Rising fuel wood prices

Assessment of severity / valuation

A short cut: **"Hot-spots analysis"** by making a qualitative judgement on:

A) Intensity of the use of the resource	B) Availability of the resource	A x B
• High intensity of use (3) • Medium intensity of use (2) • Low intensity of use(1)	• Resources almost depleted (3) • Resources become scarce (2) • Resources largely available (1)	1-5: No hot-spot **6-9: Hot-spot**

High intensity of use of firewood (3) x resources almost depleted (3) = Hot-spot

Environmental analysis of value chains – 3 steps

Step 1: Conceptual model of the interaction between the VC and the environment.

Step 2: Identification of environmental impacts of the VC and on the VC

Step 3: Assessment and valuation of the environmental impacts

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POWERING AGRICULTURE

Sustainable Energy for Food

Energy Mapping along Agricultural Value Chains

- 29.05.2019 -

A contribution to POWERING AGRICULTURE: AN ENERGY GRAND CHALLENGE FOR DEVELOPMENT

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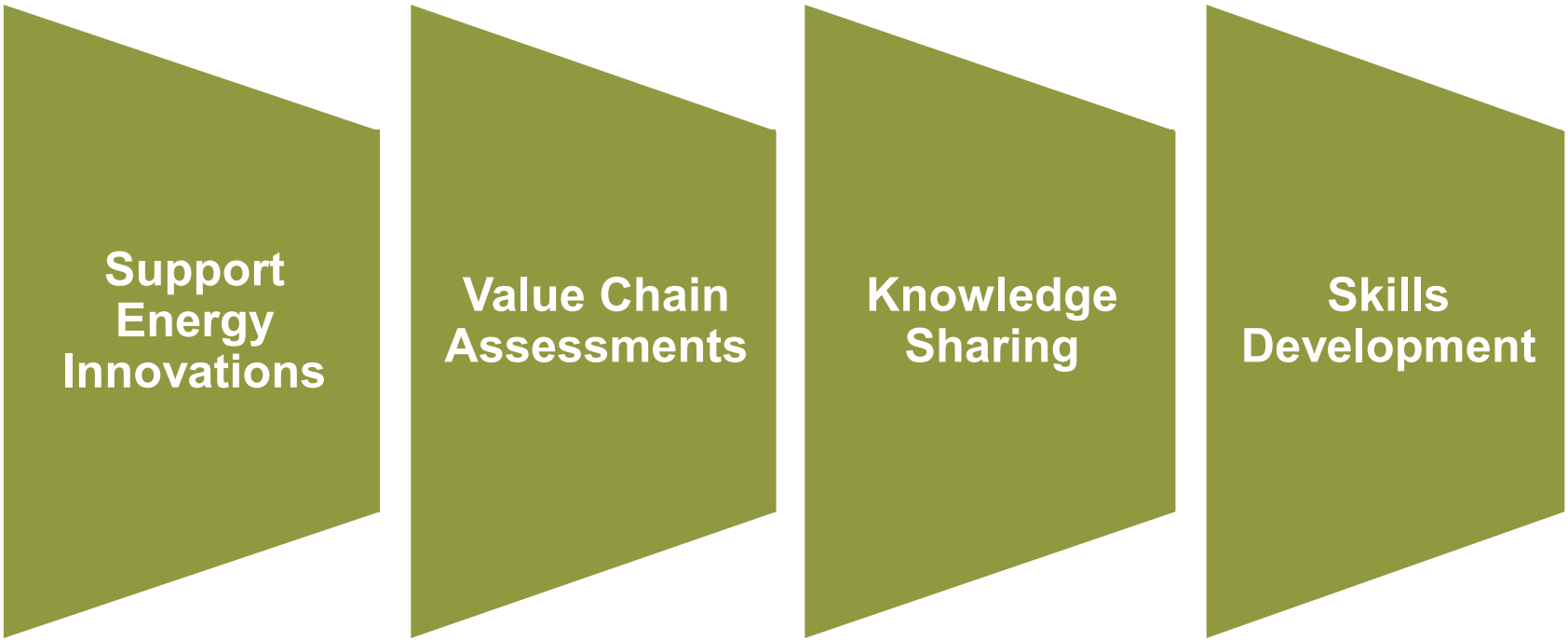
Powering Agriculture
- how we work -



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Background

Value Chain Assessments

→ **Energy Mapping**

- High energy consumption for food production, mainly from fossil fuels & low agricultural productivity
- **Challenges:** Low access to electricity in rural areas, high costs of fossil fuels & post-harvest losses along the VC
- **Solution:** Increase productivity and sustainability of resource use by promotion of decentralized clean energy solutions e.g.:
  - solar powered irrigation
  - solar cold storage
  - tapping biomass energy sources
  - using thermal energy
  - optimizing energy consumption

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Objectives and method of the Energy Mapping

- Energy mapping based on the ValueLinks Methodology (http://valuelinks.org)
- Aim:
  - allow development practitioners to obtain an overview of
    - **what forms of energy**
    - for **which processes** are utilized
    - during each **value chain step.**
  - enable an understanding of
    - **energy access,**
    - **energy intensity** and
    - potential for **energy-related interventions**

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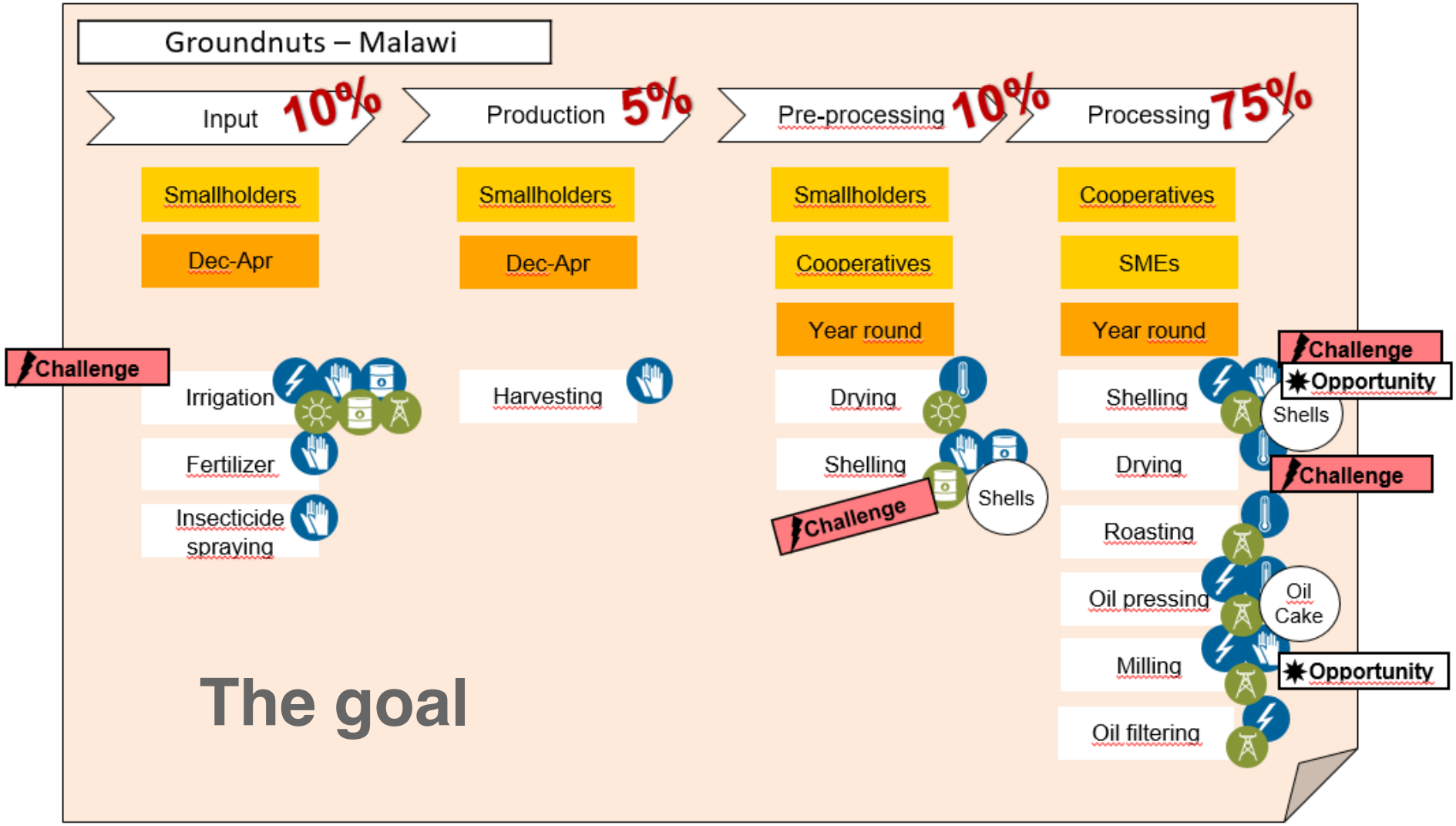

Groundnuts – Malawi
Input 10%
Production 5%
Pre-processing 10%
Processing 75%
Smallholders
Dec-Apr
Smallholders
Dec-Apr
Smallholders
Cooperatives
Year round
Cooperatives
SMEs
Year round
Challenge
Irrigation
Fertilizer
Insecticide spraying
Harvesting
Drying
Shelling
Challenge
Shells
Challenge
Opportunity
Shelling
Shells
Drying
Challenge
Roasting
Oil pressing
Oil Cake
Milling
Opportunity
Oil filtering
The goal


CAMEROUN
CAMEROON
INPUT
PRODUCTION
PROCESSING
TRANSPORT
DISTRIBUTION
END USERS
2%
15%
75%
5%
15%
SEED SUPPLY <FUEL>
IRRIGATION <DIESEL>
DRYING direct sun (1Week)
ROAD TRANSPORT
FUEL AND MANUAL
SELLING
CONSUMPT
SUPPLIERS (IRAD)
FARMERS
FARMERS
WHOLESELLER AND RETAILLER
SMALL AND MEDIUM ENTERPRISE
CONSUN
APRIL & MAY
MAY TO JULY
AUGUST
YEAR ROUND
YEAR ROUND
YEAR RO
FERTILISERS <MANUA
GROWING <Manual>
TORREFACTION
SUPPLIE
FARMERS COOPERATIVE
Machine
APRIL & MAY
JULY
AUGUST
FARMERS OR COOPERATIVE
MILLING <MACHINE
HARVESTING <Manual>
AUGUST
AUGUST
PRESSING
SOYBEAN VALUE CHAIN
OIL CAKE - Poultry Pig ...
COOKING OIL

Process overview

I: Map the current situation

1. Identify a value chain (VC)
2. Identify relevant VC steps
3. Identify activities happening at each VC step
4. Determine type(s) of energy
5. Determine energy source
6. Identify untapped energy source
7. Estimate energy demand distribution (%) along the VC

II: Barrier and opportunity analysis

III: Data refinement

IV: Reflect on your VC – develop a future scenario

I: Map the current situation

1. Identify a value chain (VC)

- Which VC is being assessed (rice, poultry, fruits, dairy, etc.)?
- What is the geographic focus (national, regional, provincial, individual case, etc.)?

Groundnuts – Malawi

I: Map the current situation

2. Identify **relevant VC step**

(e.g. Input, production, transport, pre-processing, storage, value added processing, transport and logistics, marketing and distribution, end user).

a) Each VC step is one column

b) Document VC step on a --> white, arrow shaped card: 

Groundnuts – Malawi

Input → Production → Pre-processing → Processing

I: Map the current situation

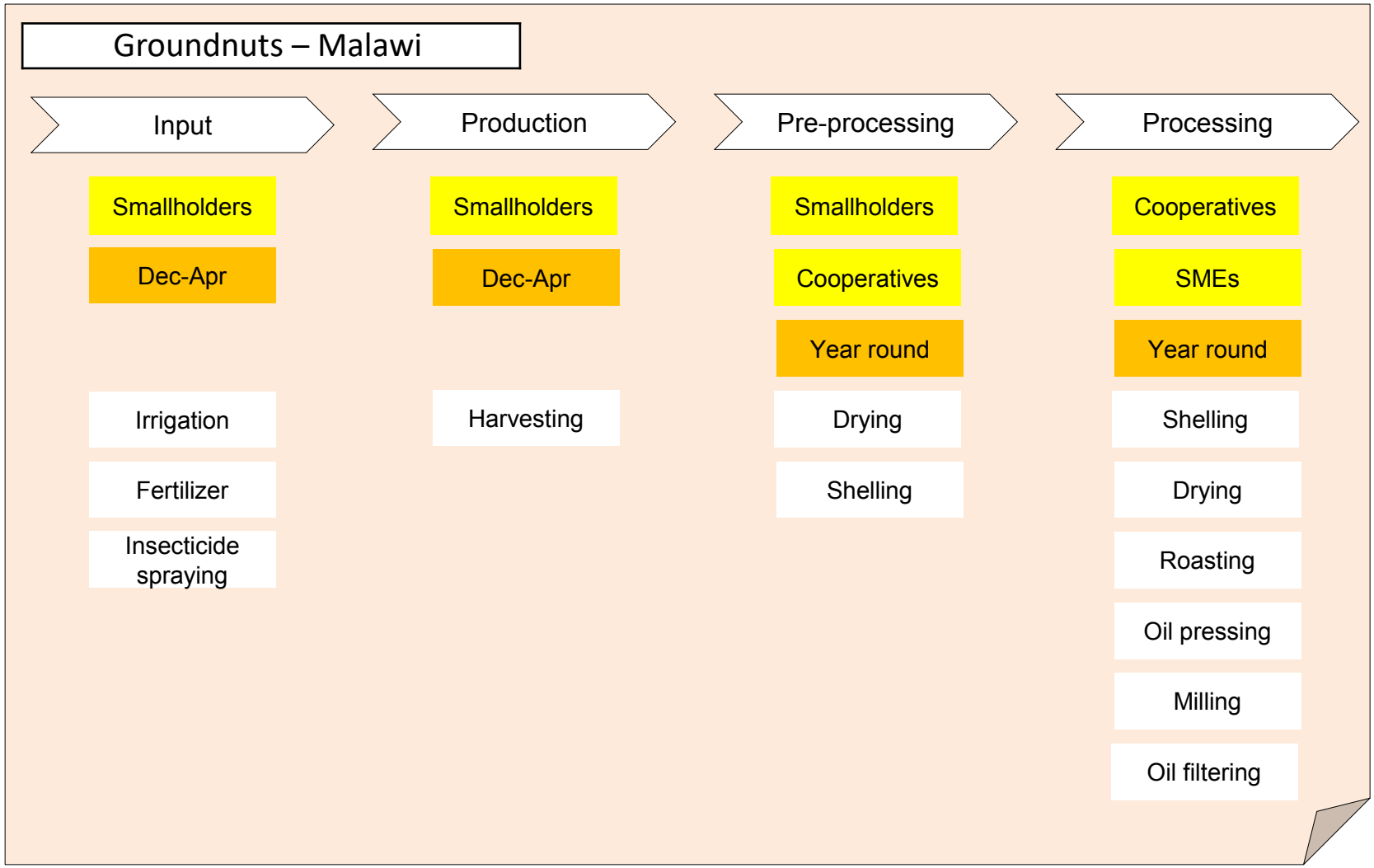
3. **Identify activities** at each VC step

Yellow rectangular card(s): **Who** is active in each step (e.g. farmer, cooperative, trader, small processor)

If activities in a step are **outsourced** to service providers or performed by other specialists, note this next to the activity

Orange rectangular card: **When** does each activity take place? (e.g. every day, in Sept after harvest)

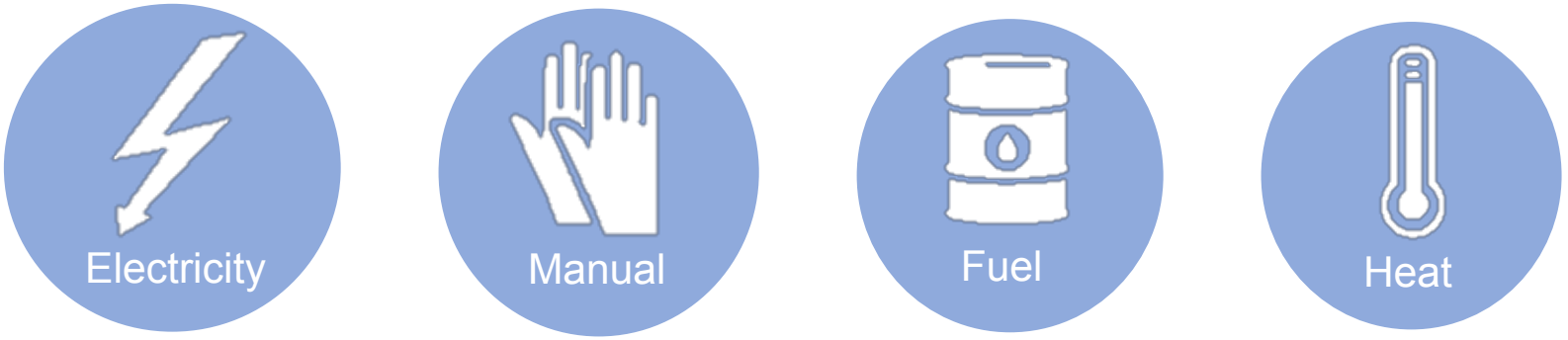
White rectangular card(s): each **activity** (e.g. irrigation, tillage, grinding, packaging) and device or method (e.g. irrigation: diesel pump; shelling: electric dehuller, drying: direct sun on floor


Groundnuts – Malawi
Input
Production
Pre-processing
Processing
Smallholders
Dec-Apr
Irrigation
Fertilizer
Insecticide spraying
Smallholders
Dec-Apr
Harvesting
Smallholders
Cooperatives
Year round
Drying
Shelling
Cooperatives
SMEs
Year round
Shelling
Drying
Roasting
Oil pressing
Milling
Oil filtering

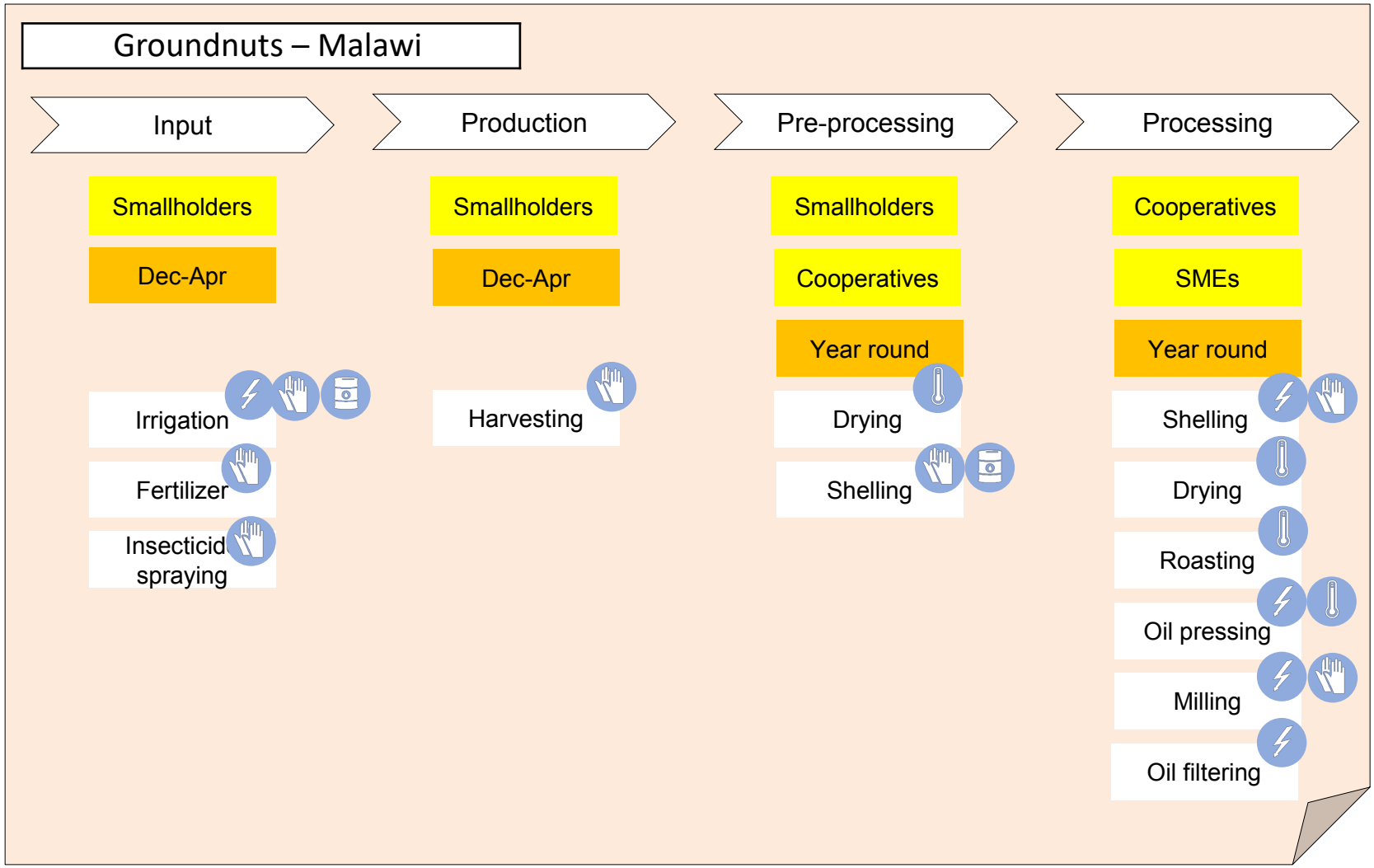
I: Map the current situation

4. Determine type(s) of energy that is directly used at each activity

Blue circle with word or icons as indicated below: **what type** of energy is used (electricity, heat, manual, fuel)



Groundnuts – Malawi



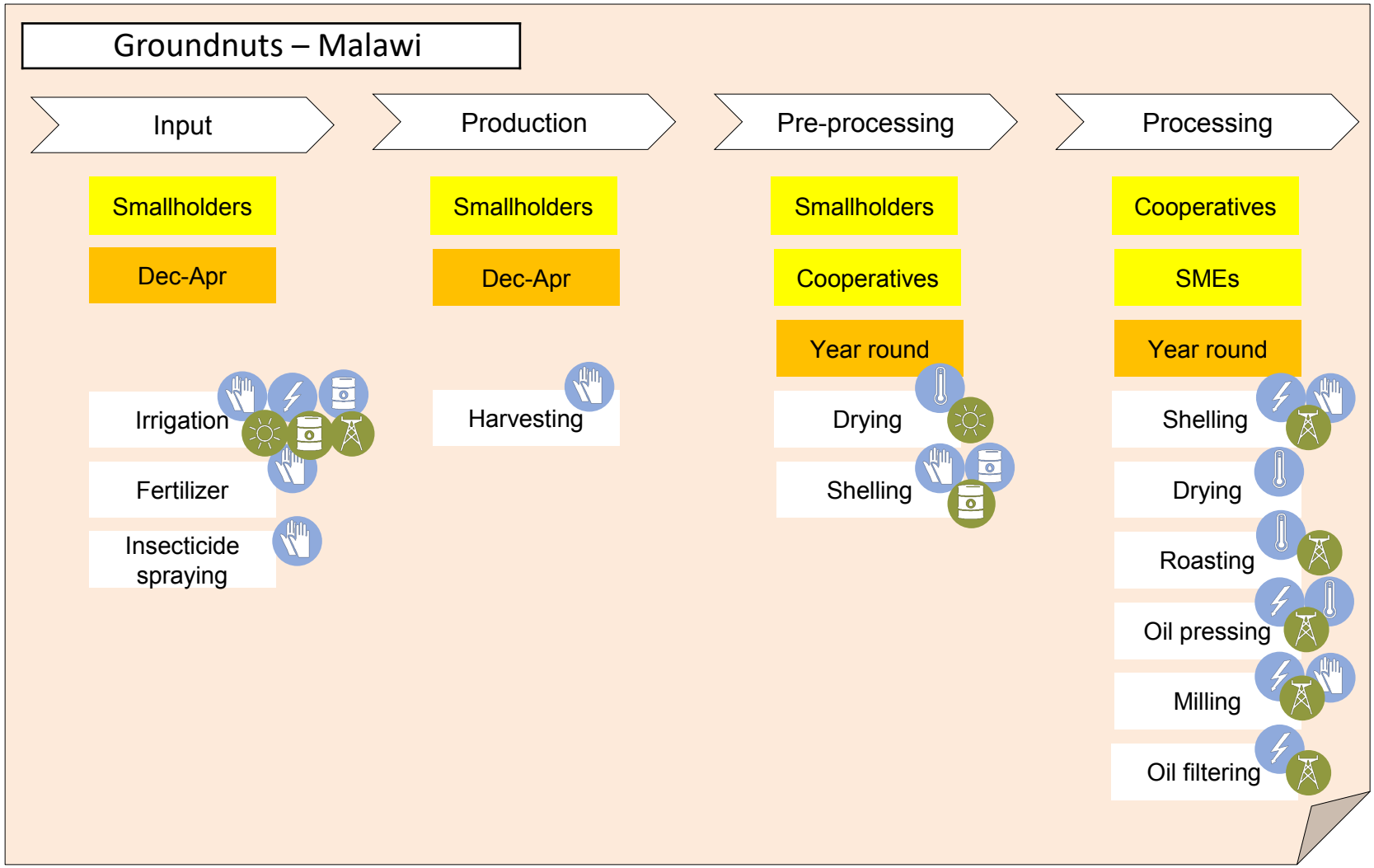
I: Map the current situation

5. Determine energy source

Green circle with word or icon as indicated below: **What source of energy is** used in the different activities?

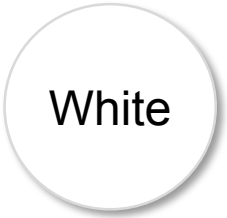
* For FUEL a ***D*** can be added for Diesel, ***P*** for Petrol or similar

Groundnuts – Malawi



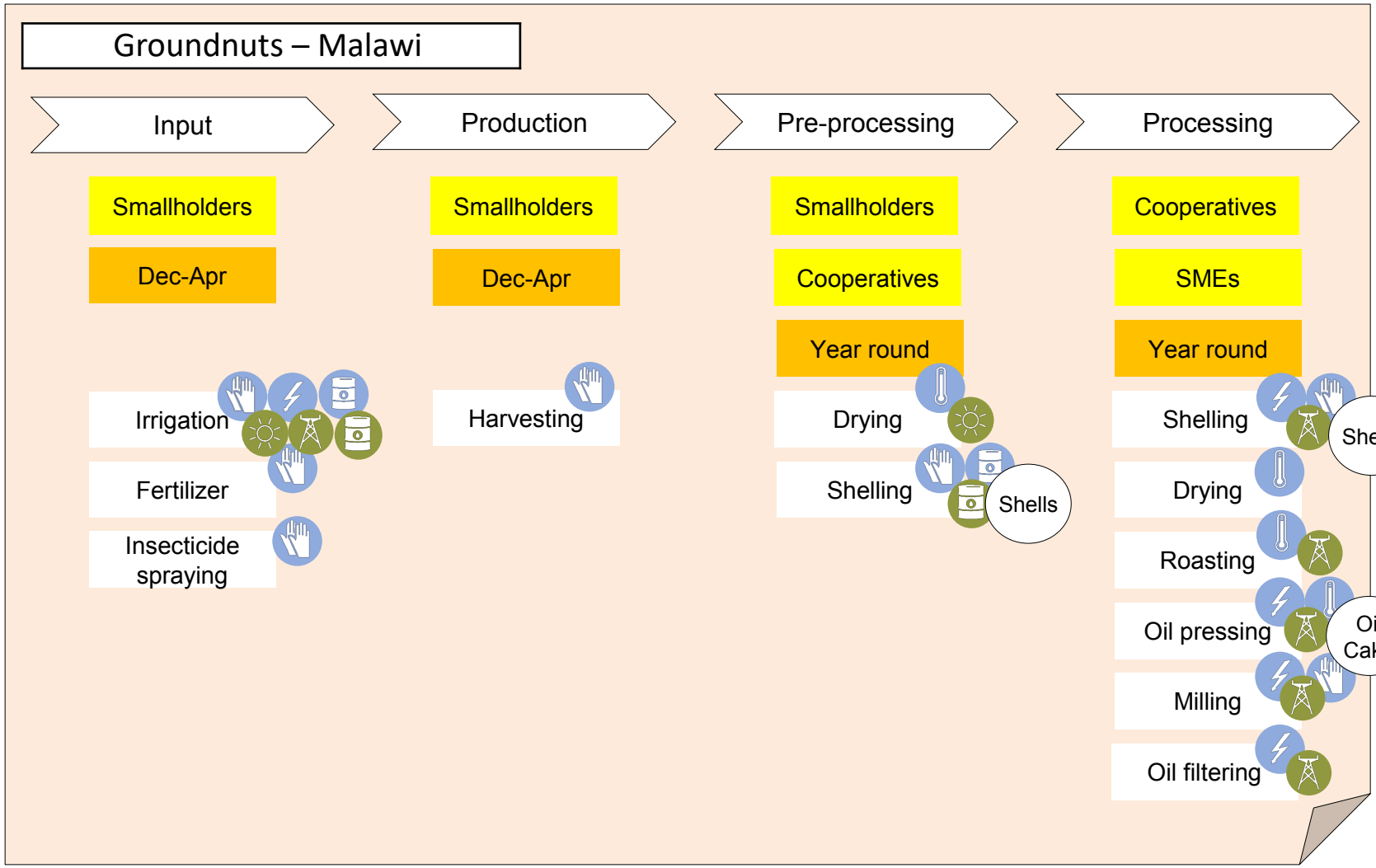
I: Map the current situation

6. Identify untapped energy sources



circle to indicate if there is any untapped energy source as a result of production (e.g. biomass, biogas, process heat)

Groundnuts – Malawi



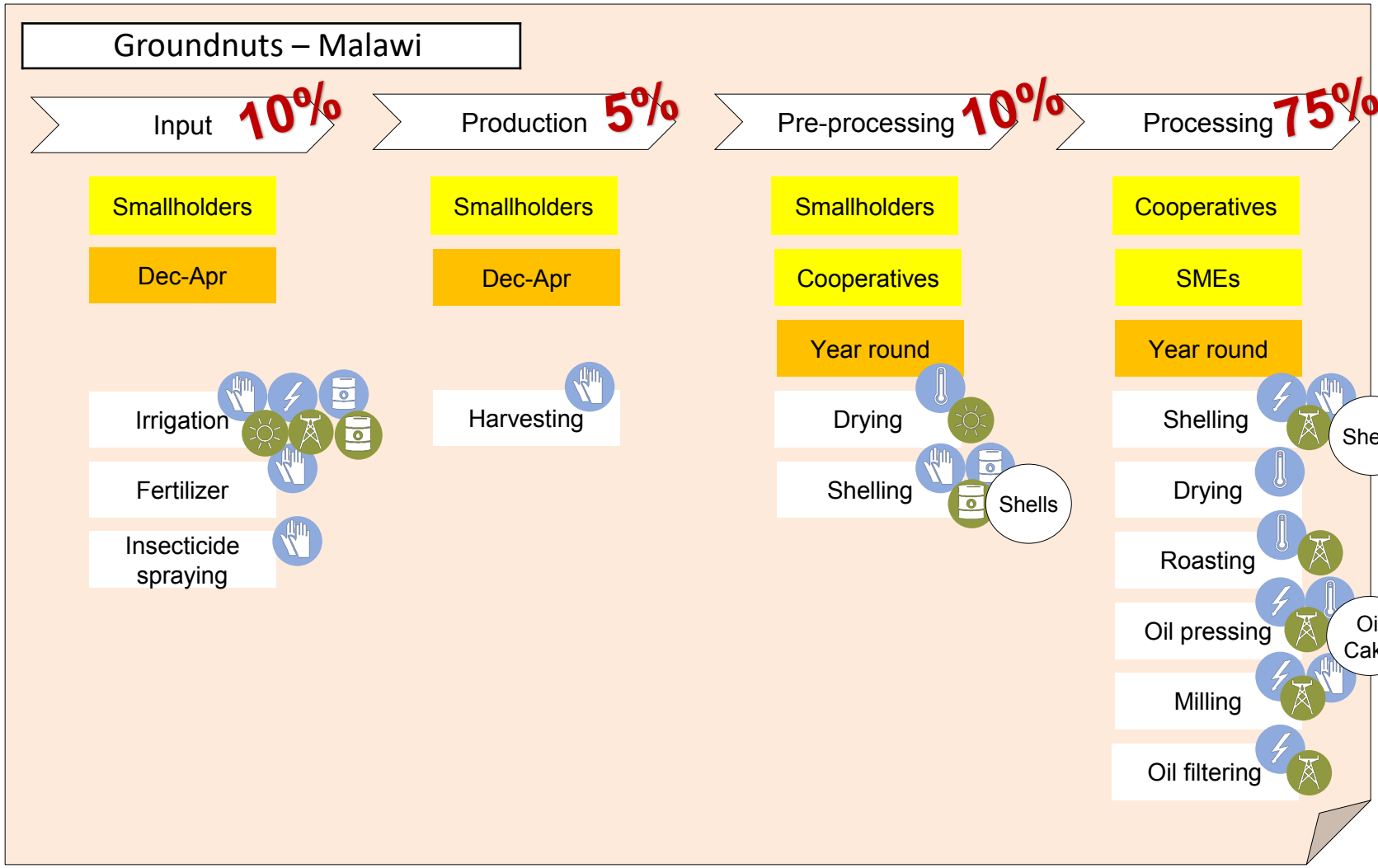
I: Map the current situation

7. Estimate the **energy demand distribution** (%) across all VC steps

- Assuming that 100% of energy is used across the value chain, what percentage proportion is used at each VC step?
- serves to indicate levels of energy intensity across the value chain

Note: these are rough indicative values and a detailed calculation is not required!

Groundnuts – Malawi



II: Barrier and opportunity analysis of the mapped VC

- Where are **key constraints/challenges** for the VC from an energy point of view (e.g. energy reliability factor, development stage of technology, prices, input/output ratios, production rates…) ?

Use 

cards

- To indicate **opportunities along the VC** (e.g. potential to save energy, replace an energy source, important stakeholder, framework condition, etc)

Use 

cards

Groundnuts – Malawi

Input 10%	Production 5%	Pre-processing 10%	Processing 75%
Smallholders	Smallholders	Smallholders	Cooperatives
Dec-Apr	Dec-Apr	Cooperatives	SMEs
		Year round	Year round
Challenge			
Irrigation	Harvesting	Drying	Shelling
Fertilizer	Opportunity	Shelling	Drying
Insecticide spraying		Challenge	Roasting
		Shells	Oil pressing
			Milling
			Oil filtering
			Shells
			Challenge
			Opportunity
			Challenge
			Oil Cake

III: Data refinement

Note:
This step is **for an advanced, more detailed analysis**.
Actual values could be added to the color cards:

- **Input/output ratio**
- **Input and output costs**
- **Amount of energy an appliance requires to operate**
- **Amount of energy an appliance would use over time**
- **The cost of operating an appliance over time**
- **The cost for procuring equipment**
- **Appliance space requirement**

IV: Reflect on your VC – develop a future scenario

- **Target group & aim**: What do you want to improve for whom? (e.g. productivity, food losses, quality, GHG, income…)?
- Are there quick wins/**low hanging fruits**?
- **Needs & opportunities**: Who is lacking what? Who offers what?
- **Change agents**: With whom to engage?

- **SWOT**: What are the VCs' weaknesses, strengths, opportunities and threats from an energy point of view?
- **How** to best tackle the needs/constraints and opportunities? (e.g. technology, capacity, awareness, frame conditions, capital…)?
- Where **can renewable energy or energy efficiency** come into play?

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THANK YOU
for your attention!

More information online:
https://energypedia.info/wiki/File:Value_Chain_Energy_Mapping_Description_of_Method_GIZ_Powering_Agriculture.pdf

Contact: Powering.Agriculture@giz.de

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