IMPACTING SMALLHOLDER LIVELIHOODS THROUGH SPATIAL ANALYSIS AND PLANNING

12/04/2018
MISSION

Increasing livelihood options for rural Malawians

Current

Smallholder

Village

Planned

Agricultural Co-op Village

Factory Town

Regional City

source: ORGpermod
PROPOSITION

a coordinated multi sector Iterative planning process
with physical assets and spatial management at the center

1. SURVEY AND ANALYSIS
2. GOAL FORMULATION
3. PLAN MAKING
4. PLAN IMPLEMENTATION
1. SURVEY AND ANALYSIS

Population Density

Cities
- 4,4 inhabitants/home
- 3,000 -> 5,000 inh/sqkm
- **density in example: 3,250**
- 0-20% agriculture

Villages
- 5,0 inhabitants/home
- 1,000 -> 3,000 inh/sqkm
- **density in example: 1,600**
- 20-80% agriculture

Rural
- 5,4 inhabitants/home
- 50 -> 1,000 inh/sqkm
- **density in example: 410**
- 80-100% agriculture

Malawi has a population of over 18 million, with a growth rate of 3.32% (CIA world factbook 2017). The population is forecasted to grow to over 30 million by 2035, and 45 million by 2050 (IFS 2018), nearly tripling the estimated 16 million from 2010 in a period of 40 years.
Suitable land = 47.5%  
= 5,627,800 ha

Based upon following indicators:
- Slope (%), Soil erosion (ty^{-1}ha^{-1}),
- Soil organic carbon (%), Texture,
- Cation exchange capacity (cmolkg^{-1}),
- pH, Soil depth, Drainage

Source left map: LI ET AL. 2017
Source right map: ORGpermod
2. GOAL FORMULATION

Targets: Population growth and Urban/Rural split 2050

- current ratio
- 5% per 15y increase
- 10% per 15y increase
- 15% per 15y increase

source: ORGpermod
Maintaining the Status Quo with Lilongwe and Blantyre (+- 5M inh) acting as the country’s urban core with a few second tier cities (+- 2M inh) such as Mzuzu and Zomba. Association of industry and urban settlement will remain insignificant.

Mid Sized Cities (+- 2M inh) as a dominant form of settlement and governance. This could improve control of density and by large will allow for the preservation of natural and arable lands in between.

Con-Urbations with connections to regional infrastructure form a linear continuous settlement. Likely to experience high level of slum urban peripheries.

Mega cities

Compact

Dispersed
Cost Benefit Analysis of planning scenarios

**SCENARIO 1**

- **PROJECT COST**
  - $ (Project construction and life cycle costs)

- **POTENTIAL BENEFITS**
  - $ (Flood protection savings, Environmental value, Social value, Economic value)

**SCENARIO 2**

- **PROJECT COST**
  - $ (Project construction and life cycle costs)

- **POTENTIAL BENEFITS**
  - $ (Flood protection savings, Environmental value, Social value, Economic value)

**SCENARIO 3**

- **PROJECT COST**
  - $ (Project construction and life cycle costs)

- **POTENTIAL BENEFITS**
  - $ (Flood protection savings, Environmental value, Social value, Economic value)

**BASE SCENARIO**

- **PREDICTED RISKS**
  - $ (Evaluation of future flood damage for the area of the project)

- **POTENTIAL LOSSES**
  - $ (Anticipated losses in the next 5, 20, 50 years)

**CURRENT VALUE**

- Estimate value of existing property and systems within the project boundary

Source: ORGpermod
3. PLAN MAKING

District level planning - Ntchisi layered Analysis

Population
• Density
• Villages

Environment
• Soil type (wetland, forest,..)
• Watershed boundaries & Waterstreams
• Topography

Industry/agriculture
• Arable land
• Industry activities (mining, markets)

Infrastructure
• Rail/Road/Port network
• Electricity network

source: ORGpermod
3. PLAN MAKING

Infrastructure analysis

(source: ORGpermod)
Environmental analysis

**East side**
- 50% of surface area
- 65% of population (= 137,000 inh)
- 80% of arable land (= 71,600 ha)
- flatland

**West side**
- 50% of surface area
- 35% of population (= 75,000 inh)
- 20% of arable land (= 19,000 ha)
- mountains

**Boundaries**
- District Boundary
- Watershed Boundary
- Forests + bufferzones
- Waterstreams + bufferzones
- Watershed boundaries

**Topography**
- < 20 m
- 20 - 300 m
- 300 - 570 m
- 570 - 850 m
- 850 - 1130 m
- 1130 - 1410 m
- 1410 - 1670 m
- 1670+ m
Industry / Agriculture analysis

90,500 ha total arable land
= % 52 of district area

- Wetland
- Tobacco
- Agriculture on hills
- Arable land
- Graphite mining activities
- Markets

source: ORGpermod
Population analysis

1. East side rural flatland
   - density = 100 - 700 inh/sqkm

2. Visana, small city
   - density = 1600 inh/sqkm
   (= most dense area of district)

3. West side rural mountains
   - density = 0 - 500 inh/sqkm

Source: ORGpermod
Hypothesis (based upon correlation between growth rates and urban/rural of countries around the world)

- If by 2045 urban/rural = 50/50 then population growth rate is around 1.7%
- To achieve this population rate will decrease on average by 2.5% of the original rate each year
- By 2045, population rate = 1.67% and population = 405,000 inhv

source: ORGpermod
## Land Use Scenarios for 2045

### Base scenario

<table>
<thead>
<tr>
<th>Rural/Urban</th>
<th>90/10</th>
<th>Conservative</th>
<th>Commercial</th>
<th>Symmetrical</th>
</tr>
</thead>
<tbody>
<tr>
<td># Commercial</td>
<td>3 farms</td>
<td>10 farms</td>
<td>27 farms</td>
<td>19 farms</td>
</tr>
<tr>
<td>1 unit = 1,500 inh - 25 sqkm</td>
<td>(4,500 inh - 75 sqkm)</td>
<td>(15,000 inh - 250 sqkm)</td>
<td>(40,500 inh - 675 sqkm)</td>
<td>(28,500 inh - 475 sqkm)</td>
</tr>
<tr>
<td>= 7,500 ha</td>
<td>= 25,000 ha</td>
<td>= 67,500 ha</td>
<td>= 47,500 ha</td>
<td></td>
</tr>
<tr>
<td># Smallholder</td>
<td>60,000 hh</td>
<td>60,000 hh</td>
<td>17,500 hh</td>
<td>36,500 hh</td>
</tr>
<tr>
<td>1 smallholder family = 5.5 inh</td>
<td>(330,000 inh - 600 sqkm)</td>
<td>(330,000 inh - 600 sqkm)</td>
<td>(96,250 inh - 175 sqkm)</td>
<td>(200,750 inh - 365 sqkm)</td>
</tr>
<tr>
<td># Cities</td>
<td>2 cities</td>
<td>2 cities</td>
<td>2 cities</td>
<td>1 cities</td>
</tr>
<tr>
<td>1 unit = 25,000 inh - 12.5 sqkm</td>
<td>(50,000 inh - 12.5 sqkm)</td>
<td>(100,000 inh - 25 sqkm)</td>
<td>(100,000 inh - 25 sqkm)</td>
<td>(100,000 inh - 25 sqkm)</td>
</tr>
<tr>
<td># Towns</td>
<td>3 towns</td>
<td>3 towns</td>
<td>3 towns</td>
<td>4 towns</td>
</tr>
<tr>
<td>1 unit = 10,000 inh - 10 sqkm</td>
<td>(30,000 inh - 15 sqkm)</td>
<td>(60,000 inh - 30 sqkm)</td>
<td>(100,000 inh - 33 sqkm)</td>
<td>4 towns</td>
</tr>
<tr>
<td>Total inh</td>
<td>505,000</td>
<td>505,000</td>
<td>296,000</td>
<td>420,000</td>
</tr>
</tbody>
</table>

### Source: ORGpermod
Range of typical investment opportunities in physical assets

- Infrastructure Networks
  - Road Infrastructure
  - Irrigation Infrastructure
  - Sanitation Infrastructure
  - Energy Infrastructure

- Local Operations
  - Cooperative Farm village
  - Factory Town
  - Port facility
  - Commercial farm
  - Civic buildings
  - Logistics buildings

Source: ORGpermod
3. PLAN MAKING

Case Studies: Moshav vs Kibbutz

Name: **Kibbutz Geva**
Location: Jezreel Valley, Israel
Total Area: 0.49 km²
Residential Area: 0.24 km²
Density: 2629/km²
Economy: Technology, packaging, chocolate

Name: **Moshav Nahalal**
Location: Jezreel Valley, Israel
Population: 803 (2016)
Total Area: 1.28 km²
Residential Area: 1.08 km²
Density: 743/km²
Economy: Fruit and vegetable agriculture

(source: ORGpermod)
Regional infrastructure development investment framework

3. PLAN MAKING
Catalogue of investments on local scale

3. PLAN MAKING

Source: ORGpermod
Local Development Investment Framework

Land resource distribution:
- Wetlands 12%
- Commercial farms 30%
- Villages 10%
- Factory Towns 5%
- Smallholders 40%
- Regional City 3%

source: ORGpermod
3. PLAN MAKING

Increasing settlement type options

Smallholder Village

40% - 50%

Rural Village

10% - 20%

Agricultural Co-op Village

5% - 10%

Factory Town

5% - 10%

Regional City

25% - 40%

Land resource distribution:

Wetlands 12%  Commercial farms 30%  Villages 10%  Factory Towns 5%  Smallholders 40%  Regional City 3%
THANK YOU
MALAWI - SURVEY AND ANALYSIS

- SOCIAL DEMOGRAPHICS
- ECONOMY
- GOVERNANCE
- ENVIRONMENT
- INFRASTRUCTURE
- ONGOING PROJECTS AND INITIATIVES
Malawi has a population of over 18 million, with a growth rate of 3.32% (CIA world factbook 2017). The population is forecasted to grow to over 30 million by 2035, and 45 million by 2050 (IFS 2018), nearly tripling the estimated 16 million from 2010 in a period of 40 years.
In terms of land area, maize takes up the largest area (more than 1.675 million hectares in 2013 = 45.5% of the national arable area), followed by groundnuts (9.8%) and beans (%8.3). Tobacco ranked the eighth crop by area with about 120,000 hectares (3.3%).

<table>
<thead>
<tr>
<th>Land Cover (2010)</th>
<th>Area - sqkm</th>
<th>% of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest Land</td>
<td>31989.6</td>
<td>27%</td>
</tr>
<tr>
<td>Grass Land</td>
<td>17772</td>
<td>15%</td>
</tr>
<tr>
<td>Crop Land - Farms</td>
<td>3554.4</td>
<td>3%</td>
</tr>
<tr>
<td>Crop Land - Smallholders</td>
<td>33648.32</td>
<td>28%</td>
</tr>
<tr>
<td>Wetlands and Waterbodies</td>
<td>24999.28</td>
<td>21%</td>
</tr>
<tr>
<td>Settlements</td>
<td>6516.4</td>
<td>6%</td>
</tr>
<tr>
<td>Total</td>
<td>118480</td>
<td>100%</td>
</tr>
</tbody>
</table>

Raw tobacco = 55% of export value
= 3.3% of arable land

$1.27 billion, 2015

sources: Country STAT 2018, MIT OEC
While the agricultural sector of Malawi contributes about a third of the country’s GDP, ~80% of the work force is employed in Agricultural sector, which supports the livelihoods of over 90 percent of the population (Malawi Government, 2013).

The smallholder sub-sector contributes around 25% of the total GDP, employs 95% of the total agricultural labor force (Malawi Government, 2004), and almost 70% of agricultural produce in Malawi comes from smallholder farmers (World Bank, 2006).

source: Statista 2018
Malawi - Topographic analysis - Five landforms

1. SURVEY AND ANALYSIS

Topography

- Highlands
- Slopes
- Plateaus
- Upper Valley
- Lower Valley

Source: ORGpermod
1. SURVEY AND ANALYSIS

Agriculture - Transportation

source: ORGpermod
About 91.5% of the total land area of Malawi is within the Zambezi River Basin (FAO 1997)
1. SURVEY AND ANALYSIS

Ongoing Initiatives Portal

**PROJECT DESCRIPTION**

**CATEGORY:**
AGRICULTURE

**PROJECT NAME:**
PRIDE - PROGRAMME FOR RURAL IRRIGATION DEVELOPMENT

**ACTIVITY:**
REINFORCING SMALLHOLDER COMMUNITIES

**LOCATION:**
NATIONAL, WITH 15 PRIORITY IRRIGATION PROJECTS

1. Nichilani (Kwale) - 310 hectares
2. Kagembe - 600 hectares
3. Nchimbi - 400 hectares
4. Muhora - 73 hectares
5. Mliona - 121 hectares
6. Lengoma - 95 hectares
7. Chinyerezi Mposa - 114 hectares
8. Ngaende - 98 hectares
9. Mpywa - 78 hectares
10. Chipata - 368 hectares
11. Kazaya - 152 hectares
12. Mphangula - 624 hectares
13. Kasama - 96 hectares
14. Mphika Hill - 43 hectares
15. Mwingi - 227 hectares

**STATUS:**
ACTIVE, 2015 - 2022

**RESPONSIBLE BODY:**
IFAD - INTERNATIONAL FUND FOR AGRICULTURE DEVELOPMENT

**SOURCES:**
https://www.ifad.org/en/overview

PRIDE intends to contribute to the resilience of smallholder communities. It will reduce vulnerability to food insecurity, climate change effects, and to the vagaries of the market by enabling farmers to sustainably enhance their production levels to such a degree that they can provide for their household nutrition demands and deliver produce to viable markets. PRIDE does so by providing smallholder farm households a combination of: (i) irrigation and soil- and water conservation infrastructure; (ii) promotion of good agricultural practices; and (iii) linkage to improved value chains.
2

GOAL FORMULATION

• CONNECTIVITY
• PRODUCTIVITY
• ACCESIBILITY
• SUSTAINABILITY
Values, Targets and Goals

Values
- good governance
- economic growth
- vibrant culture
- economic infrastructure
- food security and nutrition
- social sector development
- achieving science and technological-led development
- fair and equitable distribution of income

Targets
- Develop Irrigation Infrastructure (Water Masterplan)
- Develop Transportation Infrastructure (Transportation Masterplan)
- Achieve a more equal rural/urban ratio (around 50/50)
- Climate change adaptation
- Increase Tourism

Goals
- Agriculture, water development & climate change
- Education and skill development
- Energy, industry & tourism development
- Transportation and ICT development
- Health and Population
2. GOAL FORMULATION

Targets: Transportation Infrastructure

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</thead>
<tbody>
<tr>
<td>Integrated Scenario 1</td>
<td>Rail: Beira – Nsanje</td>
<td>48.6</td>
<td>144.0</td>
<td>192.6</td>
<td>280</td>
<td>177</td>
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<td></td>
<td>Dry port: Salima</td>
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<td></td>
<td>IWT: Chilumba – Nkhata Bay – Salima – Liwonde</td>
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<tr>
<td>Integrated Scenario 2</td>
<td>Rail: Beira – Bangula</td>
<td>63.1</td>
<td>147.0</td>
<td>210.1</td>
<td>1,477</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>Rail: Moatize avoiding line</td>
<td></td>
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<tr>
<td></td>
<td>Road: M1 Dualling – Songwe to Blantyre</td>
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<td>IWT: Chilumba – Nkhata Bay – Salima – Liwonde</td>
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<tr>
<td>Integrated Scenario 3</td>
<td>Rail: Beira – Limbe Direct</td>
<td>87.0</td>
<td>189.0</td>
<td>276.0</td>
<td>1,528</td>
<td>212</td>
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<td>IWT: Chilumba – Nkhata Bay – Salima – Liwonde</td>
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<td>IWT: Nkhata Bay – Mpamba Bay</td>
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<td></td>
<td>Road: Blantyre Expressway</td>
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<td></td>
<td>Rail: Chilumba – Mbeya</td>
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<tr>
<td>Integrated Scenario 4</td>
<td>Rail: Beira – Limbe Direct</td>
<td>70.8</td>
<td>165.0</td>
<td>235.8</td>
<td>744</td>
<td>128</td>
</tr>
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<td></td>
<td>IWT: Chilumba – Nkhata Bay – Salima – Liwonde</td>
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<td>IWT: Nkhata Bay – Mpamba Bay</td>
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</table>

source: National Transportation Masterplan 2017
2,500ha/year is decided with the Department of Irrigation, 5,000ha/year (ambitious scenario) is nearly equal to the standard development rate of SADC (South-Africa Development Communities) countries. The implementation plan is formulated with regards to: priority ordering, implementation period and cost per project, forming a smooth increase of irrigation development cost for investment.

source: Water Masterplan
3

PLAN MAKING

• COMPREHENSIVE PLANNING
• PLANNING PRINCIPLES
• CASE STUDIES
• DISTRICT LEVEL PLANNING
• INVESTMENT FRAMEWORK
Comprehensive Planning

3. PLAN MAKING

**Industry/Agribusiness**
- Arable land
- Industry activities (mining, markets)

**Infrastructure**
- Rail/Road/Port network
- Electricity network

**Governance**
- District levels
- TA levels

**Environment**
- Soil type (wetland, forest,..)
- Watershed boundaries & Waterstreams
- Topography

**Population**
- Density
- Villages

source: ORGpermod
3. PLAN MAKING

Local Development Investment Framework

source: ORGpermod
3. PLAN MAKING

Case Studies of Rural Settlements development models: large scale smallholder farming systems

source: ORGpermod
3. PLAN MAKING

Case Studies: Jezreel Valley, Israel

NOTE:
Total population: 216,233
Population of all agrarian settlements: 79,562
Area in image: 576 km²

source: ORGpermod
Coalition building and stakeholder management is a political/community organizational process.
Vertically-integrated development models with a phased approach to infrastructure and economics
PLAN IMPLEMENTATION

- ORGANIZING VERTICALLY INTEGRATED ECONOMIC SYSTEMS
- PROJECT FINANCING MODELS (PPP, TIF, ETC,)
- ZONING AND TAX INCENTIVES POLICIES
- CROSS SECTOR PARTNERSHIPS AND COALITION BUILDING
- COST BENEFIT ANALYSIS
- NON LINEAR PHASING
- IMPACT MONITORING