Strategic supply chain solutions in ‘green’ development environments

Tom Plat, January 19th 2012

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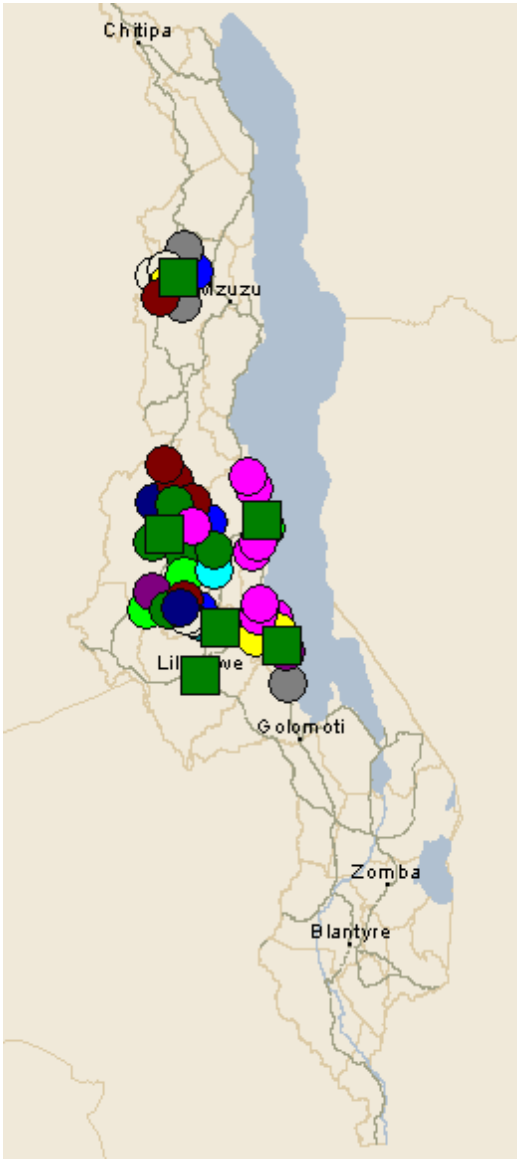

Pop question. What is the reason that Lake Malawi is called the calendar lake?

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What does Jatropha look like?

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Content

- What is Bio Energy Resources Limited?
- The supply chain of BERL: nuts
- Goals and challenges
- Supply chain solutions

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What is Bio Energy Resources Ltd.?

- Bio Energy Resources Ltd. (BERL) is a Malawian company that was established in 2006 with the sole purpose of developing bio-energy production on a commercial basis within a sustainable framework.

- BERL is promoting production of biofuel from Jatropha because of the following key reasons:
  - Jatropha is non-edible and uses non-productive land to produce it in Malawi.
  - Production of Jatropha requires low labour input and therefore less competition with the labour requirements of other crops such as tobacco.
  - Jatropha requires very little water to grow and prevents soil erosion. Oil from Jatropha seed can be used for other many other purposes.
  - Greenhouse gas emissions reduction by growing Jatropha can be achieved in a number of ways through the biofuel production process.

- Source: www.berl.biz.

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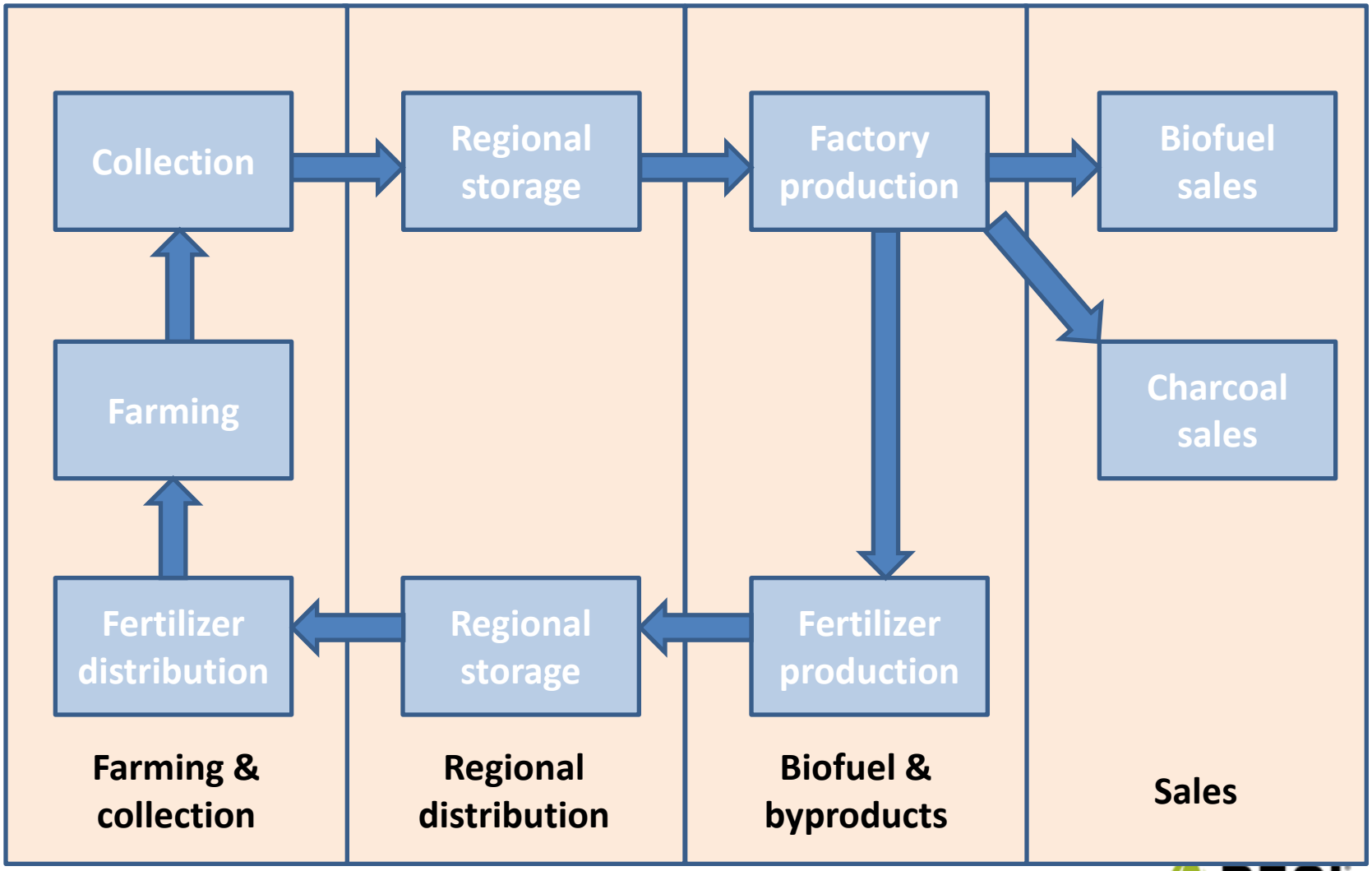
The supply chain of BERL: nuts



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The supply chain of BERL: nuts

The parts of the supply chain of BERL as defined in the logistic model are:

- **Farmers delivering seeds to collection centers.** Where should collection centers be located? How much do we need?

- **Transport from collection centers to regional depots.** How much transport do we need? How much storage capacity do we need on the locations of the collection centers and regional depots?

- **Transport from regional depots to the factory.** Somewhere in the future, the number of factories can increase. To which factory do we need to transport seeds?

- **Transport of oil and by-products from the factory to other destinations/markets.** Where should the by-products be produced, where do they need to go?

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Goals and challenges

- Goal: determine how to develop the BERL supply chain on the short and long term:
  - be cost efficient
  - increase KPI's: farmer coverage, factory input, planting strategies

- Challenges
  - Data input
  - Seasonality (harvest, transport, storage cost)
  - Scenarios: charcoal vs. compost, how much compost to return?
  - Two way supply chain: into factories and then back
  - Regional storage vs. factory input

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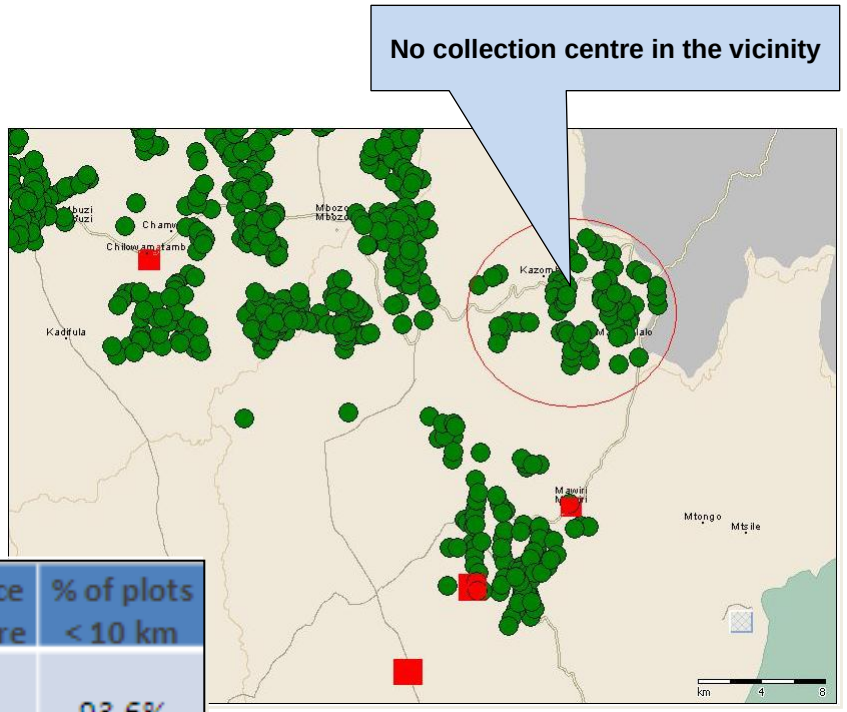
Increasing the coverage for farmers by relocating collection centres

By showing the farmers and collection centres on a map, it is easy to give insight into this location problem

Simulation of a new set of locations does the rest



District	Number of plots*	Number of collection centres	Average distance to nearest centre	% of plots < 10 km
Dowa	3.678	8	4,3	93,6%
Kasungu	6.616	22	4,3	98,1%
Nkhota-kota	1.154	5	5,2	96,2%
Salima	3.699	9	5,8	96,0%
Mzimba	2.718	9	5,5	95,7%
#N/A	18		5,7	
Total	**17.883**	**53**	**4,9**	**96,3%**

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A simulation model for the supply chain

Input on which regions to expand

Input parameters

Graph showing distribution and factory input

Decision variables

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Refresh database

Calculate volumes centres to regional depots

Calculate volumes from regional depots to factories

Planting

	Upscaling
Salima	120%
Kasungu	120%
Dowa	120%
Nkhota-kota	0%
Mzimba	0%
Average	98%

Actuals

	2009	40%					
	2010	2011	2012	2013	2014	2015	2016
Salima	40%	60%	60%	60%	60%	60%	60%
Kasungu	40%	60%	60%	60%	60%	60%	60%
Dowa	40%	60%	60%	60%	60%	60%	60%
Nkhota-kota	40%	60%	60%	60%	60%	60%	60%
Mzimba	40%	60%	60%	60%	60%	60%	60%
Average	40%	60%	60%	60%	60%	60%	60%

Factories

	2010	2011	2012	2013	2014	2015	2016
Lilongwe	1	1	1	1	1	1	1
Salima	0	0	0	0	0	0	0
Kasungu	0	0	0	0	0	1	1
Dowa	0	0	0	0	0	0	0
Nkhota-kota	0	0	0	0	0	0	0
Mzimba	0	0	0	0	0	0	0

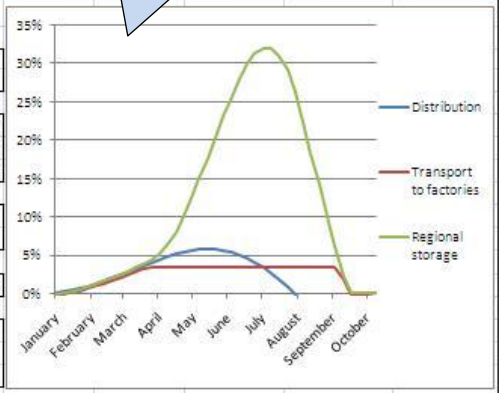
Preference of factory

	1	2	3
Lilongwe	Lilongwe	Lilongwe	Lilongwe
Salima	Salima	Lilongwe	Lilongwe
Kasungu	Kasungu	Dowa	Lilongwe
Dowa	Dowa	Lilongwe	Lilongwe
Nkhota-kota	Nkhota-kota	Salima	Lilongwe
Mzimba	Mzimba	Kasungu	Lilongwe

Max volume to factories	4%
Own storage per factory	1.000
Used for seed storage	50%

Sensitivities

Collection period	31	weeks
Transport period	40	weeks
Price of seed transport	26	MWK/tonkm
Price of seedcake return*	13	MWK/tonkm
Price of charcoal transport	26	MWK/tonkm
Storage capability per m^2	1.000	Kg
Variable cost per month of storage	3	US/m^2
Exchange rate	152	MWK/dollar
How much seed in a 30 tonner?	18	tons
How much seedcake in a 30 tonner?	30	tons
How much charcoal in a 30 tonner?	15	tons



Summary management output

Costs of transport (US dollar)	2010	2011	2012	2013	2014	2015	2016
Collection centres to regional depots	6.098	22.085	57.952	104.491	167.465	254.281	356.053
Regional depots to factories	30.702	114.052	330.990	634.571	1.062.290	818.771	1.180.333
Seedcake: factories to regional depots	4.605	17.108	34.754	66.630	111.540	85.971	123.935
Seedcake: regional depots to centres	1.088	4.027	8.113	15.334	25.113	38.693	55.206
Scenario 1 of production: Charcoal factories to Lilongwe	0	0	0	0	0	142.206	205.003
Scenario 2 of production: Charcoal factories to Lilongwe	0	0	0	0	0	71.103	102.501
Total transport cost scenario 1 charcoal	42.493	157.273	431.809	821.027	1.366.409	1.339.922	1.920.529
Total transport cost scenario 2 charcoal	42.493	157.273	431.809	821.027	1.366.409	1.268.819	1.818.028
Cost per ton seed from centres to depots (US/ton)	8	8	7	7	7	7	7
Cost per ton seed from depots to factories (US/ton)	41	42	42	44	46	23	24
Cost per ton seedcake from factories to depots (US/ton)	12	13	13	13	14	7	7
Cost per ton seedcake from depots to centres (US/ton)	3	3	3	3	3	3	3
Cost per ton charcoal scenario 1: charcoal (US dollar)						44	44
Cost per ton charcoal scenario 2: charcoal + comp (US/ton)						44	44

When to open factories and where?

Future outputs in cost, storage and trips for different scenarios

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Concluding results and advice

Sensitivities		
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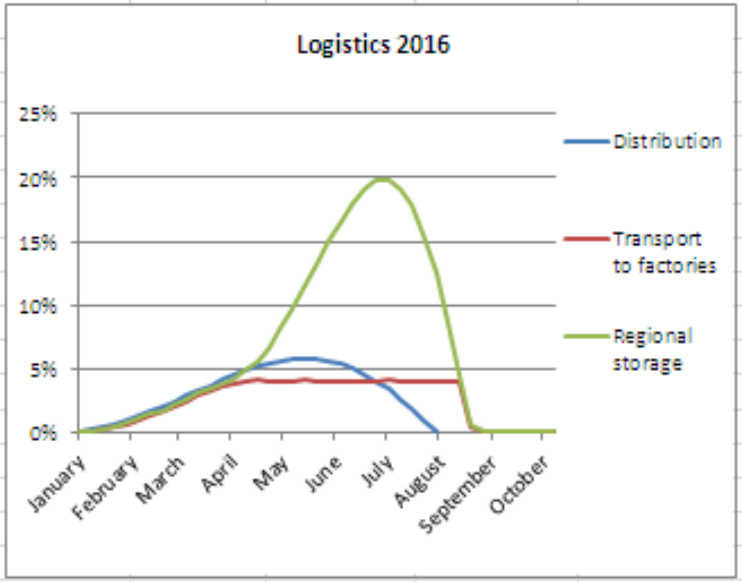

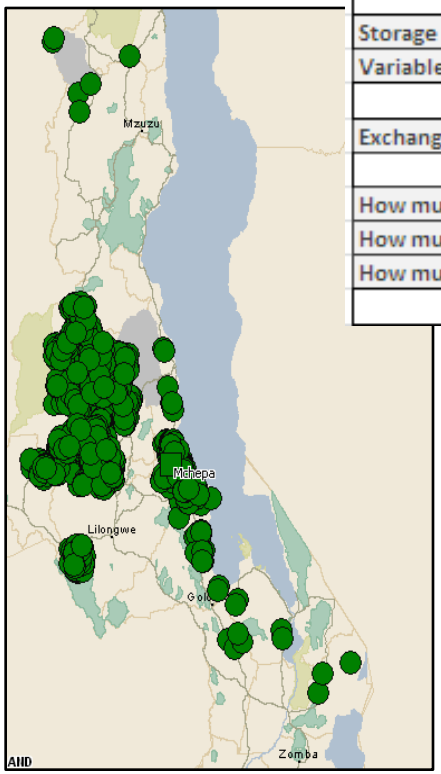

- **90% of farmers <= 10 km from collection centres (was 70%)**
- **Second factory not in 2015 but 2017; location Kasungu**
- **Central production more beneficial than de-central production**

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Questions?

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