Southern Agricultural Growth Corridor of Tanzania

Appendix IX:

SAGCOT Production and Investment Model

Draft

S*ummary*

The SAGCOT Production and Investment Model adopts a 'bottom-up' approach to estimate production capacity, investment requirements and developmental outcomes of SAGCOT over a twenty year horizon. It is supported by primary and secondary research of agriculture and other geographic issues within the SAGCOT region, analysis of Tanzania's commodity and input markets and prices, and estimates of national and international demand and trade flows.

The bottom-up approach takes six hypothetical and potential farm 'units', each incorporating smallholder commercial farmers and pastoralists, and independently profitable, and determines an appropriate development profile for each of the six clusters identified within SAGCOT using build-ups of multiples of those six farm units. It then determines the infrastructure necessary to support this build-up, at the on-farm, last mile, marketing, storage and processing, and backbone levels. Once all inputs have been determined, the model generates estimates of total investment required, the sources of that investment, and the development benefits which may accrue through following the investment profile the model suggests.

The model bases all investment in SAGCOT entirely within the identified clusters. Such an investment profile will almost certainly not reflect the reality of SAGCOT over the next twenty years, as investment is expected to be made throughout the corridor, including in areas not within the identified clusters. Limited information and the necessity of balancing accuracy, simplicity and usefulness within the model necessitate this approach.

It must be remembered that while the model takes a bottom-up approach, it is still significantly 'high level', in that the unit models, the development profiles of each cluster, and the exact nature of the infrastructure investment necessary to support these profiles are all estimates based on information available, and are necessarily simplistic. More detailed modelling of individual farm investment opportunities, of cluster development, and of infrastructure requirements are beyond the scope of this particular exercise, but are necessary for more detailed analysis and forecasting for investment purposes. The model is not intended to provide a detailed budget or investment analysis for individual components of SAGCOT.

Farm Units

The six units are a 2,650 ha mixed crop and livestock farm, a 10,300 ha livestock ranch, a 2,000 ha rice farm, a 10,250 ha sugar estate, a 600 ha citrus farm and a 150 ha banana plantation. The size of each of these units is determined by considering commodity type, processing capacity, commercial smallholder and emergent farmer and pastoralist integration, irrigation potential, and economies of scale and scope. The potential commodities are not exhaustive of all possible commodities which may be produced within SAGCOT, and are determined considering current and future market demand, by analysing Tanzania's national production, consumption, demand, imports and exports, and also global production, consumption and demand trends, to estimate the future market potential for the commodities. Yield, carrying capacity, price and cost data are sourced through detailed value chain analysis, first-hand assessments of commodity potential and prices through field visits, and analysis of international trends and markets.

Using all these inputs, a separate model for each unit is developed, also considering on-farm infrastructure requirements, and assumptions adjusted within realistic bounds to ensure each unit derives an appropriate investment return of between 15-25%. As each detailed model is developed fully, a simplified version using the same assumptions is adopted as a major input for the model.

Cluster development profile

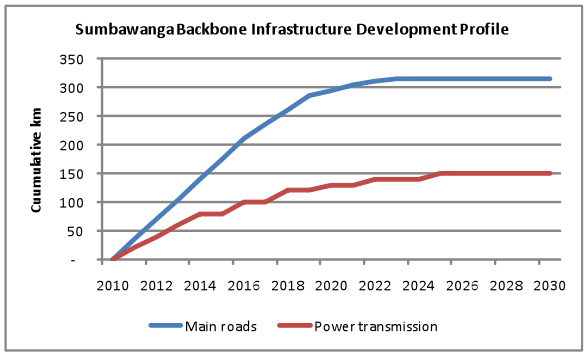
As part of the cluster identification process, close analyses of land area, land availability, climate, soils, irrigation potential, population density and existing and future infrastructure are undertaken. These form the foundation of the cluster development profiles. A realistic build-up of agricultural activity is established for each cluster, based on these analyses, using the six farm units, over a 20 year horizon.

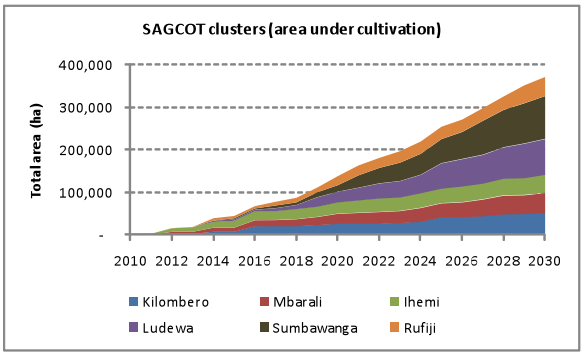
Infrastructure development

With cluster development profiles for each cluster, and having a good knowledge of existing infrastructure in each cluster, it is possible to determine the infrastructure requirements of the period of the cluster development (20 years). This begins with 'last mile' infrastructure, connecting each farm unit to the major backbone infrastructure, and includes electricity to the commercial farm and ranch units, to the commercial smallholder farmer outgrower networks, and to local communities, and the construction of feeder roads. Each of these infrastructure items has identified costs, and consistent estimates of requirement per farm unit type developed.

The next level of infrastructure is off-farm market support functions, and includes wholesale markets for commodity trading, storage facilities (large warehouse and cold storage), and processing mills. This off-farm market support is necessary for the commercial profitability of large-scale, emergent and smallholder commercial farmers. For each of these market supporting infrastructure units, estimates of costs are incorporated, supported by cost analysis. Similar to the farm unit development, the costs for each unit of market supporting infrastructure is applied consistently across the clusters.

The final level of infrastructure assessed is the backbone of the corridor. This comprises transport (road and rail networks) and energy (power transmission and distribution). Knowledge of existing backbone infrastructure is vital for this analysis, as it combines with the development profiles for each cluster to determine the requirements for the next twenty years. Again, consistent unit costs are applied for each kilometre of road, rail or electricity transmission, and for each electricity substation, across all clusters. This assists in identifying that two of the least developed clusters identified for the analysis, Ludewa and Sumbawanga, have significant backbone infrastructure requirements requiring major investment to make farming units commercially viable. This requirement can be seen in the backbone investment requirement and cluster development profiles for Sumbawanga (below).





Assessing investment requirement

Having built up the inputs to the model, it becomes possible to indentify the investment requirements by investment type (e.g. commercial farm and ranch, off-farm infrastructure, backbone infrastructure). Having determined the sources of finance for each investment type (e.g. public, private, patient capital), it is possible to identify the investment profile for each type of finance over the model's investment period, and to generate a simple financial return analysis per cluster.

Assessing developmental impact

Each farming unit modelled incorporates emergent and/or smallholder commercial outgrowers or pastoralists, with or without irrigation. Using an estimated plot size for each, the model estimates the total number of commercial outgrower farmers or pastoralists for each farm or ranch unit, for each cluster, and for SAGCOT. Similarly, using an estimate of the number of on-farm employment opportunities created per hectare of large-scale commercial farming or ranching operation, the model estimates the number of on-farm employment opportunities created.

Using Johnston-Mellor agricultural growth multipliers (Mellor and Johnston, 1984), it is possible to estimate the number of off-farm employment opportunities created by each on-farm employment opportunity. These are allocated between employment in direct processing capacities for farm production, and in the wider agricultural value chain.

Having a total number of people engaged in the whole agricultural process, from on-farm employment, to emergent and smallholder commercial farming, processing, and the wider value chain, and using an estimate for the number of people in each household of those benefitting from these employment opportunities, the model estimates the total number of indirect beneficiaries of each employment opportunity (i.e. other household members), and therefore the total number of beneficiaries of the investment made in the corridor.

Output generated

The model is able to provide summaries of:

- Total area and volume of, and income generated by, production, by: cluster, farm type, farmer type (e.g. large, emergent and smallholder commercial farmer), irrigated area, commodity, year
- Total investment required by: cluster, farm type, type (e.g. on-farm, last mile), source (e.g.patient capital, public)
- Total number of employment opportunities and indirect beneficiaries by cluster
- Development, investment and revenue profiles over time, by cluster
- Returns to investment by cluster

The possibilities of these outputs will be detailed further in the file version of this annex.

References

Mellor, J. W. and B. F. Johnston. 1984. "The World Food Equation: Interrelations among Development, Employment and Food Consumption," Journal of Economic Literature 22(2) June: 531-74.