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Agricultural growth and poverty reduction in Africa

The case for patient capital

AgDevCo

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Executive summary

Many parts of Africa have major agricultural potential; however, this potential remains largely unrealised. The major reason that there has been so little private investment in greenfield agriculture is the lack of sufficient profitable investment opportunities. Unit costs in the early stage of development are high and therefore margins and returns on the capital employed are low.

However, none of the cost disadvantages that result in low profitability need be permanent. The cause of low profitability and high risk is the greenfield state of development. The agricultural platform available to international competitors – infrastructure, strong input and output supply chains, information and extension services and agricultural credit facilities – simply does not exist in most of Africa. The solution is to overcome the barriers to entry and kick-start development so that the benefits of economies of scale and scope and 'learning by doing' can be realised, resulting in a sustainable, prosperous sector over time.

Patient capital is the most effective means of kick-starting sustainable commercial agriculture in Africa and delivering major benefits for smallholder farmers. It helps overcome the barriers to entry into commercial agriculture. It provides one-off support leaving a sustainable agribusiness sector that requires no further patient capital. It 'levers-in' large amounts of private capital into commercial farming and into infrastructure service provision. It is by far the most cost-effective way of providing major benefits for smallholder farmers and the rural communities in which they live.

Introduction

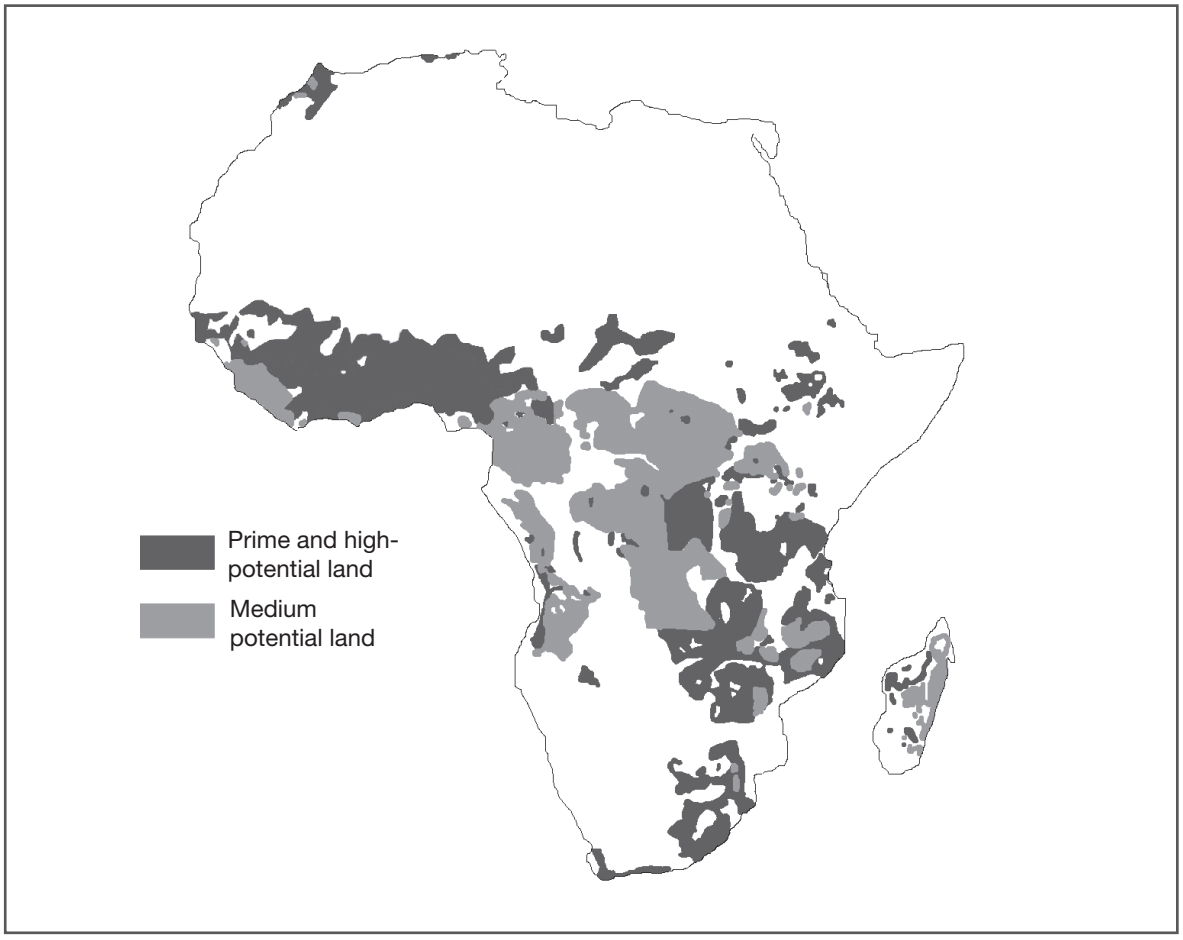
There is enormous agricultural potential in many parts of sub-Saharan Africa.[1] Large areas of underutilised arable land abound. There are good soils, suitable climate and accessible water supplies. The area of agricultural land classified as 'prime' or 'high/medium potential' for commercial agriculture exceeds the total area of agricultural land in Western Europe (Figure 1). Africa could be a major net exporter of food, whereas, in fact, it is a net importer – and imports are growing rapidly.[2] The huge latent potential has not been realised.

It is well known that growth originating in agriculture has a much greater impact on poverty reduction than growth in any other sector.[3] The power of agriculture to reduce poverty comes not only from its direct poverty-reduction effect but also from its strong growth linkage effects on the rest of the economy. So the missed opportunity to develop commercial agriculture in Africa has also been a missed opportunity to reduce poverty. Instead over the last 25 years poverty has increased in much of Africa – the only continent where this has been the case.[4]

This paper addresses three questions:

- First, why, despite the evident potential, has there been so little commercial investment in agriculture in Africa? It shows that there are high barriers to entry that deter commercial investment and keep poor people poor.
- Second, how can the barriers to entry be overcome and a much higher level of investment in commercial agriculture be induced? It argues the case for patient capital from the international community as a highly effective means of 'levering-in' large amounts of private capital into the sector, thereby kick-starting sustainable agricultural investment.
- Third, how can patient capital be deployed to ensure not only that investment in commercial agriculture is stimulated, but also that smallholder farmers are major beneficiaries and that the potential poverty-reduction impact is realised in practice? It argues that commitments of patient capital can be used to ensure that growth of commercial agriculture directly benefits smallholder farmers, and is pro-poor.

Figure 1: Prime and high-potential agricultural land in Africa



Source: Eswaran et al (1996), United States Department of Agriculture.

Why has there been so little investment in agriculture in Africa?

There has been extraordinarily little investment in commercial agriculture in the high-potential regions of Africa. Less than five per cent of suitable arable land is used for commercial agriculture; less than four per cent of arable land suitable for irrigation is irrigated; fertiliser use is far below that of the rest of the developing world (Figure 2). It is no exaggeration to say that, other than in South Africa, commercial agriculture in Africa is at the very earliest 'greenfield' stage of development.[5] New commercial farming ventures typically suffer from an absence of infrastructure (no feeder roads, no grid electricity supply and no water supply for irrigation); agricultural inputs are expensive; the workforce is inexperienced; there are few experienced managers; access to markets is difficult; and realised farm-gate prices are low.

There are three categories of explanation for why there has been so little investment:

- inappropriate government policies
- insufficient profitable opportunities
- inability to finance viable opportunities.

This paper considers the first two categories; the third category is addressed in a separate paper.

Getting the policies right

It is often argued that the key to success in stimulating investment in commercial agriculture is getting the policies right. There is much truth in this argument. Until the turn of the century, many governments in Africa had adopted policies inimical to investment in agriculture. Inappropriate macroeconomic policies included overvalued exchange rates and high domestic real interest rates (often caused by excessive government domestic borrowing). Inappropriate sector policies included very high effective tax rates on farmers using such mechanisms as state marketing boards. These policies inevitably reduced both agricultural incomes and the incentive to invest in commercial agriculture.[6]

Over the past decade, these perverse government policies have been reversed, or at least moderated, in many countries. It is now much more common for governments to recognise agriculture as a priority sector and to seek to encourage agricultural investment.[7] However, despite a generally more benign policy environment, with a few notable exceptions the supply-side response has been disappointing. This paper argues that, while it is true that getting the policies right is necessary, on its own this is not sufficient.

Insufficient profitable opportunities

Rapid growth of agricultural production and incomes requires large amounts of profitable private investment. Private investment will be undertaken if two conditions are met. First, there must be sufficient opportunities whose expected return on investment exceeds the return on capital required by commercial investors. Second, investors must be able to raise the debt and equity capital needed to fund the investments. In this section, we consider whether the reason that there is little private investment in commercial agriculture is because there are too few opportunities whose expected returns exceed the returns required by commercial investors, and if so why.

The expected profitability of an opportunity is a function of the volume of production, the price received for the output, and the capital and operating costs incurred to produce and market the output. If there are insufficient profitable opportunities in Africa the reason is not likely to be comparatively poor agronomic potential. There are large areas of available, high-quality land. Many agronomic studies have shown that the yield potential is equal to that of the most productive growing regions in the world. This is confirmed by the high productivity achieved during the colonial period across many parts of Africa and by the observed high yields in those limited parts of Africa where irrigation is available and modern farming practices are employed.

Figure 2: Current status of African agriculture

Percentage of arable land in commercial production:	Less than 5%
Percentage of irrigable land under irrigation:	4% (South Asia: more than 30%)
Fertiliser use (kg/hectare):	13 (South Asia: 98)
Improved varieties of cereals (% of area grown):	24% (South Asia: 77%)
Agricultural productivity (% of global average):	25%

Source: World Bank (2008), *World Development Report 2008: Agriculture for Development*.

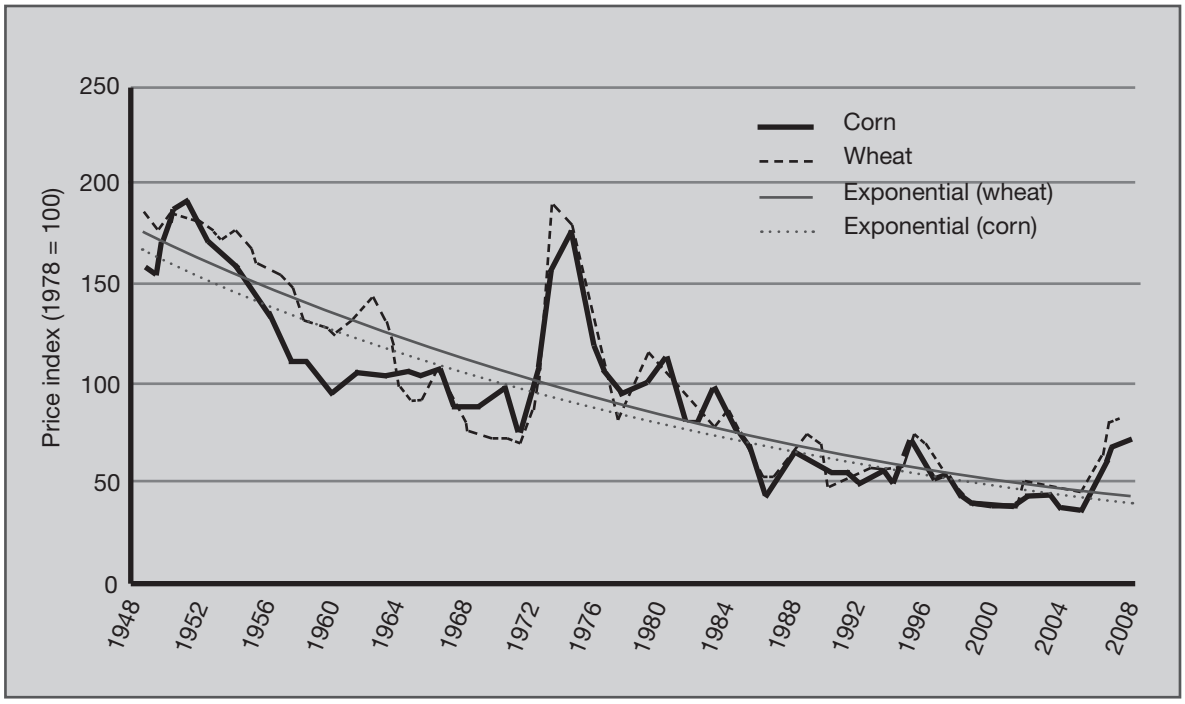
Nor is lack of demand a problem for most agricultural products in the short term. International markets are huge relative to the scale of African production. African markets are quite large and food imports are growing rapidly. Increased supply will find a market. The question is whether farmers will be able to sell into these markets at a price that will generate a profit.

Most agricultural products are traded goods so their border prices are set in international markets. Border prices reflect competition between international suppliers, most of which benefit from economies of scale and scope, optimisation of crop selection and crop management techniques, access to state-of-the-art agriculture-supporting infrastructure and extension services, and often subsidised credit. Competition over the past 50 years has driven substantial productivity improvements, which have in turn resulted in a marked downward trend in real (inflation-adjusted) agricultural commodity prices despite rising global demand (Figure 3).[8] Agricultural protection policies in Europe and the USA probably also contributed to this downward trend. Aggressive buying strategies by supermarkets and other wholesalers have added to downward pressure on farm-gate prices.[9] The border prices received by African producers will be determined by the costs of highly efficient competitors and these other market factors.

African farmers selling into export markets will receive a farm-gate price equal to the border price, less transport costs and traders' margins. If transport costs and traders' margins are high then the farm-gate price that the farmers receive will be much lower than the border price. They may be able to achieve a higher farm-gate price for sales in domestic and regional markets, but only if transport costs and traders' margins are lower than for imports, and only for volumes up to the limit set by local demand.

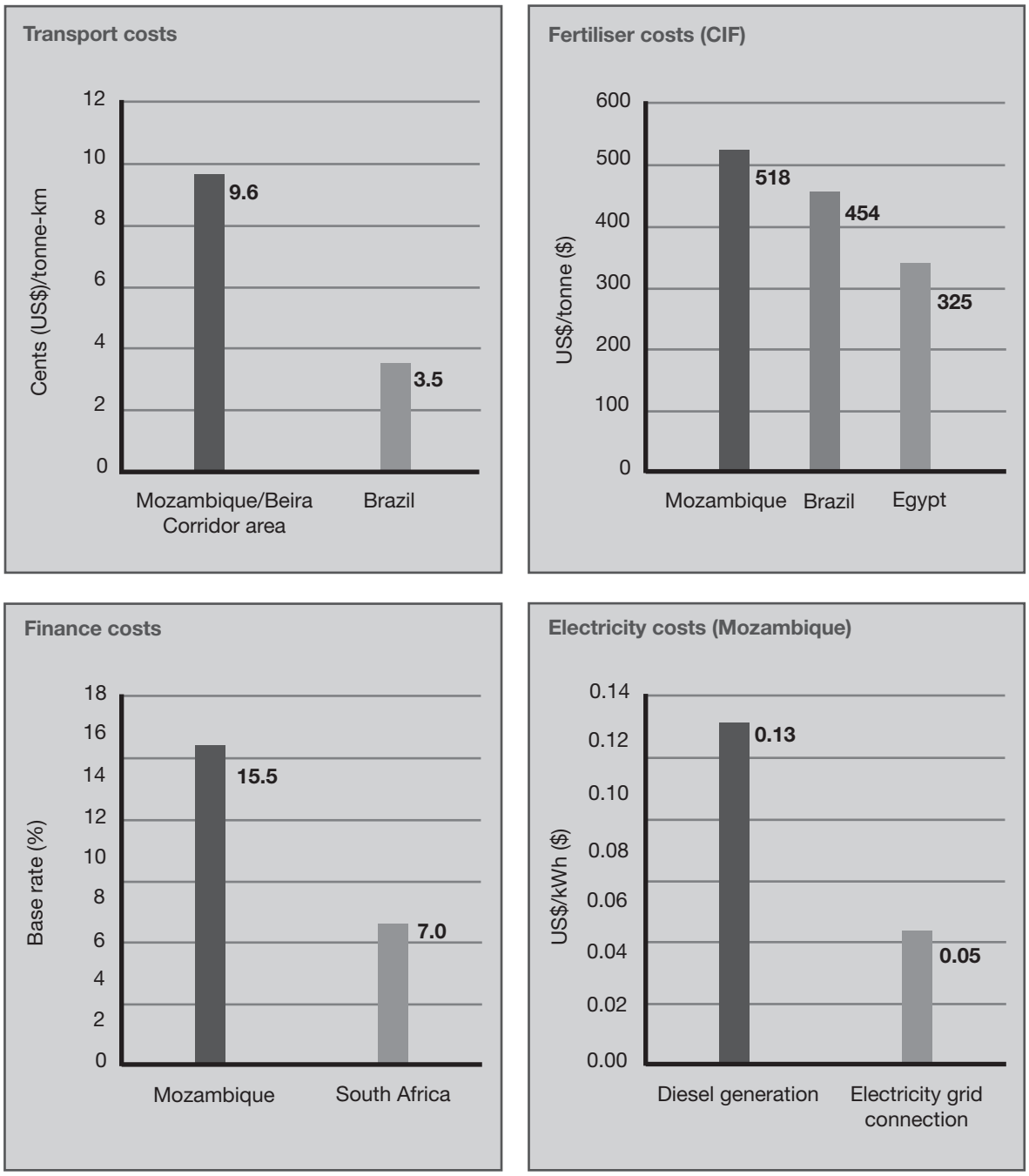
The key to profitable agriculture is therefore the ability to achieve production and delivery costs that are no higher than those of their competitors. But even a cursory review of the evidence shows that, currently, most African producers cannot do this. On all fronts most African farmers (other than some in South Africa) incur much higher costs than international competitors (Figure 4 opposite). Transport costs per tonne (by road, sea and air) are more than double those of international competitors. Because few commercial farms are grid connected they must rely on diesel-generated electricity, which is often more than three times as expensive as grid-connected electricity. The delivered cost of fertiliser can be more than double that faced by competitors.

Figure 3: Agricultural commodity price trends (index of real corn and wheat prices), long-term trend 1948–2008



Note: The 1948–2007 prices are marketing-year averages. The 2008 prices are the November 2008 World Agricultural Supply and Demand Estimates (WASDE) season averages, mid-point of range from the 2008/09 marketing year. Prices deflated by Bureau of Economic Analysis (BEA) annual implicit GDP deflator.

Figure 4: Current costs of African agricultural producers



If water supply for irrigation has to be provided by the farmer, as is typically the case, the cost of irrigation per tonne of output can be so high that it renders irrigated production by small- and medium-sized farms unprofitable. This is because there are high fixed front-end costs in delivering water to the farm gate that must be paid for out of sales revenues that are low relative to fixed costs in the early years.

The cost of working capital (when available at all) is much higher in many African countries than in competitor countries, for three reasons: local currency real interbank interest rates are often very high – the legacy of high government borrowing in the past; risk premia for new agricultural ventures are high, reflecting the greenfield state of development; and credit in competitor countries is often subsidised.[10]

Investors in greenfield ventures have to incur significant one-off start-up costs, such as land clearing, which do not have to be borne by competitors. The potential advantage of low labour costs is negated in greenfield situations by low skill levels and low productivity of the workforce, and consequential high labour supervision costs. These cost disadvantages, which are characteristic of the immature, early stage of agricultural development in Africa, are frequently much greater than the cost advantage of cheap land. It is therefore

unsurprising that many greenfield commercial farming ventures in Africa exhibit high unit production costs, low margins, and returns on capital invested below those required by commercial investors.

To make matters worse, greenfield agriculture is particularly risky. Besides the usual risks involved in agriculture (eg weather, market price volatility etc), there are additional start-up risks such as selection of crops, seed varieties and farm management practices, achieving acceptable product quality etc. These high start-up risks raise the minimum return required on capital invested in early-stage agriculture.

Figure 5 illustrates the problem. The line 'rf–rs' shows the required return on investment for different levels of risk. As risk increases, so does the return required by commercial investors. Greenfield ventures are very risky so investors require a much higher expected return to invest in them.[11] Opportunities with risk-return pairings below the line 'rf–rs' will not be able to secure commercial funding. For the reasons noted above, many greenfield agricultural ventures have low expected returns and high risk and therefore map below the line 'rf–rs'.

The conclusion is that the major reason why there is so little commercial investment in agriculture in Africa is that there are insufficient profitable opportunities in the short term.

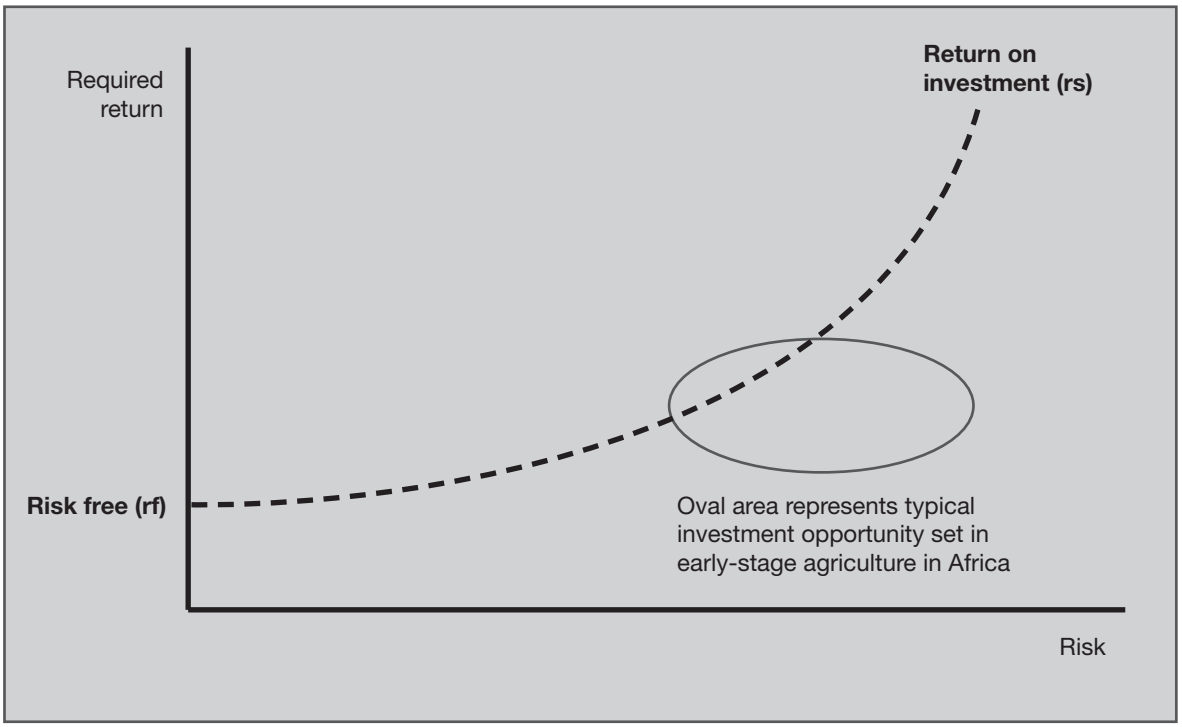
Creating a profitable agribusiness sector

However, it would be wrong to conclude that agribusiness in Africa cannot be commercially viable in the medium term. None of the cost disadvantages need be permanent. All the necessary conditions – good soil and climate, available land and water – are present in abundance in many areas. The cause of low profitability and high risk is the greenfield state of development of the sector. The agricultural platform available to international competitors – infrastructure, strong input and output supply chains, information and extension services and agricultural credit facilities – simply does not exist in most of Africa. The solution is to kick-start development so that the benefits of economies of scale and scope and the productivity improvements that arise from 'learning by doing' can be realised over time.

What is the evidence for this assertion?

Economies of scale There is strong evidence for the importance of economies of scale in major links in agricultural value chains.[12] They are present in transport/logistics services, input supply chains, post-harvest storage, marketing and processing, and agriculture-supporting infrastructure (electricity and water supply). Figures 6a–d (opposite and page 10) and the appendix (page 18) summarise some of the

Figure 5: Expected returns required by commercial investors



evidence. It is very clear: many links in the value chain exhibit declining average costs over time as the volume of production grows; and the greatest average cost reductions are achieved in the early years when the scale of operations moves from very small to medium size.

Economies of scope There are also significant economies of scope as agribusinesses grow over time. As capacity and capability improve in one value chain, so benefits accrue elsewhere in other value chains. Examples include: logistics (where improvements in efficiency in the value chain for one product induce benefits for producers in other value chains); marketing (where, once channels to market have been established for certain products, new products can flow through those same channels); and financial services (where, once capability in agricultural finance has been established, new sector and product opportunities are stimulated). Economies of scope are an additional source of reductions in average cost over time.

Learning by doing Greenfield investments are to some extent experiments. In the early years experimentation is needed to optimise crop and

Figure 6a: Economies of scale in agricultural value chains

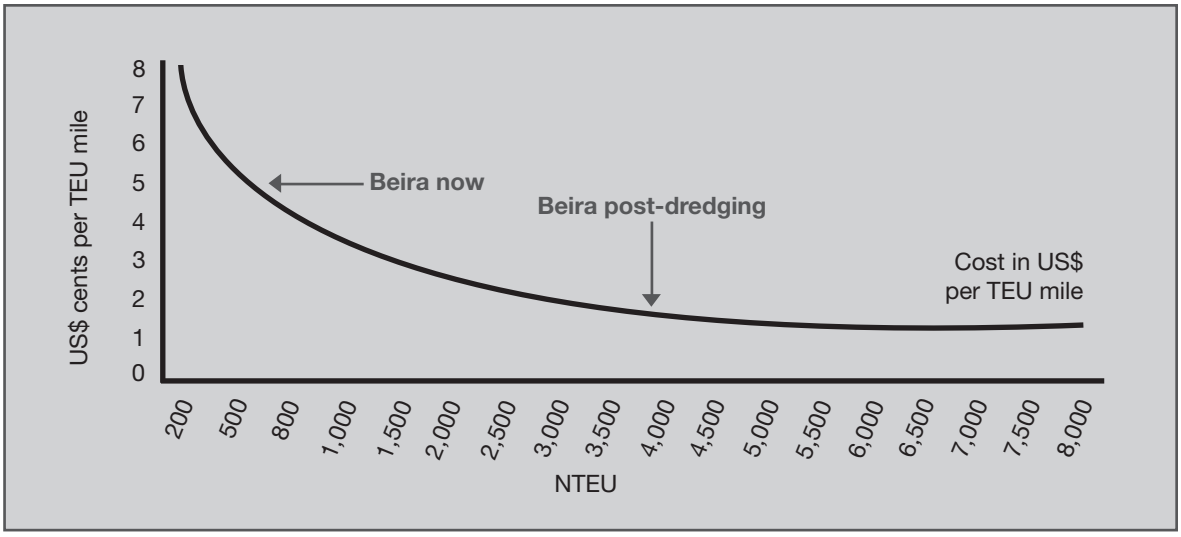


Figure 6b: Average electricity distribution cost (Swiss cents per kWh)

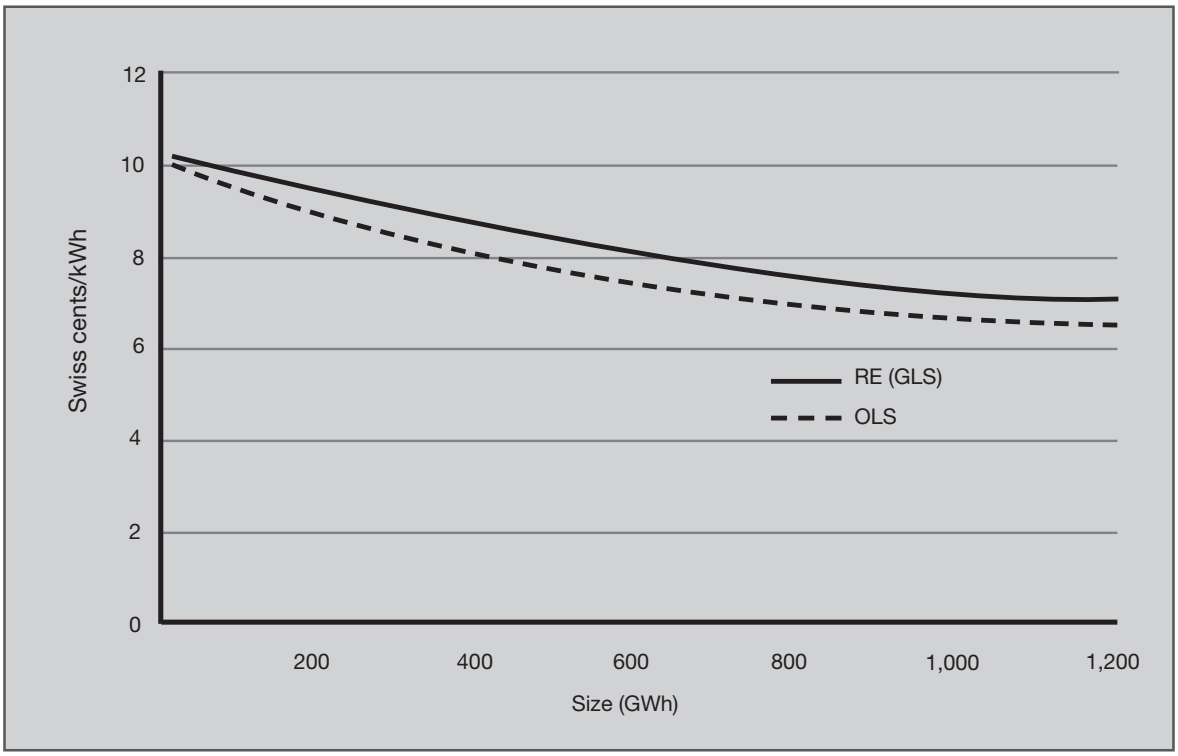


Figure 6c: Economies of scale of fishmeal processing plants

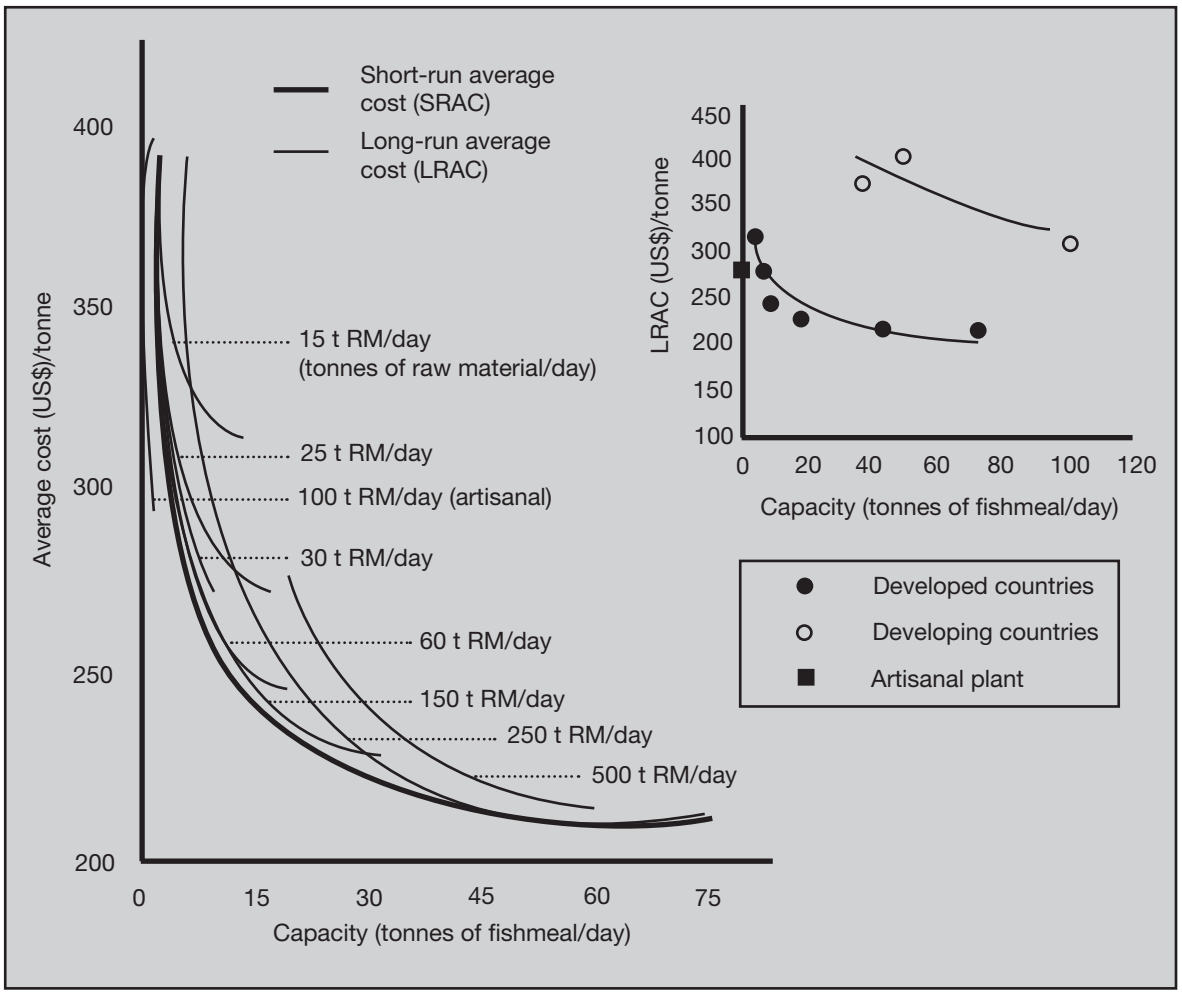
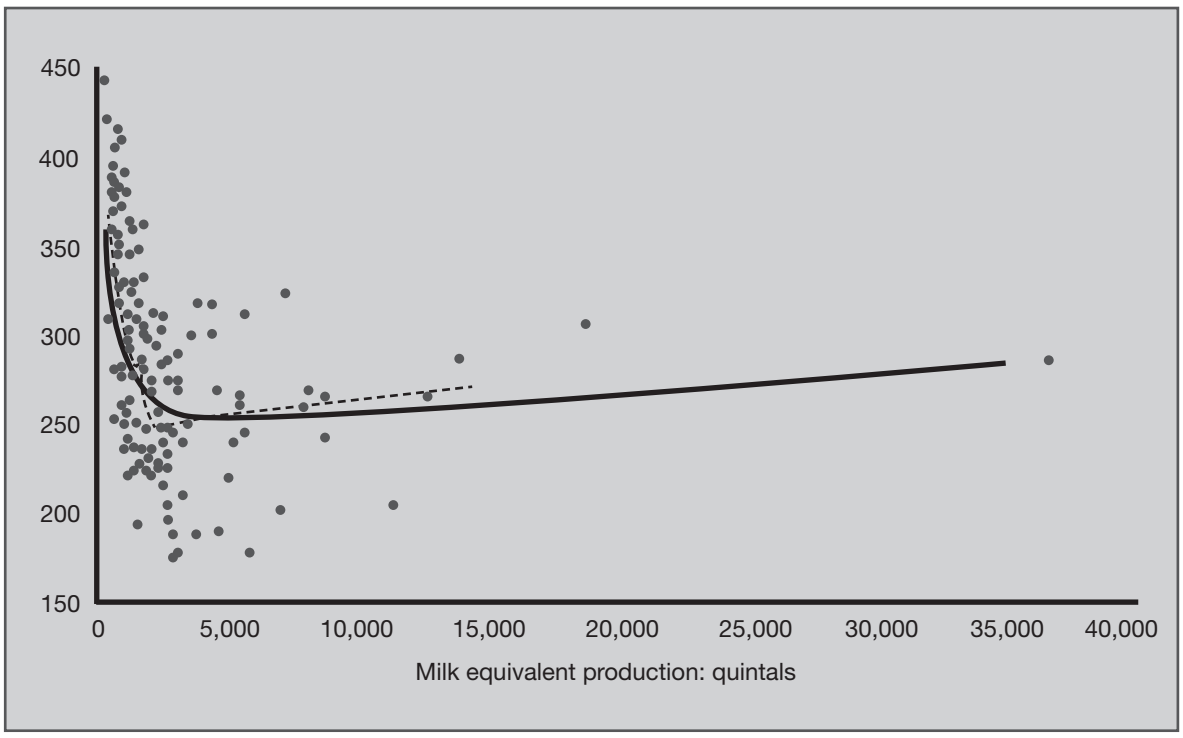


Figure 6d: Economies of scale in dairy production (cost per quintal)



Source (6a–d): See Appendix on page 18.

seed selection and farm management practices and to match quality to consumer preferences and regulatory requirements. Building new channels to markets takes time and involves trial and error. Therefore yields and income improve over time from sub-optimal levels in the earliest years. As the workforce becomes more experienced, it becomes more productive and less expensive supervision is required. The process of learning by doing is an important additional cause of declining average costs over time.

One-off start-up costs Greenfield ventures must clear virgin bush. These costs, which do not have to be borne by competitors, depress returns on investment at the start-up stage. However, since these are one-off costs, average costs following start-up will be lower than average costs at start-up. Therefore incremental margins and profitability following start-up will be higher than expected returns prior to start-up. The existence of these one-off start-up costs constitutes a barrier to entry by commercial investors.

All the evidence suggests that a large reduction in average costs from an initially high level is to be expected, and can be achieved, over the first 10 years of agricultural development starting from the greenfield state, as the benefits of economies of scale and scope and learning by doing are realised and once start-up costs have been 'sunk'. Average costs along the value chains can be reduced by more than 30 per cent from current levels and fully commercial returns achieved on incremental investment.

This general argument is supported by specific evidence from agricultural operations in southern Africa. Figure 7 shows the 'before' and 'after' cost structure of a commercial farm operation in Mozambique. The cause of current low margins is a combination of high transport costs, high electricity costs, high fertiliser costs, and low labour productivity. If transport costs per tonne were reduced to the African average, grid-connected electricity were available instead of diesel generation, fertiliser costs fell to levels more typical of their competitors, and labour productivity rose to Kenyan levels, then operating margins would increase from less than five per cent to 40 per cent and the return on capital employed would rise to commercial levels.

The conclusion is that the cause of low profitability and high risk is the greenfield state of development. It results from lack of early-stage investment to create the platform required if commercial agriculture is to be competitive. The lack of investment is caused by the low profitability, which is itself a function of the absence of economies of scale and scope in the early years. If the investments in on- and off-farm agribusiness took place they would bring down average costs, improve margins and generate fully commercial returns on incremental investment over time. This would kick-start a virtuous circle of improving productivity, falling costs, rising profitability and sustainable growth. However, the high costs and risks constitute a barrier to entry preventing this virtuous circle fom starting to turn. So the key question is how to kick-start the process. How to overcome the barriers to entry to commercial investment so that the undoubted potential can be realised?

The case for patient capital

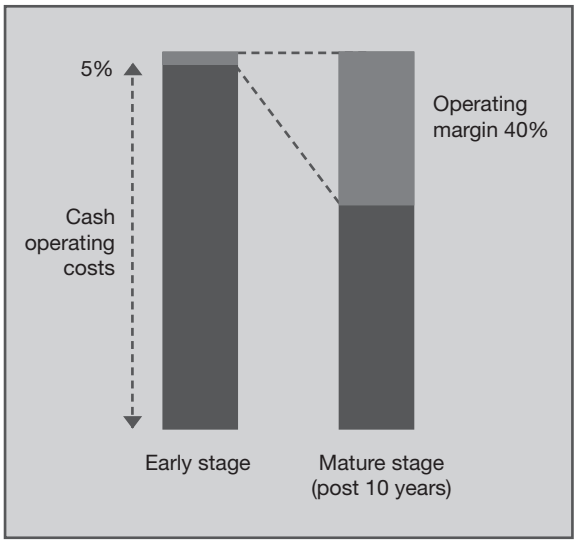
This section of the paper argues that patient capital is the most effective means of kick-starting sustainable commercial agriculture in Africa and delivering major benefits for smallholder farmers.

What is patient capital?

Patient capital is long-term capital made available by the international community on concessional terms. It is used to part-fund the capital costs of irrigation and related agriculture-supporting infrastructure.

The model proposed here is that irrigation related infrastructure assets would be financed and built by infrastructure service companies (ISCs). The ISCs would lease irrigation services

Figure 7: Cost structure of African agricultural producer – early and mature stages



Operating margin increases as transport, electricity and irrigation costs decline, as production grows and labour productivity improves. Source: Mozambique producer.

to small- and medium-sized farmers (Figure 8). The ISCs would fund themselves with senior debt, patient capital and ordinary share capital. Patient capital needs to be long-term, subordinated to senior debt and on concessional terms. Here, to illustrate the arguments, it is assumed to have a maximum term of 20 years and a coupon of six per cent nominal.

The ISC would provide irrigation services to a range of small and medium-sized commercial farms and smallholder farmers in a region. Therefore the fixed costs could be spread across a portfolio of users, reducing unit costs to any individual farmer, and diversifying the demand and payment risks. Funding the infrastructure assets via the ISC also reduces the funding requirement imposed on small and medium-size farmers and smallholder farmer organisations.[13]

The lease charges would be set at a level sufficient to recover the ISC's costs, including the cost of capital, over the full life of the assets. The benefit of the long tenor and concessional cost of patient capital would be passed on to farmers in lower lease charges than would otherwise be the case in the early years. The result will be lower production costs, and therefore higher farm profitability, in the early years. This should stimulate on-farm investment in commercial agriculture that otherwise would not take place.

Lease charges for commercial farmers would be profiled, rising to full cost-recovery levels over, say, 10 years. Smallholder farmers would benefit from heavily discounted lease charges, particularly in the early years.

Patient capital term sheet

The patient capital instrument could be in the form of either redeemable preference shares or subordinated loan stock. Figure 9 (opposite) sets out an illustrative patient capital term sheet, assuming for illustrative purposes that it is in the form of redeemable preference shares.

Issuer ISC

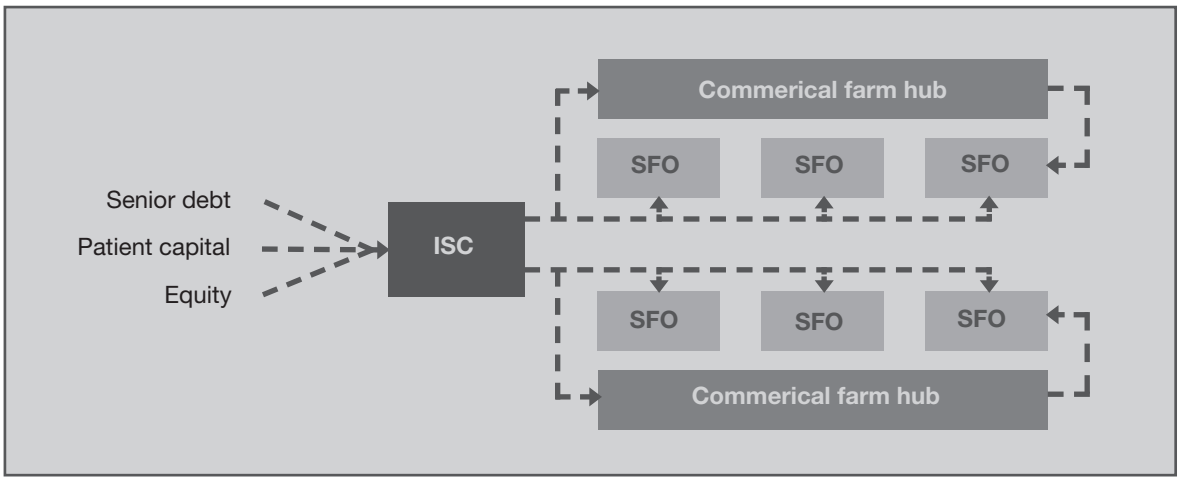
Use of proceeds To build irrigation assets and lease them to small- and medium-sized commercial farmers including smallholder farmer organisations.

Term The maximum term needs to be materially longer than the maximum term of the senior debt, and subordinated to it so that it can lever-in senior debt above patient capital in the ISC capital structure.

Amount of patient capital The amount of patient capital would be determined in each case as the smallest amount judged necessary to stimulate early stage investment in commercial agriculture. For any given tenor and coupon, the higher the ratio of patient capital to total capital employed, the lower the lease charges to farmers. There would be a maximum ratio of 50 per cent, but the ratio would generally be lower than this. Where the lessees are expected predominantly to be smallholder farmers, to keep lease charges affordable, the ratio might be as high as 50 per cent in certain cases.

Cost of capital The assumed six per cent nominal coupon represents a balance between a meaningful real (inflation-adjusted) cost of

Figure 8: Infrastructure service company – business and financing model



1. ISC leases irrigation services to commercial farm hubs and smallholder farmer organisations (SFOs)
2. Commercial farm hubs provide access to inputs and end-markets for SFOs
3. ISC funded with senior debt, patient capital and equity
4. Shareholding either private sector or public-private partnership (PPP)

Figure 9: Patient capital term sheet

Issuer:	ISC
Instrument:	Redeemable preference shares
Term:	Maximum 20 years (reflecting life of assets being financed)
Use of proceeds:	To part-finance agriculture-supporting infrastructure
Amount:	Determined case by case (maximum 50% of total capital employed by ISC)
Cost:	6% nominal, US$ or € denominated, [2-3 year] grace period
Redemption:	From year 10–20 (unless acceleration rights invoked)
Acceleration rights:	Rights to accelerate redemption if target revenues exceeded (subject to senior lenders' rights)
Ranking:	Subordinated to senior lenders
Security:	Subordinated claim (behind senior lenders) over all assets and cash flow of ISC including security provided by farmers/lessees
Events of default:	Agreed case by case
Upside sharing:	Sharing of upside if target revenues exceeded (either as additional yield or extra benefits for smallholder farmers)

capital and a significant concessional element, allowing for meaningful reductions in lease charges in the early years.

Repayment The redemption period should ideally commence after senior lenders have been fully repaid because this will increase senior lenders' willingness to lend to the ISC.

Acceleration rights In the event that lease income exceeds targets agreed when funding commitments were made, there could be provision for acceleration rights enabling patient capital providers to accelerate redemption when the patient capital is no longer needed. Such rights would need to be subordinated to those of senior lenders.

Security Patient capital investors would have a subordinated claim over the assets and cash flow of the ISC. The security package would also include any claims that the ISC has acquired over farmers' assets and cash flow. Securing the patient capital in this way will make the ISC and farmers fully aware of the adverse consequences of default and therefore minimise the moral hazard issues associated with capital made available on sub-commercial terms.

Risks The key risk facing patient capital investors is that lease income is insufficient to service and redeem the patient capital. There are two aspects to this: first, the risk that the demand for the services (and therefore lease income) turns out to be lower than expected. For example, because investments in irrigated commercial farming did not take place on the scale or within the timescale originally anticipated. This risk can be mitigated in part by linking the commitment of patient capital to parallel commitments to invest in related irrigated agriculture investments. Second, there is the risk that farmers default on lease payments, perhaps because crop yields prove to be disappointing. This risk can also be mitigated partially by giving the ISC a claim over the assets and output of the farmers/lessees.

Upside sharing Upside sharing provisions could apply if the ISC generates higher than target lease income, in which case it would share the upside with the providers of patient capital. This could either be in the form of additional financial payments, or by triggering commitments from the ISC to provide additional benefits for smallholder farmers. The lease agreements between the ISC and commercial farmers/lessees would include parallel provisions whereby the commercial farmers would pay fully cost reflective tariffs sooner than would otherwise be the case. The upside sharing provisions and the acceleration rights will help ensure that commercial farmers and shareholders in the ISC do not earn unintended windfall gains at the expense of patient capital providers.

Conditions precedent to commitment
Providers of patient capital are likely to have dual objectives – to catalyse sustainable commercial agriculture and to ensure major benefits accrue to smallholder farmers. The term sheet suggests that ISCs would have to commit to ensure that smallholder farmers had access to the newly created infrastructure assets on affordable terms. In addition they would commit to support improved access by smallholder farmers to inputs, storage and end-markets. Business plans and funding agreements would need to incorporate specific arrangements to give effect to these undertakings.

Alternative patient capital terms

The term sheet set out in Figure 9 is one approach. Alternative ways of structuring patient capital are available. For example, if patient capital providers preferred to 'frontload' the concessional element then the term of the patient capital could be shortened, if the ratio of patient capital to total capital employed were increased and/or the coupon further reduced. Another approach would be to require the ISC to use reasonable endeavours to refinance the liability in the commercial debt and/or equity markets once the senior debt has been repaid and to use the proceeds to redeem the patient capital. In this case, continuing grant funding may be required to keep irrigation service charges affordable for smallholder farmers following redemption.

Arguments in favour of patient capital

There are five arguments in favour of deploying patient capital in this way:

First, it helps to overcome the barriers to entry into commercial agriculture and to kick-start growth of sustainable commercial agriculture. Increasing access to affordable irrigation will bring about major improvements in crop yields and farmers' incomes. Returns on early-stage investment in agriculture improve and therefore greater investment in agriculture is stimulated.

Second, once commercial investment has been kick-started, agribusinesses along the whole length of the value chain are stimulated, therefore beginning the downward movement of all agribusinesses along the average cost curve that results from growth and learning by doing. Over time, incremental returns on new investment become fully commercial; no more patient capital is needed. The original patient capital investment can be redeemed and reinvested in new greenfield areas. Patient capital is a one-off heave over the barriers to entry.

Third, patient capital used to fund irrigation services via ISCs reduces the risks of entry into early-stage agriculture (hence reducing the cost of capital) and relieves the financing constraint faced by most small- and medium-sized farmers.

Fourth, patient capital deployed in this way induces high leverage of capital from commercial financial markets. First, there is the induced private investment in commercial agriculture that otherwise would not take place. Second, there is leverage of senior debt into the ISCs: without the subordinated, long-term patient capital the senior debt could not be raised. Third, there is the additional leverage that arises when patient capital is withdrawn, replaced with commercial debt and/or equity, and reinvested elsewhere in new greenfield ventures.

Fifth, patient capital would be deployed so as to ensure in every case that smallholder farmers and the rural communities in which they live are major beneficiaries. Patient capital would be a lever to bring about pro-poor agricultural development.

Arguments against patient capital

There are several arguments that may be made against deploying patient capital in this way:

First, some may argue that patient capital is a subsidy and a 'bad thing' because it will induce investment in unsustainable businesses. There are several responses. First, it is a standard result of micro-economics that, where there are economies of scale, the appropriate response is a one-off subsidy to overcome the barrier to entry.[14] This is just such a situation. Second, it is unlikely that unsustainable investments will be financed because the commitment to invest patient capital would be simultaneous with parallel commitments to invest risk capital by commercial investors, and they will only invest if they are satisfied that the proposition is profitable and sustainable.

Second, some may argue that businesses will always seek more patient capital than they really need (because it is cheap). The result could be to transfer rents to commercial investors at the expense of patient capital providers. This is a valid concern, but a number of safeguards to deal with it have been suggested. The upside sharing provisions would ensure that unplanned upside was shared with patient capital providers and/or smallholder farmers. The acceleration provisions would ensure that patient capital was withdrawn as soon as it was no longer needed.

Third, some may argue that patient capital will induce overuse of the subsidised input, namely, irrigation. This is implausible, to say the least, given that there are hardly any irrigation assets in Africa. In any event, the subsidy element of the patient capital is temporary, phased out over 10 years for commercial farmers.

Fourth, some may argue that it is better to give grants directly to smallholder farmers, rather than invest patient capital in this way. There are several responses to this argument. First, there is no leverage with grant funding. The number of smallholder farmers that can benefit from a US Dollar of grant funding is very much less than when there is financial leverage induced by

investment of patient capital. Second, all of the concerns raised above against patient capital have much greater force where support is given as grant funding. There is a greater likelihood of investing in unsustainable ventures and much higher risk of applicants seeking more grant funding than they really need. Third, the cost of providing irrigation services directly to smallholder farmers is very much greater than providing it via an ISC with access to patient capital. A given amount of grant funding used to 'buy down' the coupon on patient capital generates much larger benefits for smallholder farmers than the same amount of grant funding deployed into direct support programmes for smallholder farmers.

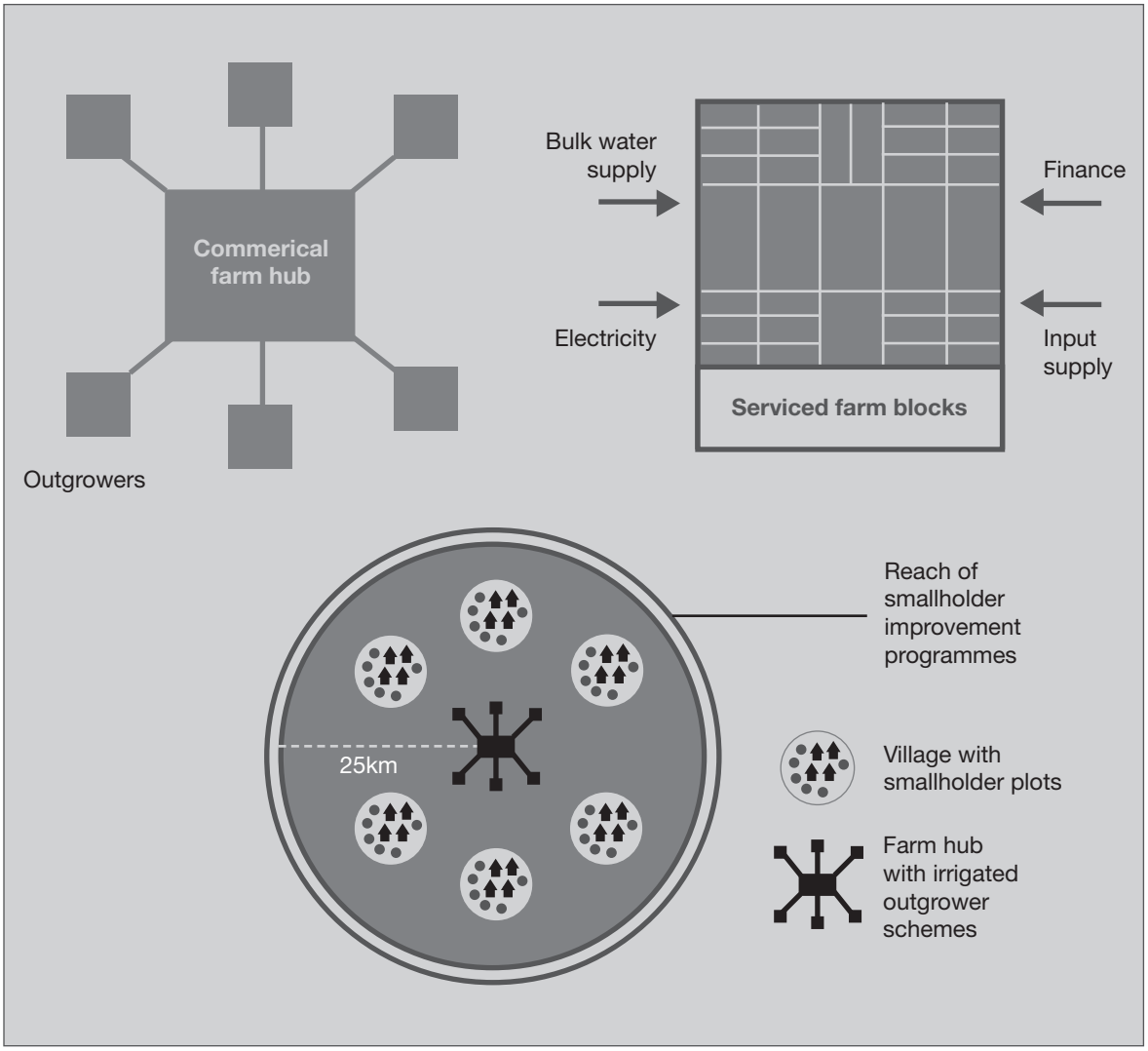
Finally, there is the argument that concessional funding should be focused exclusively on smallholder farmers, and not benefit medium-sized commercial farms. It is to this argument that we now turn.

How to ensure that smallholder farmers are major beneficiaries?

Central to the business model set out here is the concept of commercial farm hubs and structured linkages between each hub and smallholder farmers living in the area. Figure 10 illustrates the nature of the linkages between the ISC, the commercial farm hubs, smallholder farmer organisations close to the hub, and smallholder farmers further away from the hub.

Let us focus first on the commercial farm hub. The ISC leases irrigation services to the commercial farms and levies lease charges that initially benefit from the concessional terms of the patient capital but rise to full cost recovery levels over 10 years. The yield and value uplift, resulting from use of irrigation and modern farming practices, is sufficient to pay (via the lease charges) the full cost of installing and operating the infrastructure assets over their full

Figure 10: ISC – Commercial farm – smallholder farmer linkages



life. Therefore since the irrigation services are paid for in full by the commercial farm hub they can be made available to smallholder farmers at marginal cost. The cost of extending irrigation services to adjacent smallholder farmers is very much lower than the average cost of providing irrigation for the hub. So the high yield and value uplifts resulting from irrigation can also be enjoyed by adjacent smallholder farmers – and they do not have to pay much (if anything) for access to the irrigation services.

In addition to the benefit of cheap irrigation the smallholder farmers also benefit from improved access to cheaper agricultural inputs (improved seeds, cheaper fertiliser and crop management products etc) and post-harvest facilities and services (storage, processing, marketing, transport services etc).

As the distance between smallholder farmer communities and the commercial farm hub increases, so the cost of providing access to irrigation services located at the hub increases. Nevertheless, even those smallholder farmer communities more distant from the hub can enjoy the same benefits of improved access to inputs and markets as those living closer to the hub. The value uplift is not as great as when irrigation of smallholder plots can be provided, but it is still significant.

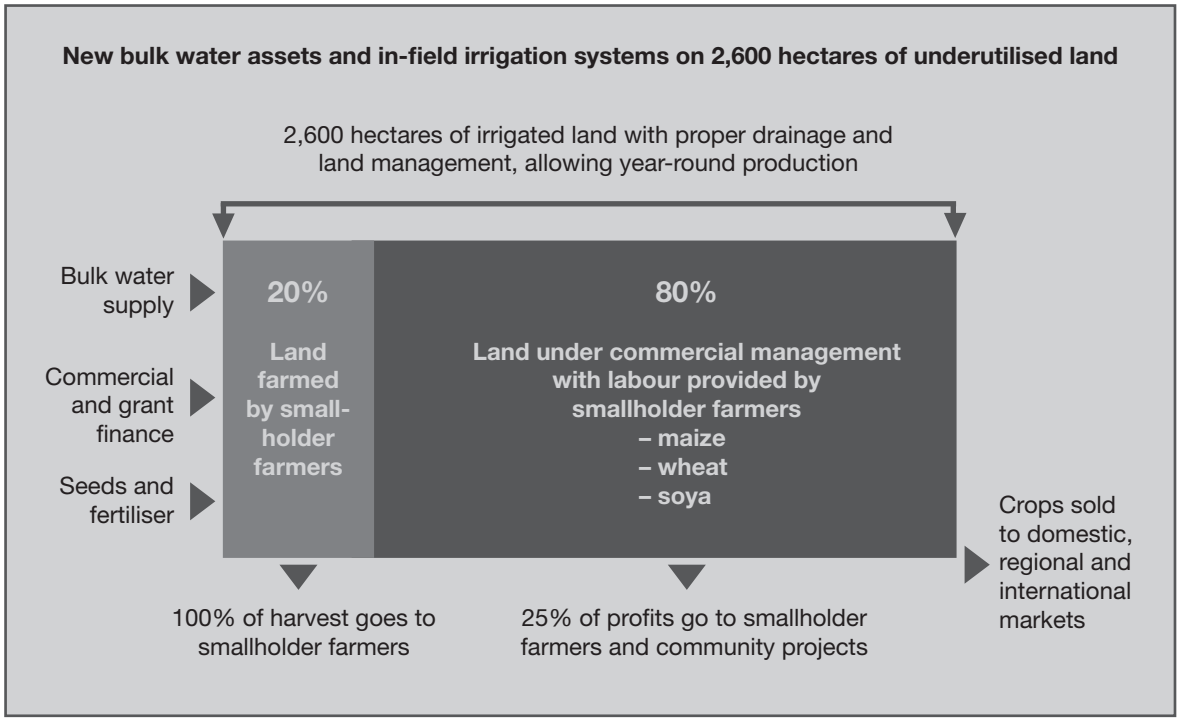
The Chiansi irrigation project: patient capital in action

The Chiansi irrigation project in Zambia, currently being developed by InfraCo, is an example of patient capital in action. The deployment of patient capital will facilitate large-scale development of irrigation assets on a basis that is both sustainable and will result in a more than tripling of smallholder farmer incomes. Figure 11 summarises the Chiansi model, which is described in detail in a separate paper.[15] Chiansi confirms the propositions set out here, namely, the need for patient capital to overcome barriers to entry; the sustainability of agriculture without any further patient capital over the medium term; and the large benefits accruing directly and indirectly to smallholder farmers.

Sourcing patient capital

Patient capital will need to be sourced from providers of concessional funds whose primary objective is transformational improvements in the productivity and incomes of smallholder farmers and their families. Potential providers include the international development agencies, bilateral donors, private foundations and social impact investors.

Figure 11: Chiansi irrigation project



Source: InfraCo.

Many of the opportunities that we have been identified as suitable for deployment of patient capital are relatively small-scale, less than US$50 million. The transaction costs involved in securing patient capital and complementary commercial debt and equity on a project-by-project basis are very high. There is a strong case for a patient capital fund that would channel patient capital to specific opportunities where it has been demonstrated that the investment will result in sustainable commercial agriculture and deliver major benefits for smallholder farmers.

Conclusions

Many parts of Africa have major agricultural potentiall; however, this remains largely unrealised. The major reason that there has been so little private investment in greenfield agriculture is the lack of sufficient profitable investment opportunities. Unit costs in the early stage of development are high and therefore margins and returns on capital employed are low.

However, none of the cost disadvantages that result in low profitability need be permanent. The cause of low profitability and high risk is the greenfield state of development. The agricultural platform available to international competitors – infrastructure, strong input and output supply chains, information and extension services, and agricultural credit facilities – simply does not exist in most of Africa. The solution is to overcome the barriers to entry and kick-start development so that the benefits of economies of scale and scope and 'learning by doing' can be realised, resulting in a sustainable, prosperous sector over time.

Patient capital is the most effective means of kick-starting sustainable commercial agriculture in Africa and delivering major benefits for smallholder farmers. It helps overcome the barriers to entry into commercial agriculture. It provides one-off support leaving a sustainable agribusiness sector that requires no further patient capital. It 'levers-in' large amounts of private capital into commercial farming and into infrastructure service provision. It is by far the most cost-effective way of providing major benefits for smallholder farmers and the rural communities in which they live.

Notes

1 Throughout this paper, unless otherwise expressly stated, references to Africa mean sub-Saharan Africa.

2 Source: World Bank (2008), *World Development Report 2008: Agriculture for Development*.

3 Source: ibid.

4 Source: ibid.

5 The main exceptions to this generalisation are the small number of large plantations producing, for example, sugar, bananas or palm oil, which are commercially viable without patient capital because they operate at scale and they are financeable because they have creditworthy sponsors.

6 Source: World Bank (2008), *World Development Report 2008: Agriculture for Development*.

7 See, for example, CAADP/AGRA publications.

8 Commodity prices are deflated to constant prices, ie excluding general price inflation. In 2008 the global commodity-price spike raised concerns that a structural shift in the supply/demand balance for food was taking place that would reverse the downward historic trend in food prices. There is uncertainty about future commodity-price trends. This uncertainty increases the risks associated with greenfield agricultural investment and causes lenders to take a prudent, ie pessimistic, view.

9 Moreover, minimum quality standards that must be met by African producers have risen to reflect consumer preferences and tighter regulatory requirements in importing countries. The higher costs involved in improving quality have generally not been compensated with a price premium.

10 Agricultural credit and loan-guarantee programmes are widely available in competitor countries.

11 According to the Capital Asset Pricing Model, expected returns increase linearly with higher risk for listed securities and mature businesses. However, there is much evidence to suggest that expected returns increase to very high levels, and availability of capital falls sharply, when investments are in early-stage start-ups.

12 There has been much debate about economies of scale in farming. There is some evidence that, given the same access to infrastructure, input services and markets, very small farms are less productive and have higher unit costs than large farms. But it is unquestionably the case that small farms cannot generate enough value to pay for the cost of installing infrastructure with its high fixed costs. Therefore small farms will be much less profitable than large farms in the early stage of development, even if they achieve the same yields per hectare, if they have to fund infrastructure themselves.

13 Inability by small- and medium-sized farmers to obtain credit is a major constraint on investment in early-stage agriculture. This is discussed at length in a separate paper: Palmer (forthcoming), *Financing early-stage agriculture in Africa*.

14 For example, Stiglitz and Drifill (2000), *Economics*, Norton.

15 Palmer (2010), *Chiansi irrigation: patient capital in action*, AgDevCo.

Appendix

Further evidence of the importance of economies of scale and learning by doing as key drivers of competitiveness in agricultural value chains

Economies of scale

Cullinane and Khanna, 'Economies of scale in large containerships: optimal size and geographic implications', *Journal of Transport Geography 7*, pp81-195.

'As expected… the benefits of scale economies while the ship is at sea follows the shape of a negative exponential curve, where marginal savings in unit costs reduce progressively with increasing ship size.' Figure 6a in this paper (page 9) is taken from Cullinane and Khanna. Planned dredging in the port of Beira will facilitate access by larger vessels resulting in a reduction in costs per mile of more than 50 per cent. However, realising these savings will require rapid growth of tonnage through the port to enable high load factors on the larger vessels.

Limao and Venables (2001), *Infrastructure, Geographical Disadvantage, Transport Costs and Trade*, LSE and Columbia University Working Paper.

'The paper presents results on the disadvantages faced by… African countries. Transport costs are relatively high… most of this poor performance is explained by poor infrastructure.'

Teravaninthorn and Raballand (2008), *Transport Prices and Costs in Africa*, World Bank.

'Transport prices for most African landlocked countries [are] three to four times more than in most developed countries.'

FAO (1995), *Economic engineering applied to the fishery industry*.

'Economies of scale are extremely important and cause the long-run average cost curve to decrease for the large production range. Examples are… farm machinery plants, some vegetable canneries, juice plants and fish canneries.'

Dismukes et al (1998), *Capacity and Economies of Scale in Electric Power Transmission*, Utilities Policy 7.

'We find strong economies [of scale] of all relevant ranges of capacity and across all regions of the USA.'

Filppini and Wild (2001), *Regional Differences in Electricity Distribution Costs and the Consequences for Yardstick Regulation of Access Prices*, Energy Economics.

'We find increasing returns to scale for the electricity distribution utilities in our sample. In addition there are significant economies of customer density and economies of output density. Average distribution costs fall the more densely populated the service area is, and the higher the average consumption per customer (ie the output density) is.'

Boussemart et al (2006), *Economies of Scale and Optimal Farm Size in the Estonian Dairy Sector*.

'This study of the Estonian dairy sector confirms that there are large economies of scale at very small-scale of farms but that economies of scale do not apply once minimum efficient scale of operations has been established.'

Kumbhakar (1993), 'Short Run Returns to Scale, Farm Size and Economic Efficiency', *Review of Economics and Statistics*, Volume 75, Number 2.

'By relating farm profitability to returns to scale, technical, allocative and scale efficiencies… of 89 Utah dairy farms… we find that small farmers as a group are less efficient relative to medium and large firms… and finally, returns to scale of the small farms are found to be greater than those of medium and large farms.'

Learning by doing

Goldemberg et al (2004), 'Ethanol learning curve – the Brazilian experience', *Biomass and Bioenergy 26*, pp301–304.

'The progress ratio of the technology is the variation of prices according to the cumulative sales. The lower the progress ratio, the more the drop in prices. In US Dollars, sugarcane ethanol produced in Brazil has shown progress ratios of 93% (1980–1985) and 71% (1985–2002).'

Junginger et al (2005), 'Technological learning and cost reductions in wood fuel supply chains in Sweden', *Biomass and Bioenergy 29*, pp399–418.

'The main cost reductions were achieved in forwarding and chipping of PFF, largely due to learning by doing, improved equipment and changes in organisation. The price for wood fuel chips follow an experience curve from 1975 to 2003... calculated at 87%.'

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