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TRACTOR BASED SERVICES AND RELATED SUPPORT POLICIES IN DEVELOPING COUNTRIES

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ABSTRACT Increasing agricultural production is of major concern to developing countries. It has been suggested that farm productivity is directly related to the farm power available which implies that significant increases in agricultural production can only be achieved through increasing power-based mechanization with two or four wheel tractors. To achieve such increases, the utilisation of existing agricultural machinery must be raised to economic levels by encouraging tractor owners to take a cross-sector approach and by providing tractor-based services to public/private sector enterprises in rural areas throughout the year. To realise this objective, it must first be ensured that a cross-sector market for tractor-based services exists and if so, to promote use of these services. This may be achieved through organising training workshops for tractor and machinery owners, creating service provider associations and establishing business linkage arrangements between tractor owners and rurally based enterprises. From the results of a market survey carried out in 1998 in three districts of Uganda, it was estimated that the annual demand for tractor services could be provided by about 97 tractors, so confirming the existence of a cross-sector market. Subsequently, a number of workshops for tractor owners were held which encouraged the start-up of a tractor-based service providers association. In addition, business linkage arrangements were identified in both the public and private sectors through the conduct of enterprise surveys. The significance of these findings demonstrates that cross-sector markets for tractor-based services exist in developing countries and that tractor owners and rural enterprises would be responsive to project initiatives. Guidelines for the development of tractor-based service providers were prepared on the basis of the field research undertaken and these are currently being updated by FAO. Field trials for the approach will take place in 2010.

Keywords: Tractors, tractor-based services, service provider, tractor hire, mechanization strategy, tractor ownership

INTRODUCTION The provision of tractor-based services is intrinsically linked to agricultural mechanization. Mechanization policies have been subject to much debate and have often centred on the economic feasibility and rationale of using tractors to increase agricultural productivity and overall production in developing countries. Unfortunately, some research papers indicated that this type of mechanization was uneconomic in Asia

(Binswanger, 1978) and in sub-Saharan Africa (Pingali, Bigot and Binswanger, 1987) and from the late 1980's onwards most western donor agencies stopped supporting projects related to tractor-based agricultural operations, especially in Africa. This also occurred at a time which coincided with the introduction of economic structural adjustment programmes where Governments in sub-Saharan Africa were required to reduce government spending including subsidies. However, contrary to popular belief there were also researchers, notably in India and the USA, who supported the view that "farm productivity is directly related to the amount of farm power available", thereby advocating that significant increases in agricultural production can only be achieved through support to mechanization development (Giles, 1967; Singh, 2009).

Consequently, two contrasting scenarios developed in Asia and sub-Saharan Africa. Government policy in Asia acknowledged that farm productivity was related to farm power and subsidised privately owned tractorisation. As a result, the number of tractors in the region increased from 139 000 in 1961 to 1.27 million in 1980 whereas in sub-Saharan Africa, the tractor population rose from 235 000 in 1961 to only 440 000 in 1980 and this mainly as a result of publicly owned tractor-based schemes (Mrema, Baker and Kahan, 2008; Ashburner and Kienzle, 2009).

Tractor mechanization in Asia in the 1960s and 70s accelerated due to increased demand for timely land preparation caused largely by the introduction of high yielding varieties of wheat and rice and the opportunities that arose for intensifying agricultural production, together with rising rural wage rates and costs of draft animals. The resulting introduction of tractors by farmers on the larger land holdings not only led to timely land preparation but also an expansion of the cultivated area and increased cropping intensity. However, Asian farmers also found that even with subsidised tractors, they could only economically justify tractor ownership by using their tractors' surplus capacity to undertake ploughing and transport for neighbouring farmers. But surprisingly, this part-time contracting proved so profitable that even small farmers could purchase tractors of various sizes and types including both single-axle and conventional tractors, to meet the demand for tractor-based services (Singh, 2009).

In contrast to this change in Asia, mechanization in Africa has stalled over the past three decades. The public sector tractor hire schemes of the 1960's and 70's were the focus of mechanization in many African countries, but proved ineffective and uneconomic at providing the needed services and were abandoned in the 1980's and 90's. In the wake of this abandonment and a general lack of interest in engine-powered farm machinery, donors turned to supporting intermediate forms of mechanization such as animal traction, hand tools and small tractor development (Ashburner and Kienzle, 2009). The development of small tractors was soon discontinued and the limited success of animal traction faltered due to disease, drought and deteriorating animal health services, leaving agricultural production largely reliant upon human power and hand tools (Mrema, Baker and Kahan, 2008).

Considering these trends and taking into account globalisation, population pressure, rural migration and the impact of HIV/AIDS on the available labour force in rural areas, there is now growing concern that sub-Saharan Africa cannot achieve the required agricultural sector growth and development that is needed to combat poverty by continuing mainly to

rely on human power and hand tools and on labour and energy intensive cultivation methods.

During structural adjustment and the demise of public sector tractor hire schemes in Africa, most tractors were sold off to the private sector. The rationale was to allow the private sector to step in and fill the vacuum, which they did to a limited extent. However, two decades on and tractor populations in sub-Saharan Africa have stagnated. The average annual utilisation rates for many of Africa's tractors are well below those for Asia and the majority of tractors are beyond their economic life and in poor mechanical condition. The inability of the private sector to increase tractor populations through the purchase of new tractors may be, among other factors, indicative of insufficient demand for tractor-based services to make tractor ownership economically viable and profitable.

With recent improvements in Africa's economic performance, many sub-Saharan African countries have focused on agricultural mechanization by seeking assistance from FAO to develop agricultural mechanization strategies. As a consequence of this resurgence in tractor-based mechanization and the availability of low cost tractors, a number of African governments have proceeded to purchase large quantities of tractors directly from manufacturers without having previously formulated a strategy to support their distribution, economic operation and maintenance. This is a worrying trend as it may lead governments to return again to the direct provision of tractor-based services. As already indicated, such public sector tractor hire schemes did not prove successful when previously introduced in the 1960s.

It is therefore necessary that governments, donors and tractor owners are made aware that private tractor ownership is economically viable and is able to meet a country's mechanization needs through the effective utilization of both existing and future tractor populations. However, the challenge is to demonstrate that an effective demand for tractor-based services exists and that economic rates of utilization and profitability are achievable. The question then arises as to whether an off-farm cross-sector market for tractor-based services actually exists in sub-Saharan Africa and how to identify tractor owners interested in providing these services, businesses willing to purchase such services and the support needed to encourage development of tractor-based service providers.

These questions formed the basis of a research proposal submitted to the UK Department for Agricultural Development (DFID) in 1997 and as a result, a research project was funded to investigate the development of tractor-based contractors. This was conducted under a DFID Knowledge and Research Programme, entitled "The Establishment of Small Scale Road Transport Contractors". The resulting guidelines from this research are currently being updated by FAO under a license agreement with the original authors. This paper is therefore based on the field work undertaken in Tanzania and Uganda during the investigation into the development of tractor-based contractors. The paper covers the rationale of a cross-sector approach, identifying a cross-sector market, promoting tractor-based services and in developing service providers and the required supporting policies and initiatives (Hancox and Petts, 1999).

1 TRACTOR-BASED SERVICES

1.1 The rational for taking a cross-sector approach The principal argument for encouraging the development of tractor-based service providers is the crucial role they can play in the development of rural areas as well as increasing agricultural production. Such an increase is dependant upon motivating farmers and only through incentives will they respond by bringing new areas into cultivation and farming more intensively. However, the majority of farmers rely on family labour for crop production using hand tool technology. Their productive capacity is then limited to efficiently and effectively farming less than two hectares and even with incentives they will be unable to increase their cultivated area or farm their existing holding more intensively without access to additional farm power.

These farmers need access to affordable, flexible power sources that offer minimum risk but enable them to respond quickly to production incentives by ensuring timeliness of planting. One such source is potentially available if more efficient use can be made of the private-sector tractor capacity that exists in the majority of developing countries. This could be done through the hiring of tractor-based services. This is still a relatively under-utilised approach but one which offers an enormous opportunity for enterprise diversification and business development for small private tractor owners.

The major issue facing developing countries is how to make tractor-based technology available to farming families in the rural areas. It is obvious that due to capital constraints, every farm household cannot own a tractor, but they do need to have access to tractor-based services. In the past, governments have introduced tractor hire schemes to achieve this but these have in most cases been abandoned as uneconomic. This leaves the private sector tractor owners to meet the demand and as they are predominantly practising farmers, they are able to use their tractor's surplus capacity to help neighbouring farmers.

However, the level of annual utilisation being achieved by these individual tractor owners is uneconomic, being typically less than 500 tractor hours per year. At these levels of utilisation, farmers cannot support tractor ownership and find themselves in a downward spiral of insufficient income to cover the costs of maintenance, repairs and replacement. Indeed, the business skills amongst most actors in the machinery chain are rarely well developed. The full costs of operating a machinery fleet are not always well understood by hire service enterprises and recapitalizing is jeopardized if fixed costs are not adequately covered. Transport costs on poorly maintained rural roads, large distances between clients and fragmented holdings all add to operating costs. Machinery operators and mechanics need constant in-service training to operate machines effectively and efficiently and to avoid expensive downtime and yet many countries do not have adequate technical training programmes (Sims and Kienzle, 2009).

The reason for low rates of tractor utilisation is a failure to achieve continuity of work throughout the year. This under-utilisation is caused by tractors being used mainly in small scale agriculture for primary cultivation and transport, which only provides a narrow window of opportunity for work during each cropping season. After this window closes the tractor remains idle until the next period of peak demand. This is particularly the case in areas where rain fed agriculture is practised and there is only one season –

such areas constitute a large part of Africa. To address this problem, tractor owners need to consider taking a cross-sector approach to provide tractor-based services throughout the year.

Fortunately the multi-tasking capability of the agricultural tractor provides tractor owners with a clear competitive advantage over owners of equipment with single role capability. Such versatility reduces risk because owners are not dependant upon a single business sector.

The promotion of tractor-based services across non-traditional industry sub-sectors will generate new opportunities to exploit the full potential of agricultural tractors. The limiting factor is the lack of awareness by tractor owners and rural based enterprises to the potential opportunities that exist. Furthermore, tractor owners must have the capacity to provide tractor based services to meet contractual requirements. For these reasons, governments will need to provide support to identify and exploit cross-sector market opportunities and to assist in developing the tractor owner's capacity to meet those opportunities.

1.2.1 Market Identification To identify cross-sector market opportunities during field research for the DFID project, the process began with a list of major industry groupings in the country and information on these groupings was obtained from government sources. Each group was broken down into their respective sub-groups, sectors and sub-sectors on the basis of their potential for using agricultural tractors. The major industrial groups that offered the most potential were agriculture, forestry, mining, quarrying, construction, transportation and the public sector such as roads and water departments. Once these groups and their associated sub-sectors had been identified, a process of market scanning was undertaken.

1.2.2 Market Scanning Scanning the agricultural sector began by consulting the Ministry of Agriculture to obtain an overview of the major crops being grown, including forestry production. Agriculture was the dominant industry group and those sub-sectors represented by contract farming were targeted because crops grown under contract will attract pre-crop finance. This enables small farmers to pay for tractor hire or enable contracting-out arrangements to be developed with the agribusinesses concerned.

Scanning the roads sector was divided according to road classification. The market for tractor-based services was related to labour-based roads which represented a huge potential, but surprisingly neither the road authorities nor the tractor owners were aware of this potential indicating that initiatives would be needed to actively promote this market.

Building and civil engineering associations were consulted to identify infrastructure projects and information on mining and quarrying was obtained from the Departments of mines and natural resources. Regarding road transport and manufacturing, local chambers of commerce provided the names of trade associations representing these sectors.

Once market scanning was completed, the resulting matrix identified the core industry groups broken down into sectors and sub-sectors, the public/private enterprises involved in each sub-sector, the regional distribution of sub-sector crops and tractor populations.

This table represented the available cross-sector market which was then analysed for actual and potential tractor demand.

1.2.3 Market Demand Analysis To determine actual and potential demand for tractor-based services in each of the identified market sub-sectors, it was necessary to target specific regions and districts. This was achieved by further analysis of those regions with the highest number of sub-sectors.

A questionnaire survey was first undertaken. With a specific region clearly defined, the private sector enterprises and government departments active in each sub-sector were then identified at the district level. The next step was to undertake a questionnaire survey to obtain information from public/private sector rural enterprises. Key questions asked were; type of tractor-based activities undertaken, minimum equipment requirements, contract work available, procedures for contractor selection and equipment inspection, contract rates and terms of payment.

The questionnaire was completed through personal visits to randomly selected enterprises. In those cases where an enterprise undertook all tractor-based activities in-house, the aim was to identify any activities which could eventually be contracted out if reliable tractor-based service providers were available.

The market demand for tractors was then calculated. Using the questionnaire data in conjunction with sub-sector analysis sheets, tractor demand was calculated by time period. These tractor demand figures were summarised to provide a total and seasonal demand on a monthly basis, for the tractors available in each district. The summary can be seen in Fig.1 which clearly identifies that a substantial cross-sector market existed for tractor based services throughout the year. This tractor demand profile represented the sum of the actual and potential market opportunities in each sub-sector which needed to be further defined in terms of their attractiveness to the tractor-based service provider.

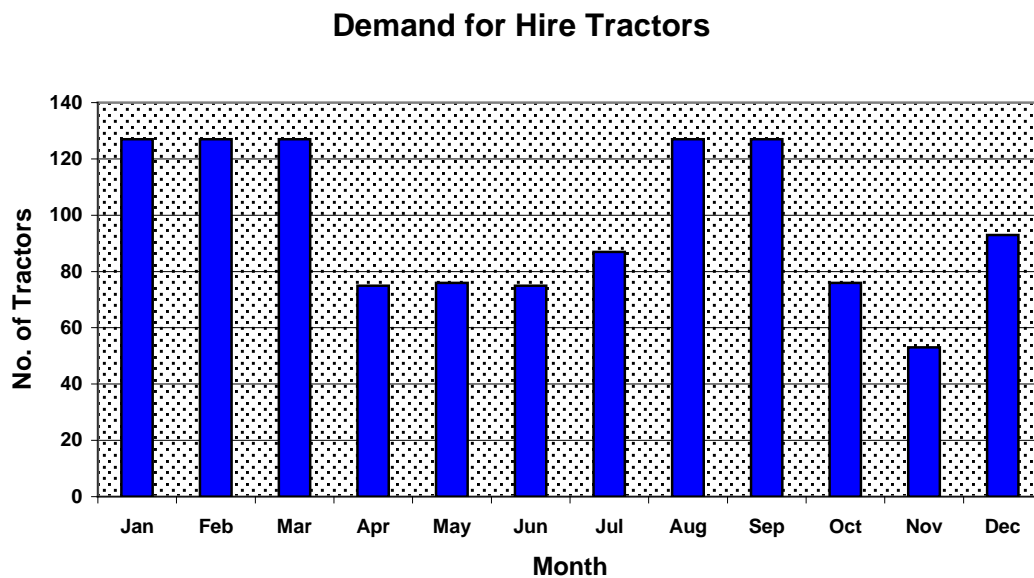


Figure 1. Demand for tractor-based services in three districts of Uganda

1.2.4 Analysis of Market Opportunities Each sub-sector was categorised by comparing its attractiveness to the service provider against the sub-sector's acceptance of contracting out. The results showed that the tractor-based services market was divided into two categories. The first represented those sub-sectors that had accepted contracting out as a commercially viable option and were attractive to the tractor-based service provider. The second represented those sub-sectors that had not yet accepted contracting out as a viable option but offered future potential for such an arrangement. These were the sub-sectors that would need to be developed further using a business linkage model.

1.3 Promoting tractor-based services

1.3.1 Creating Awareness The field research identified that many tractor owners and enterprise managers were unaware of the opportunities for using tractor-based services. Consequently, creating awareness in these two groups needed to concentrate on capacity building and market development. In building tractor owner capacity, this needed to be delivered through a tractor-based service providers association and market development through establishing business linkages with rural-based public/private sector enterprises.

1.3.2 Tractor-Based Service Providers Association The advantages in forming an association are the identification of a target population of tractor owners, the provision of a focus for project intervention and business contacts, the recognition of a sub-sector identity and the status of a corporate voice. The most effective way of forming an association is by first holding a series of tractor owner's workshops to encourage the start-up of a tractor-based service providers association. Once an embryo association has been formed, it needs to be developed through project assistance on a pilot project basis. A process of incremental development should be followed within the capacity of the association by first developing the association, then the demand side (business linkages) and finally the supply side (contractor capacity).

1.3.3 Business Linkage Development A business linkage is a cost-effective means of providing a mechanism to promote sustainable business relationships or linkages between large and small enterprises. A business linkage must be demand led and mutually beneficial to both large and small enterprises in order to be sustainable and to contribute to the rural development process.

The most common form of linkage arrangement is contracting out a tractor-based activity. The reason for choosing this method is because sub-contracting as a business linkage arrangement has expanded dramatically in the developing world on a purely commercial basis in other sectors with little or no assistance from governments or donors. This universal gravitation towards the use of business linkage arrangements to enhance commercial development highlights its potential as a rural development mechanism.

1.4 Developing Tractor-Based Service Providers

1.4.1 Identification of Tractor Owners Tractor owners are widely dispersed throughout the rural areas, making it difficult to make contact with them. Therefore it was necessary at the start of field investigations to organise sponsored workshops for tractor owners in selected areas. This ensured that a large target audience of tractor owners was identified to enable a database to be established. The completion of a questionnaire was an essential

pre-condition for participation in the workshops as from these questionnaires an accurate profile of the individual tractor owners could be established. The group activity of the workshops enabled the issues and problems affecting the provision of tractor-based services to be identified.

1.4.2 Marketing Problems Faced by Tractor Owners Tractor owners did not consider themselves to be tractor-based service providers and did not promote their activities. A cost-effective way of improving their collective access to market information was through a tractor-based service providers association. Such a grouping would provide a focal point for rural enterprises to register their contract requirements and enable the group to promote business linkages with interested rural businesses through inter-association networking.

1.4.3 Problems Faced in Providing Tractor-Based Services From the data collected through market scanning, the rural enterprise and tractor owner's questionnaires and the group workshops, a detailed picture emerged of the problems associated with providing tractor-based services. The key problems were related to attitudes, access to capital and the limited capacity to provide tractor-based services.

The average tractor owner's expectation of increasing income from providing tractor-based services was governed by three factors: the availability of reliable contract work, the possibility of his tractor to deal with an increased workload and the level of risk the owner was prepared to accept. The average tractor owner's propensity to take risks would only change when he could observe that reliable and profitable year-round contract work was available and that the low productivity (which is related to the age of the tractor) is the limiting factor to increasing his income. Therefore, if reliable year-round contract work was seen to be available, the average tractor owner would want to purchase a new tractor at the earliest opportunity thereby creating demand for new tractors and agricultural equipment.

However, the limited availability and high cost of finance are the main constraints preventing tractor replacement in the private sector and the resulting fleet of old and unreliable tractors is the main contributing factor to the low levels of utilisation and expectations that are currently experienced by tractor owners.

The limited capacity to provide tractor-based services is also related to poor business and financial management skills on the part of the service providers, which includes basic record keeping. Most owners fail to recognise the need for accountability or to measure the profitability of their tractor-based services. Unfortunately, there is also often a general unwillingness of Government at all levels to contract public sector work on infrastructure to private tractor owners.

2 SUPPORTING POLICIES, INITIATIVES AND OPPORTUNITIES

2.1 Government policy The Asian experience has shown the importance of encouraging and supporting farm mechanization through appropriate policies that address profitability of farming, land tenure and ownership issues. The experience has also shown the availability of agricultural machinery is essential for stimulating effective tractor demand and promoting the sustainable mechanization of agricultural production. Government

policies need to encourage the development of new supply chains with suppliers such as in India, China and Brazil. These are already established global players in the export of low cost unsophisticated sturdy agricultural machinery which is appropriate for African conditions. However, such a policy must also include the establishment of dealership networks to service the machinery being imported.

Structural adjustment provided the impetus for governments to place tractor hire services in the hands of the private sector, but poor agricultural performance over the years has restricted growth and investment in these services. Therefore, governments must be encouraged to use their agricultural mechanization policies as a vehicle to promote the development of private sector tractor-based service providers as a sustainable and cost-effective method of increasing tractor-based mechanization. In particular, those Government departments dealing with the development of rural infrastructure need to be encouraged to set up contracting systems which enable tractor owners to participate in the associated construction, repair and maintenance activities.

2.2 Banking and Financial Sector Initiatives In the past, governments have enhanced the supply of term finance through agricultural development banks and credit projects, but because of poor performance, most credit programmes have been phased out and agricultural development banks liquidated. The resulting gap in the funding available for term lending has not been filled and the availability of term finance for farmers remains limited (Hollinger, 2004). However, in recent years agricultural investment funds have experienced significant growth in number and volume. This is under-scoring the interest of both the public and private sector to help address the financial resource constraints for achieving food security and agricultural productivity growth (Miller et al., 2010)

The depressed state of agricultural bank lending and the disinterest shown by donors and governments has been a major constraint in financing tractor-based mechanization. Such investment requires large amounts of capital which is beyond the self-financing capacity of most farmers. An innovative approach is therefore a major requirement to finance tractors on reasonable terms and conditions.

Such an approach has been developed in Tanzania through a private sector initiative involving a commercial bank, a development company and a tractor dealership. This joint initiative has been set up to assist farmers to purchase tractors under more favourable banking terms than those being offered by the banking sector (Charles, 2009). This innovative tractor financing scheme is a major step forward and has proven to be a viable and sustainable model that can be replicated on a national or regional scale across Africa. The model also lends itself to being developed as a public/private/partnership (PPP) to include public and private capital and donor support to enable the financial sector to work with farmers, tractor dealerships and other stakeholders.

2.3 Roads Sector (local government and urban/district councils) Donors are actively encouraging the use of low-cost labour-based technology and the development of small-scale private sector labour-based contractors for the construction and maintenance of rural roads. A number of projects have already been implemented in Africa using labour for the principle activities but relying on agricultural tractors and trailers for material haulage, road compaction and road grading. These offer tractor owners substantial opportunities for providing tractor-based services in this sector. However, despite the

success of labour-based technology, the majority of governments are still reluctant to include such technology in their regular rural roads maintenance programmes. It would thus be beneficial if governments and donors could be made aware of the cost-effectiveness of using labour- and tractor-based technology in rural road maintenance and construction.

2.4 Agro-Industry sector initiatives There are two groups in this sector. The first of these undertakes all their activities in-house, thus leading to few opportunities for contracting out tractor-based services. However, these private sector businesses are becoming acutely aware of the need to increase efficiency in order to stay competitive in the face of global competition. Restructuring to achieve competitive advantage will force them to concentrate on their core business activities and look to contracting out non-core activities to stay competitive. This will provide opportunities for tractor-based services. Moreover there is also a general need for a policy environment which is conducive for broader development of agro-industries in which service providers could find the necessary enabling environment for their business (Da Silva et al., 2009).

The second group already undertakes contract farming, an arrangement which is becoming an increasingly important aspect of agribusiness as a means of organising commercial agriculture for both large- and small-scale farmers (Eaton and Shepherd, 2001). Further impetus for growth in contract farming is arising from the worldwide changes in consumption habits and the expansion of agri-business into both fresh and processed food products. This group shows great initiative by actively encouraging the provision of tractor-based services and is also responsive to the needs of tractor owners by providing loans to repair tractors and purchase fuel.

2.5 Donor Initiatives Donor initiatives supporting rural roads are referred to as rural transport projects and support a range of transport infrastructure improvements besides roads. The largest share of rural transport lending comes from multi-sector agricultural and rural development projects. Although the beneficial impact of rural roads on the performance of the agricultural and transport sectors is well known, the important role that agricultural tractors can play in the development of these sectors is less well understood. Accordingly, there is a need for developing initiatives to promote tractor-based services either through development programmes and/or by organizing training seminars using its guidelines and training materials.

Donors are also encouraging an integrated cross-sector approach to planning rural development by taking a sector-wide rural transport approach and encouraging the use of planning tools and international performance indicators. The formulation of integrated rural development policies and strategies covering transport, transport facilities, roads and agriculture, are pre-conditions for donor investment. Consequently, FAO is taking the initiative to ensure that countries are developing national mechanization strategies that address the use of tractor-based technologies on a commercial basis for rural development across all key sectors (transport, roads, and agriculture) and in this way also support the development of tractor-based service providers for commercial agriculture.

CONCLUSION The significant findings from the research into tractor-based service providers was the need to develop a model for increasing tractor utilization based on the concept of developing business linkages between the tractor owners and public/private sector businesses. The use of a common form of business linkage arrangement such as sub-contracting can allow a tractor owner firstly to diversify into providing tractor-based services to neighbouring farmers and then to consider specialisation into transport or road maintenance as his experience and confidence increases.

The key components for such a development model include identifying market opportunities, promoting tractor-based services through the development of business linkage arrangements, establishing a tractor-based service providers association and building tractor owner capacity to meet the needs of providing sustainable tractor-based services. Tractor owners will need training in marketing, accounting, financial, management and mechanical skills.

Tractor owners also operate within a business environment over which they have little or no control. This can have either a positive or negative effect on their development as is evident from the past Asian and African experiences. Therefore the need for an enabling environment to support and facilitate the emergence of tractor-based service providers is crucial for the cost-effective development of agricultural mechanization and rural development. Key requirements for such an environment include a profitable agricultural sector, access to tractor finance at reasonable cost and support for the development of tractor-based service providers.

The theme throughout this paper has been focused on increasing the effective utilization of existing mechanization service providers and future tractor owners in the private sector. For mechanization to be successful in sub-Saharan Africa there is a need to increase the effective annual utilization rates of the tractors. This is particularly the case in rainfed agriculture common throughout the sub-continent where the season for land preparation is quite short. The theme has followed a minimalist cross-sector approach based on the potential demand from both the public and private sectors for contracting out tractor-based services. As such, the paper calls for government and donor initiatives to support FAO in formulating a development project to undertake field trials of tractor-based services based on the FAO guidelines. Such a project would encourage private sector led mechanization, as a viable alternative to public sector tractor hire schemes.

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