

Challenges of animal traction research and development in West and Central Africa at the eve of the 21st Century

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Abstract

On the eve of the 21st century the continuous development of animal traction in West and Central Africa shows that the technology meets the needs of most farmers. Cultivated areas are generally between 2 and 12 ha. Such development was initially achieved jointly with the state-supported extension of the groundnut and cotton subsectors. In spite of the state disengagement in the development of the rural sector, animal traction has progressed over the years. The changes involved in the institutional and economic context have resulted in an increased number of development operators and higher responsibility for farmers and farmer's organizations. But outside the public domain, the viability of support services to agriculture including financing systems, veterinary follow-up and extension services remain questionable. The major concerns for farmers is how to buy draught animals and improve animal traction use, as animal teams are a power source for agricultural works and transport, an income as well as a manure source. Research and development challenges have changed as regards animal traction. Previously the objective of development structures was to introduce the technique in the farming systems. They provided farmers with the services and means they needed (credit, extension, and training). In response to their demand, research programmes aimed at developing equipment and technical standards. Now the research needs must transit by many operators that lack information and references to construct them. In fact, they are diffuse, difficult to evaluate and define. The biotechnological and system-based approaches used to understand them must be completed with socioeconomic sciences and research works must be conducted at different farms, ecology and socioeconomic context. The present research and development trends in animal traction are about adaptation, diversification and improvement of use, and improved methods of acquisition and management.

Introduction

In West and Central Africa, since the end of World War II, development and research projects on animal traction have been mainly technical. They have acted in support to development and distribution programmes of productivity agricultural models, elaborated by researchers, development and decision makers. Despite the important means mobilized by states, these models have not been adopted as such by farmers. This situation, combined with the major changes which occurred in the institutional context for the last years, has resulted in a distrust of technical research works such as the development and adaptation of farm equipment (for agricultural works and transport).

However animal traction has spread rather well in 40 years but to a different extent according to countries and agroecological areas. Farmers have had to address major problems of adaptation. We must recognize that in many regions, animal power is often used only for ploughing and the development of the technology seems to be "blocked" midway. This

situation suggests new research questions concerning methods of access to the technology, but also to its profitability and possible diversification of the use of draught animals.

This paper, after describing some conditions for adopting and using animal traction, analyzes the changes which have occurred in the relevant development and research challenges during the second half of the 20th century in sub-Saharan Africa. It leads to some important questions concerning the sustainable development of animal traction and proposes to renew methodological approaches.

Animal traction development in West and Central Africa

From a state-supported development to the state disengagement

Between the end of World War II and the middle of the 1980s, animal traction has strongly developed in semi-arid and sub-humid areas of West and Central Africa. This happened mainly through the

advancement of cotton and groundnut farming. During this period, the state played an omnipresent role in rural development of concerned countries through development agencies that monitored the sub-sectors from production to marketing. Important aspects concerned agricultural equipment and draught livestock with due regard to credit means, extension activities, manufacture and distribution (SEDAGRI, 1971; Bordet *et al.*, 1986; Binswanger and Donovan, 1988).

For about ten years, states have gradually disengaged from development, because of their financial difficulties and pressures exerted by the international financial community. In this context, we can note that animal traction continues to spread everywhere it had been introduced (Lhoste, 1995; Havard, 1997).

In the following French-speaking countries of Africa: Benin, Burkina-Faso, Cameroon, Ivory Coast, Guinea, Mali, Niger, Central African Republic, Senegal, Chad and Togo; estimates in 1995 were 2.2 million draught animals and 2.6 million equipment (ploughs, multipurpose cultivators, carts and seeders), i.e. an increase of about 43% and 41% respectively between 1985 and 1995. But, the development and distribution of animal traction differed across countries. Eighty per cent of equipment and animals are estimated to be in three countries: Senegal, Burkina-Faso and Mali.

In cotton-cropping areas of Cameroon, Burkina-Faso and Ivory Coast animal traction numbers doubled between 1985 and 1995. On the contrary, the progression was lower in three types of conditions: in countries where the adoption rate of animal traction was already high in 1985 (Senegal, Mali), in countries mainly situated in humid areas with little cattle breeding (Togo, Benin, Guinea); and in poor countries marked by political and military turmoil (Chad, Niger). The case of the Central African Republic was unique. Although animal traction use tripled between 1985 and 1995, numbers of draught animals remains the same as at the time of introduction, only 14,000 draught cattle.

In all these countries, small-sized family farms are prevalent (between 2 and 12 ha for 2 to 15 agricultural workers). The mixed farm breeding system is applied with grain crops, legumes, cotton, cattle and small ruminants. In general, farms using animal traction have the highest surface area, the greatest number of persons and the highest area.

Two hypotheses can be proposed to explain the continuous progression of animal traction after the state disengagement:

- On the one hand, it fits well to structures and to the financial capacities of farms in the countries concerned. It therefore remains, in this end of

the 20th century, a technology for the future in this region of the world;

- On the other hand, it has reached a distribution threshold important enough to allow the development of an uphill and downhill private sector of animal traction practitioners (tradesmen, manufacturers, veterinarians, credit organizations) who substitute the state.

Diversified adoption levels and ways of use

From introduction to spontaneous spreading of the technology

In an FAO study, Inns (1995), has shown that the adoption of a technical innovation passes by a succession of thresholds and stages (curve 'S'). This curve divides in four variable duration stages according to the case:

- development;
- distribution;
- adoption;
- maturity.

Applied to animal traction, development corresponds to the introduction of the technique (research, promotion); distribution corresponds to the slow beginning of the technology sustained by a strong extension action; adoption marks a rapid progression (improved users' know-how and technique) and maturity is characterized by a growth slowing in the equipment rate, after reaching a convenient level to satisfy the farmers' requirements in animal power. At this last stage, users try to diversify animal traction use and test improvements.

At each stage of adoption, the role and implication of state are not the same. During the first two stages, the state acts as a prime mover in the development of the technology in terms of research (agricultural mechanization, breeding), equipment financing (credits for tools and animals) and extension (technological teaching). In the last two stages, the state intervenes differently as regards research activities (human sciences, mechanization and breeding) and development (coordination of actions, follow up-evaluation and advice on innovation, training). It progressively disengages.

Each country, according to the needs of the agricultural sector, agricultural policies, and the development level presents a specific adoption trajectory. The groundnut basin in Senegal is shown as an example (Figure 1). The development stage of animal traction is shown for 11 French-speaking countries in sub-Saharan Africa (Table 1). Besides the diversity of adoption levels, there is a varied use of animal power according to agro-ecological zones, prevailing productions and agricultural policies.

Table I. Stages of development of animal traction in 11 French-speaking countries of sub-Saharan Africa

Stages	Stage I development	Stage II distribution	Stage adoption	Stage IV maturity
Equipment rate (% farms)	< 5%	5 à 20%	20 à 40%	60 à 90%
Countries	Central African Republic	Benin Togo Guinea	Cameroon, Ivory Coast Chad, Niger Burkina-Faso	Senegal Mali

Figure 1. Adoption stages of animal traction by farmers in the central area of Senegal between 1935 and 1995

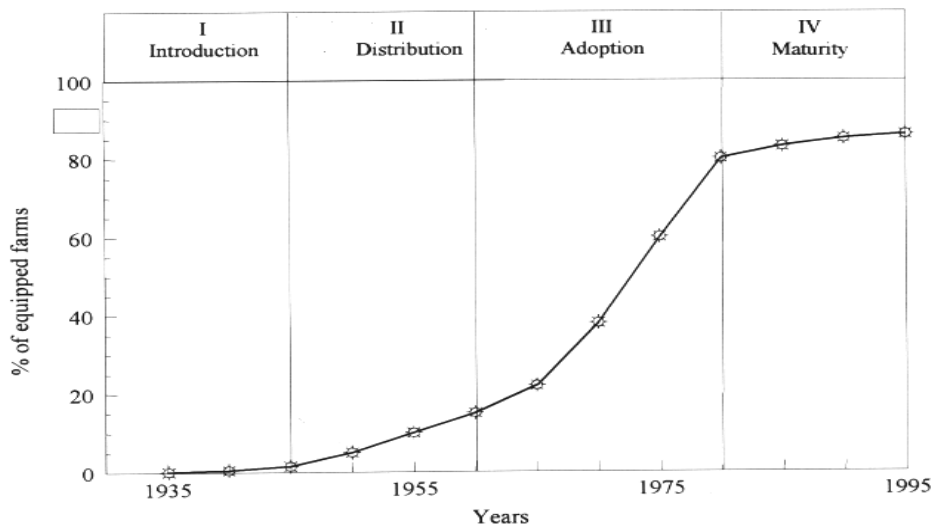
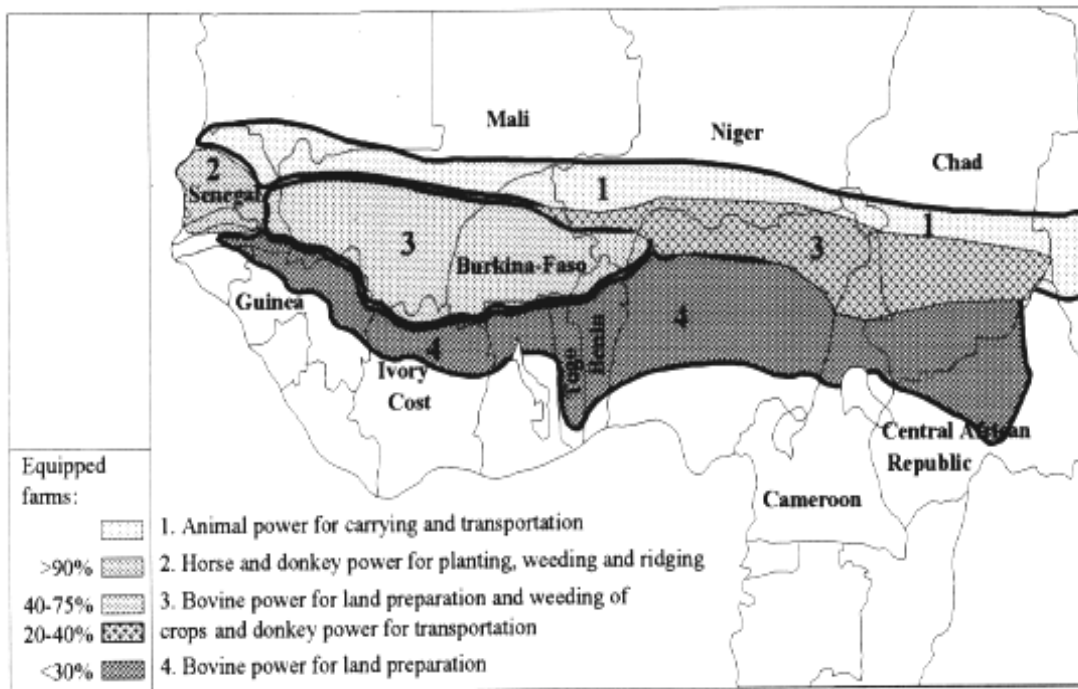


Figure 2. Main types of animal power use in French-speaking countries of sub-Saharan Africa



Source : Havard *et al.*, 1998

Four main types of animal power use

A chronological and comparative analysis undertaken on 11 French-speaking countries of sub-Saharan Africa has allowed to distinguish four main uses of animal power (Figure 2) (Havard *et. al.*, 1998).

Type 1 represents arid areas in these countries, where rainfed cropping is limited and animal power is used for transport and water lifting. Type 2 represents the groundnut basin in Senegal in the semi-arid area. Horses are used for seeding, weeding, groundnut lifting and transport. The totality of farms is equipped. Agricultural implements locally available are abundant, but the market is unstructured.

Type 3 is mainly situated in the semi-arid area, marked by the development of cattle traction for tillage in the cotton-growing areas (Senegal, Mali, Burkina-Faso, Far North of Cameroon, South Sahelian area of Chad) and the groundnut-growing area (Niger). Transportation with donkeys is widely used. In favorable conditions, the equipment rate of farms varies from 20 to 75%, and there are many manufacturers' workshops producing farm equipment.

Type 4 prevails in the sub-humid areas (cotton-growing areas in Benin, North-Cameroon, Ivory Coast, Guinea, Central African Republic, Chad, Togo). Animal traction is used only for ploughing, weeding and earthing up with cattle teams. Less than 30% farms use animal traction. The agricultural equipment available varies greatly according to the country (high number in Chad, limited number in Benin, non-existent in Central African Republic). In the humid area, trypanosomiasis reduces the breeding of draught animals.

Changes in research and development challenges

Development challenges: to take account of farmers' needs

In 40 years, there has been a flow from a normative development model that intended to introduce animal traction in farming systems, to an increased awareness of farmers' needs.

Today, the animal power and the breeding of draught animals are not completely mastered and are inadequately used (Vall, 1996). Adopting animal traction in farms has resulted in an increased work productivity, but rarely in an increased soil productivity, because farmers are more interested in speed than in better work (Gifford, 1985; Bordet *et. al.*, 1986; Pingali *et. al.*, 1987; Binswanger and Donovan, 1988; CRD N° 21, 1989; Lhoste, 1995; Le Thiec, 1996; Havard *et. al.*, 1998).

The introduction of the technology by development companies was often limited to a yoke for ox-ploughing and transport. A trend towards diversification can be seen at both levels of animal species, agricultural equipment and uses of animal power: animals (horses, single ox, draught cows, use of dromedary); equipment (weeding tools modification, horse-drawn carts, minimum tillage); and uses (contract-based ploughing, cart hiring). Henceforth, mechanized soil conditioning has relatively well spread and work peaks for farmers have changed towards other works (weeding, harvesting).

The progressive disappearance of public aid and agricultural financing systems (Wampfler, 1998), as well as the CFA frank devaluation in 1994, have led farmers to develop new strategies for buying draught animals. Credits to buy animals are increasingly rare. Credits for equipment are mainly guaranteed on a cash crop and act almost always on the principle of the interdependent caution. In some countries, as Burkina-Faso, savings and credit banks finance animal and equipment credits, with good results, but on relatively limited scales. Generally, farmers are increasingly facing difficulties to buy animals and agricultural equipment on credit. Therefore, they decide to purchase cheaper animal species (e.g. donkeys) and to obtain cheaper equipment, generally of poor quality.

Today, after the disengagement of development companies, we can observe the installation of a new uphill and downhill environment of animal traction and to an "atomization" of development functions that were formerly assumed by a reduced number of governmental structures. Users' demand is increasingly carried by farmers' organizations (Faure *et. al.*, 1996). The small-enterprise sector is taking over the farm equipment production. This production is not totally mastered and manufacturers face many problems of technical, management and organizational types. Artisans can manufacture acceptable-quality equipment and at a good price. It is on them that we must place the hope in a liberalized economy (Le Thiec and Havard, 1996; Doumezel and Primo, 1997). Private veterinarians are also upcoming.

Research challenges: to adapt to changes in demand

Between the end of World War II and the middle of 80s, research works in animal traction mainly intended to satisfy a now disappearing demand from development and extension structures. During this period, extension activities aimed at introducing animal traction in farming systems. The objective was to intensify the cultural practices, firstly for cash crops that guaranteed input and equipment credits,

but also for food crops (Pingali *et. al.*, 1987; Bigot and Raymond, 1991).

Research in animal traction was oriented on the development of agricultural equipment, draught animal breeding techniques and on the agro-economic comparison between manual and mechanized farming systems (Goe, 1983; MAT No. 91, 1985). Finally, during that period, research and development actions were very normative and took little account of farmers' demands. The concern was to introduce the technology. These last ten years, we must recognize that most of the research works in animal traction maintained the same orientation and did not accommodate the satisfaction of new farmers' needs nor those of the animal traction environment that appeared after the state disengaged.

Henceforth, the demand for research works must meet the approval of new actors. But it is diffuse, difficult to evaluate and define. These actors lack information and references (Figure 3). The agronomical research lacked an adaptive method and approach. In fact, biotechnological and system-based approaches are no longer convenient. It is also necessary to use the socioeconomic sciences on financing points and of support services to agriculture. Information exchanges (networks, seminaries, etc.) have granted an insufficient place for technological transfers between sub-Saharan countries of Africa; and it is now convenient to remedy such insufficiency through approaches of regional development.

Figure 3: Research challenges in animal traction: operators, approaches, actions

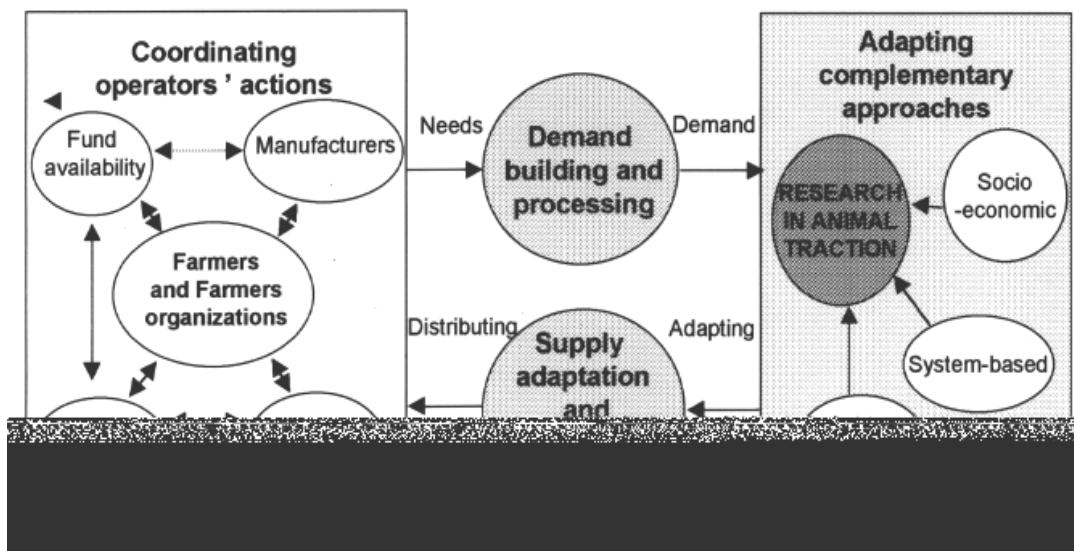
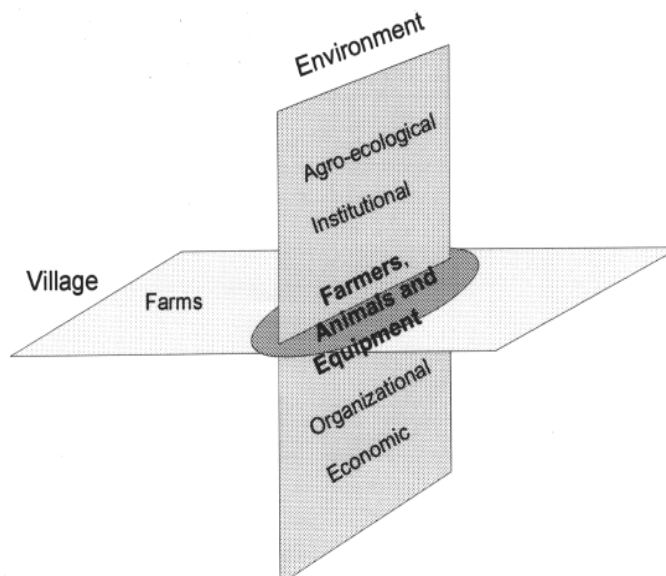


Figure 4: Scales of research interventions in animal traction



From challenges to research and development concerns

To answer the new research and development challenges, we formulate, in the form of questions, hypotheses of work and we propose to renew methodological approaches for the short and medium term.

News questions

The different challenges can be approached through two main questions:

- *How to satisfy in a sustainable way both the farmers' demand and needs in animal traction, and*
- *those of operators of the technological environment, in a liberalized context ?*

These general questions can be answered by noting several points:

1. Firstly, farmers increasingly face difficulties to acquire draught animals, because of the disappearance of the conventional financing systems. This leads to the following interrogations: is the profitability of agricultural activity sufficient to allow the investment in draught animals? Are animals and equipment prices too high for most of the farmers? Can the equipment and animals needed be easily found? Do the existing financing systems grant investment credits for animal traction, and to what conditions?
2. Secondly, farmers do not visualize enough their draught animals' potentialities, which leads to concern about their choice and needs in animal traction and to an in-depth analysis of their constraints. Do farmers master adequately the technology? Are extension tools and services appropriate? Are popularized equipment and techniques adapted (to a sustainable agriculture, to farmers' financial capacities?) Is the profitability of agricultural activity sufficient to justify the purchase of additional equipment?
3. Thirdly, private support services to agriculture face difficulties to develop themselves according to sectors. From which next interests arise: what are the emergence conditions of a private sector support to agriculture? What are the promising sectors for a private service? Which roles remain for the government?

Another pending issue is how to adapt research methods and tools to satisfy the users' demand by

associating animal traction environment operators (individual and collective).

Previously, two important constraints have had to be addressed. First, decision-makers had to be convinced that it is necessary to support research programs including the animal traction aspect, because many of them considered such an aspect to be useless and out of date.

In the second place, it seemed important to help the new development actors organize themselves, because they lacked an exchange and dialogue platform to collaborate on the definition of needs and on technological development challenges.

Emergence of a new methodological approach

To consider these questions, the methodology envisaged has to allow interventions at several scales and the use of a participatory approach, so as to propose products adapted to the different actors' needs (farmers, artisans, veterinarians, etc.).

Scales of intervention

Two scales seem appropriate to us (Figure 4):

- The village lands and the farms; where the work will be performed with groups of farmers using animal traction or desiring to acquire it;
- The agro-ecological, organizational and economic environment where works will be made with operators of the agro-equipment sector, financing systems and draught animals tradesmen.

The participatory approach

The whole method is based on a participatory approach. It will be implemented in two stages: analysis and investigation:

- to study farming practice and strategies of animal traction;
- to analyze the environment composition and dynamics of animal traction.

The second stage concerns adaptive research defined as a transfer and an adaptation of pre-existent techniques to satisfy local demand. The concern is how to address the demand, including elaborate modes of distribution of innovations to users.

Products adapted to the different actors

These research works have to lead to the development of biotechnological, socioeconomic and organizational innovations:

- biotechnological: on the breeding of draught animals, tool kit and technical itineraries, management of the animals career;
- on tools of agriculture financing and the agro-equipment sector;
- on organizational advice tools for farmers and operators.

The renewal of methodological approach and of research and development intervention modes has to allow:

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- to conduct development research operations in animal traction in accordance with institutional dynamics and regional development ;
- to establish a dialogue between rural development actors and research organizations.

To make it, these approaches have to take into account:

- i) the analysis of farm functioning and diversity ;
- ii) the characteristics and dynamics of the uphill and downhill environment of animal traction;
- iii) the changes in the institutional and economic environment.

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