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Abbreviations and acronyms

ACEMA	Association Euro-Africaine des Centres de Mécanisation Agricole, Cameroon and France	BRT	Bellerive Rural Technology, Switzerland
ACIAR	Australian Centre for International Agricultural Research, Australia	BTC	Botswana Technology Centre, Botswana
ACIAR-DAP	ACIAR Draught Animal Power Project, Townsville, Australia	CAMERTEC	Centre for Agricultural Mechanization and Rural Technology, Tanzania
ACREMA	Atelier de Construction et de Réparations de Matériel Agricole, Niger	CATMI	Camerounian Agricultural Tools Manufacturing Industry, Cameroon
ADMARC	Agricultural Development and Marketing Corporation, Malawi	CDARMA	Centre de Développement Artisanat Rural et Machinisme Agricole, Niger
ADP	Animal Draft Power Programme, Ministry of Agriculture, Zambia	CEEMA	Centre d'Etudes et d'Essais de Machinisme Agricole, Madagascar
ADPRDP	Animal Draft Power Research and Development Project, Magoye, Zambia	CEEMAT	Centre d'Etudes et d'Expérimentation du Machinisme Agricole Tropical, France
AETC	Agricultural Engineering Training Centre, Zimbabwe	CEMAG	Ceara Maquinas Agricolas S/A, Fortaleza, CE, Brazil
AFMA	Atelier de Fabrication de Matériel Agricole, Niger	CIAE	Central Institute of Agricultural Engineering, Bhopal, India
AFRC	Agriculture and Food Research Council, UK	CIMMYT	Centro Internacional de Mejoramiento de Maíz y Trigo, Mexico
AFRC-Engineering	AFRC Institute of Engineering Research (formerly NIAE), Silsoe, UK	CIPEA	Centre International pour l'Elevage en Afrique (ILCA), Ethiopia
AFVP	Association Française des Volontaires du Progrès, France	CMDT	Compagnie Malienne pour le Développement des Textiles, Mali
AGS	Agricultural Services Division of FAO, Italy	CNEA	Centre National d'Équipement Agricole, Burkina Faso
AIRIC	Agricultural Implement Research and Improvement Centre, Nazareth, Ethiopia	COBEMAG	Coopérative Béninoise de Matériel Agricole, Benin
AMRDU	Agricultural Machinery Research and Development Unit, Zambia	COMAG	Société Malgache des Constructions Métalliques et du Matériel Agricole, Madagascar
ARMA	Cellule de l'Artisanat Rural et Machinisme Agricole, Niger	CPATSA	Centro de Pesquisa Agropecuaria do Tropic Semi-Arido, Petrolina, Brazil
ARPON	Amélioration de la riziculture paysanne à l'Office du Niger, Mali	CTVM	Centre for Tropical Veterinary Medicine, Edinburgh, UK
AT	Appropriate Technology	cm	centimetre (unit of length)
ATIP	Agricultural Technology Improvement Project, Botswana	cu. ft	cubic foot (unit of volume, approximately equivalent to 28 litres)
BBF	Broad-bed and furrow (system of cultivation)	cv	cheval vapeur (horse power; unit of power approximately equivalent to 0.75 kW or 1 hp)
BDPA	Bureau pour le Développement de la Production Agricole, France	DAP	draft (or draught) animal power

Abbreviations and acronyms

DLG	Deutsche Landwirtschafts-Gesellschaft (German Agricultural Society), Frankfurt, Federal Republic of Germany)	IAE	Institute of Agricultural Engineering, Zimbabwe
DRSPR	Division de Recherches sur les Systèmes de Production Rurale, Mali	IAR	Institute of Agricultural Research, Ethiopia
d	day	ICRISAT	International Crops Research Institute for the Semi-Arid Tropics, India
dN	decanewton (unit of force approximately equivalent to 1 kg weight)	IEMVT	Institut d'Elevage et de Médecine Vétérinaire des Pays Tropicaux, France
E	English language publication	ITA	International Institute of Tropical Agriculture, Nigeria
E,F	Publication available in separate English and French editions	ILCA	International Livestock Centre for Africa, Ethiopia
E/F	Single publication, partly in English and partly in French	ILO	International Labour Organisation, Switzerland
EFSaip	Evaluation of Farming Systems and Agricultural Implements Project, Gaborone, Botswana	INRA	Institut National de la Recherche Agronomique, Settat, Morocco
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuaria, Brasilia, Brazil	IRRI	International Rice Research Institute, Manila, Philippines
ENDA	Environment and Development in the Third World, Senegal	ISC	ICRISAT Sahelian Centre, Niger
F	French language publication	ISRA	Institut Sénégalais de Recherches Agricoles, Senegal
FAO	Food and Agriculture Organization of the United Nations, Rome, Italy	IT	Intermediate Technology
FMDU	Farm Machinery Development Unit, Botswana	IT-Transport	Intermediate Technology Transport, UK
FRG	Federal Republic of Germany	ITDG	Intermediate Technology Development Group, UK
FSERT	Fédération suisse d'élevage de la race tachetée rouge, Switzerland	ITP	Intermediate Technology Publications, London
ft	foot (measurement approximately equivalent to 30 cm)	imp	imperial (system of weights and measures once widely used in Britain and elsewhere)
G	German language publication	J	joule (unit of work or energy)
GARD	Gambian Agricultural Research and Diversification Project, The Gambia	JMRDP	Jebel Marra Rural Development Project, Sudan
GATE	German Appropriate Technology Exchange, GTZ, Germany (FRG)	kg	kilogram
GOM	Geest Overseas Mechanisation Ltd, UK	kgf	kilogram force (unit of force approx. equivalent to 1kg weight or 10N)
GRDR	Groupe de recherche et de réalisations pour le développement rural dans le tiers monde, France	kJ	kilojoule (unit of work or energy)
GRET	Groupe de Recherche et d'Echanges Technologiques, France	km	kilometre
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit GmbH, Federal Republic of Germany	kN	kilonewton (unit of force approximately equivalent to 100 kg f)
g	gram (unit of mass)	kph	kilometres per hour
h	hour	LENCO	Lusaka Engineering Company, Zambia
ha	hectare	l	litre
hp	horsepower	lb	pound (unit of mass approximately equivalent to 0.45kg)
IAID	International Agricultural Development	lbf	pound force (unit of force approximately equivalent to 0.45kg weight)
		MIAC	MidAmerica International Agricultural Consortium, USA

MJ	megajoule (unit of energy or work)	SISMAR	Société Industrielle Sahélienne de Mécaniques, de Matériels Agricoles et de Représentations, Senegal
MoA	Ministry of Agriculture	SMECMA	Société Malienne d'Etude et de Construction de Matériel Agricole, Mali
M.Sc.	Master of Science, university degree	s, or sec	second
m	metre	TAMTU	Tanzania Agricultural Machinery Testing Unit, Tanzania
mm	millimetre	TIRDEP	Tanga Integrated Rural Development Programme, Tanzania
mph	miles per hour	TROPIC	Société camerounaise de métallurgie, Cameroon
N	newton (unit of force approximately equivalent to 0.1 kg weight)	TUB	Technische Universität Berlin, FRG
NGO	Non-governmental organization	t	tonne
NIAE	National Institute of Agricultural Engineering, UK	UCOMA	Unité Construction Matériel Agricole, Niger
Nm	newton metre (unit of work or energy equivalent to 1 joule)	UFI	Ubango Farm Implements, Tanzania
OAU	Organization of African Unity	UK	United Kingdom
OHV	Opération Haute Vallée, Mali	UN	United Nations
P	Portuguese language publication	UNDP	United Nations Development Programme, USA
PAFSAT	Project for Promotion of Adapted Farming Systems based on Animal Traction, Cameroon	UNIDO	United Nations Industrial Development Organization, Austria
Ph.D.	Doctor of Philosophy degree	UPROMA	Unité de Production de Matériel Agricole, Togo
PP	Projet Productivité, Niger	USA	United States of America
PROPTA	Projet pour la Promotion de la Traction Animale, Togo	USAID	United States Agency for International Development, USA
PVC	polyvinyl chloride (synthetic material)	USOA	Usine des Outillages Agricoles, Guinea
RIIC	Rural Industries Innovation Centre, Botswana	VITA	Volunteers in Technical Assistance, USA
RNAM	Regional Network for Agricultural Machinery, Los Baños, Philippines	W	watt (unit of power)
RTDU	Rural Technology Development Unit, Kenya	W.	West
r.p.m	revolutions per minute	WADA	Wum Area Development Authority, Cameroon
SADCC	Southern Africa Development Coordination Conference	WOP	Work Oxen Programme, Sierra Leone
SAFGRAD	OAU Semi-Arid Food Grain Research and Development, Burkina Faso	WSDC	Western Savannah Development Corporation, Sudan
SFMP	Small Farm Mechanization Programme, Nakuru, Kenya	WTC	wheeled toolcarrier
SFP	Small Farm Program (Tillers Small Farm Program, Michigan, USA)	yd	yard (unit of length approximately equivalent to 0.9 metre)
SISCOMA	Société Industrielle Sénégalaise de Constructions Mécaniques et de Matériels Agricoles, Senegal	ZZK	Zana za Kilimo, Mbeya, Tanzania
		"	inch ("pouce" in French) measurement unit equivalent to about 25mm

Glossary

Anglebar	a multipurpose toolbar designed by Project Equipment, UK	collar	part of a harnessing system; a padded O- or U-shaped device that fits around the neck of animal and rests around the "shoulders".
araire	ard plow (F).	coulter	knife- or disc-shaped attachment to a plow that cuts vertically into the soil and any vegetation immediately in front of plowshare.
Arara	a multipurpose toolbar manufactured in Benin, Niger, France (Société Arara) and elsewhere.	couplings	harnessing straps or ropes linking a pair of animals and preventing them moving apart.
ard	symmetrical plow without mouldboard, usually of traditional wooden design.	digger body	plow body with a short, upright mouldboard that breaks up the soil as it turns.
Ariana	multipurpose rectangular toolframe designed by Jean Nolle; intermediate between simple toolbar and wheeled toolcarrier.	dissel boom	long traction shaft of cart or pole-drawn implement.
attelage	team of animals (F).	duckfoot share	broad, triangular share (often about 150mm wide) set almost horizontally for cultivating or weeding.
BBF system	broadbed and furrow system of cultivation on large flat ridges.	dynamometer	instrument for measuring force.
blade	secondary cultivation implement	equine	relating to horses, donkeys and mules; sometimes used as collective noun for these species.
harrow	widely used in Asia; based on narrow horizontal blade (sweep) that passes through soil surface.	ergometer	instrument for measuring work (measures force and distance)
(bakhar)		evener	pieces of wood arranged at right angles to direction of movement between the harnessing traces and an implement; since the point of power offtake is not central, they can be used as levers to combine the efforts of two or more animals of dissimilar strength.
Bos indicus	a species of cattle, typified by presence of hump; includes most breeds from Asia and tropical Africa.	forecarriage	two wheels supporting the front of a plow; seldom used in Africa.
Bos taurus	a species of cattle, typified by absence of hump; including most "European" breeds.	forehead-yoke	an uncommon yoking system in which yoke is attached <i>in front</i> of the horns of an animal.
bovine	relating to cattle species; sometime used as a collective noun for these.	frog piece	shaped central element of mouldboard plow body, to which share, mouldboard, landside and beam are bolted.
breaking-plow	term sometimes used to refer to the stronger ard plows.		
breeching-strap	part of a harnessing system; a strap or cord that passes behind an animal, and prevents harness moving forward during braking.		
bridle	part of a harnessing system; straps or cords that pass around head of animal.		
broad-beds	large flat ridges		
bund	a ridge used to control water flow.		
butteuse	earthing-up ridger (F).		
Ciwara	a multipurpose toolbar manufactured in Mali, similar to Houe Sine.		

furrow-wheel	a second wheel, usually larger than the landwheel, used in some plows to provide additional stability.	landside	the part of a mouldboard plow body that runs in the furrow; it assists plow stability by reducing pitching and by offsetting the lateral forces associated with the asymmetrical inversion of the soil (to one side only).
hake	front part of plow to which draft chain may attach	manège	circular animal-powered device for driving stationary equipment [literally roundabout] (F).
halter	part of harnessing system; strap or rope tied around head of an animal to assist control.	maresha	local name for the ard commonly used for plowing in the Ethiopian highlands.
hame	rigid vertical bars on either side of an animal to which traces are attached; the hames are separated from the animal by a collar or pads.	metabolic energy	energy required or used to maintain normal cell or body functions.
harnais	harness (F).	monobeouf	single ox (F).
head yoke	yoke fixed behind the head of an animal, tied to the horns; synonymous with horn yoke.	mote	type of water raising system
heel	rear end of the landside of a plow, that assists stability and pitch control; a wearing part that may be detachable and replaceable.	mouldboard	shaped piece of metal or wood designed to divert soil to one side of a share.
houe	cultivator or weeder (F); some multipurpose toolbars were developed primarily as cultivators.	mouldboard plow	plow with a mouldboard fitted; the design is asymmetrical, as soil is diverted to one side only.
Houe-Occidentale	a design of small cultivator and multipurpose toolbar that can be used with donkeys and horses; manufactured and used in West Africa.	N'Dama	breed of small, humpless cattle found in West Africa; relatively tolerant of the disease trypanosomiasis.
Houe-Saloum	a design of multipurpose toolframe, that preceded the Ariana.	neck yoke	a confused term that should be dropped since some authors have used it to refer to head/horn yokes and others to refer to withers yokes.
Houe-Sine	a design of multipurpose toolbar designed by Jean Nolle; widely used and manufactured in West Africa.	newton	unit of force, approximately equivalent to 0.1 kg weight
Houe-Manga	a design of small cultivator/weeder with adjustable width settings manufactured in West Africa that can be used with single donkeys.	Nikart	a design of wheeled toolcarrier, developed by ICRISAT and AFRC--Engineering.
horn yoke	yoke fixed behind the head of an animal, tied to the horns; synonymous with head yoke.	nominal size	yoking term; the distance between [the centres of] two yoked animals.
horsepower	unit of power, approximately equivalent to 0.75 kW.	Pecotool	design of multipurpose toolbar manufactured on small scale in Sierra Leone and Tanzania.
joug	yoke (F).	pitching	the rotation of a body in a vertical plane parallel to the direction of forward movement; "up and down" movement of an implement.
joug de corne	horn or head yoke (F).	Policultor 300	design of multipurpose toolbar manufactured in Brazil; based on Houe Sine.
joug de garrot	withers yokes (F).	Polyculteur	wheeled toolcarrier (F); specific designs of wheeled toolcarrier developed in Senegal in the 1950s and 1960s.
joug de nuque	horn or head yoke [literally neck yoke] (F).	pouce	inch (F).
joug de tête	horn or head yoke (F).	power	the <i>rate</i> of doing work.
joug frontal	forehead yoke (F).		
Kanol	a design of multipurpose toolbar developed by Jean Nolle that uses a		

puddler	implement for breaking up and mixing (puddling) the top soil of a flooded rice ("paddy") field.	swingle tree	horizontal bar to which harnessing traces attach; the bar keeps the traces separated, and transmits the force to an evener or implement.
rayonneur	row marker (F).	taurine	<i>Bos taurus</i> type of cattle, including "European" breeds and some West African humpless breeds such as the N'Dama.
ripper	strong tine used to break up heavy soil.	three pad collar	type of harnessing system using two shoulder pads attached to rigid hames and a top withers pad.
rolling	the rotation of a body in a vertical plane at right angles to the direction of forward movement; the "tipping over" movement of an implement.	tines	the soil-contacting descending bars of a cultivator or teeth of a harrow.
saddle	part of a harness lying over the back of an animal that supports a back load or strap.	traces	the traction ropes, straps or chains that pass either side of an animal and transmit the force from animal to implement.
Sahel	semi-arid zone to the south of the Sahara Desert.	Triangle	a design of multipurpose cultivator/weeder used in Burkina Faso and Togo.
sakia	traditional animal-powered water-raising device used in Egypt.	Tropicultor	one of Jean Nolle's designs of wheeled toolbar, further developed by ICRISAT.
scratch plow	a term sometimes applied to an ard plow.	turn-wrest plow	reversible mouldboard plow
semi-digger	plow body with a fairly short and upright mouldboard that tends to break up the soil as it turns.	Unibar	a prototype design of multipurpose toolbar developed by Project Equipment, UK, in the 1960s.
semi-helicoidal	mouldboard shape that produces a more gradual soil inversion than a semi-digger.	vertisol	heavy black soil, "black cotton soil".
Senegambia	the combined territories of Senegal and The Gambia.	wheeled toolbar	multipurpose implement based on a transverse toolbar supported by two wheels; the toolbar accepts a variety of implements including (in many cases) a cart body.
share	the wearing blade of a plow or similar implement.	whippetree	swingle tree; horizontal bar to which harnessing traces attach; the bar keeps the traces separated, and transmits the force to an evener or implement.
shoulder yoke	yoke resting on the "withers" of an animal above the shoulders.	withers	that part of the back of an animal that is over the shoulders and directly above the first thoracic vertebrae.
skeis	a term used in southern Africa for the vertical wooden pegs that form part of a yoke.	yawing	the rotation of a moving body in a horizontal plane; the "side to side" deflection of an implement moving forward.
skid	a supporting part of an implement designed to pass easily over the ground surface; an alternative to a wheel, which may be made of wood or curved steel.	yoke	strong bar, usually made of wood, which an animal can push against in order to pull an implement.
Super Eco	a design of seeder manufactured in Senegal and quite widely used in West Africa.	zebu	type of <i>Bos indicus</i> humped cattle.
Strad	an over-the-row weeder, designed for ridge cultivation in Nigeria, with two or more gangs of rotating tines.		
strops	term used in southern Africa for leather harnessing thongs.		
swing plow	mouldboard plow design without a furrow wheel or skid to support the beam.		

Note: (F) indicates a French word.

Addresses of some organizations cited

The following annotated address list contains the names and addresses of some of the "resource" organizations cited, some of the projects mentioned in the previous chapters and some of the manufacturers of animal traction implements in Africa. The mention of manufacturers here does not constitute an endorsement of any products. While the information is provided in good faith, changes are rapid in this field and the accuracy of the addresses and descriptions cannot be guaranteed. Further details of organizations in Africa, are to be found in the GATE Animal Traction Directory: Africa.

Australia

ACIAR-Draught Animal Power Project,
Graduate School of Tropical Veterinary Science,
James Cook University, Townsville 4811,
Queensland, Australia Telex 47009 UNITOWN AA

The Coordination Unit of the ACIAR-supported Draught Animal Power Project is based at James Cook University. Research topics include the nutrition of working buffaloes and small numbers of fistulated buffaloes have been trained for work. Other areas of research interest include health and reproduction and farming systems research relating to animal traction. The DAP Project liaises with draft animal programmes in several southeast Asian countries, and has particularly strong links with research programmes in Indonesia. It publishes the DAP Project Bulletin twice a year. It assisted the convening of the second ACIAR international workshop on draft animal power in Indonesia in 1989.

Austria

United Nations Industrial Development
Organization (**UNIDO**),
Vienna International Centre, P.O. Box 300,
A-1400 Vienna, Austria Telex: 135612

UNIDO is a UN agency with particular interest in developing local industries, including the manufacture of animal traction equipment at factory, workshop and village blacksmith level. It has supported networking in Asia (RNAM) and Southern Africa (SADCC countries). It has published directories of organizations concerned with the development and production of agricultural implements.

Belgium

Commission of the European Communities
(**EC, EDF, FED**), 200 rue de la Loi,
B-1049 Brussels, Belgium Telex: 21877 COMEU B

The European Community finances a large number of rural development projects in Africa, and elsewhere, many of which have draft animal components.

Benin

Coopérative Béninoise de Matériel Agricole
(**COBEMAG**), B.P. 161, Parakou, Benin

The parastatal COBEMAG, established with UNDP support, is the major manufacturer of animal-drawn equipment in Benin. Organized as a cooperative, it delegates much of its fabrication work to blacksmiths in different villages. In recent years it has received technical support from FAO, but lack of capital to purchase raw materials has restricted the production runs of the main items, Arara multipurpose toolbars and ox-carts.

Botswana

Farm Machinery Development Unit,
Sebele Agricultural Research Station,
Private Bag 0033, Gaborone, Botswana
Telex: 2752 SACAR BD

The Farm Machinery Development Unit (FMDU) and the earlier EFSAIP have tested and developed animal traction equipment. Several wheeled toolcarrier designs were evaluated during the period 1971-1983, but none was found appropriate for small-farm conditions. Tine-tillage techniques were tested for several years but it was concluded that deep mouldboard plowing and rapid planting were most appropriate. Therefore a com-

bined plow-planter, comprising a simple seeder attached to a conventional plow, was developed and is being promoted.

Agricultural Technology Improvement Project (ATIP), Department of Agricultural Research, Private Bag 0033, Gaborone, Botswana

Farming systems research project, supported by USAID, that includes work on cultivation strategies using draft animals and supplemental feeding.

Rural Industries Innovation Centre (RIIC), Private Bag 11, Kanye, Botswana Telex: 2435 BD

RIIC is an appropriate technology organization and part of Rural Industries Promotions, a non-profit development organization supported by government grants and aid agencies. Work includes blacksmith training and small-scale equipment research, development and manufacture. It has developed first and second generation prototypes of donkey-powered water pumps. It manufactures small numbers of seeders and plow-planters, and has been cooperating with a network of several small workshops in developing the production of these implements in several parts of the country.

Southern African Centre for Cooperation in Agricultural Research (SACCAR), Private Bag 00108, Gaborone, Botswana

Telex: 2752 SACAR BD

SACCAR facilitates liaison in agricultural research within the nine member states of SADCC. Animal traction is one of SACCAR's areas of interest. It sponsored a regional workshop on animal traction in 1987.

Brazil

CEMAG Ceara Maquinas Agricolas S/A, Av. Gaudioso de Carvalho, 217 Bairro Jardim Iracema, C.P. D79 CEP 60000, Fortaleza, CE, Brazil.

Telex: (085) 1533 CMGL BR

Manufacturer of agricultural equipment including a range of animal-drawn multipurpose toolbars and wheeled toolcarriers based on Jean Nolle's designs.

Empresa Brasileira de Pesquisa Agropecuaria (EMBRAPA), C.P. 04-0315, Brasilia-DF, Brazil
Centro de Pesquisa Agropecuaria do Tropic Semi-arido (CPATSA), CP 23, Petrolina, Pernambuco, Brazil

EMBRAPA is the national agricultural research organization of Brazil responsible for numerous specialized centres and research stations. CPATSA

is a regional research unit specializing in the semi-arid parts of the country where there is most potential for draft animals. Research with animal traction has included the development of wheeled toolcarriers, ridge-tying implements and injection seeders.

Burkina Faso

Centre Nationale d'Equipement Agricole (CNEA), B.P. 7240, Ouagadougou, Burkina Faso

Manufacturer of animal traction equipment. Its network of two large and nine small workshops in several parts of the country has been reduced for financial and logistical reasons. Main products are simple plows and triangular cultivators, often still known by the previous acronym ARCOMA.

SAFGRAD, B.P. 1783, Ouagadougou, Burkina Faso Telex: 5381 SAFGRAD BF

The Semi-Arid Food Grain Research and Development (SAFGRAD) programme of the Organization of African Unity has a farming systems research team and has been working with animal traction in Burkina Faso. It has developed, in cooperation with IITA, a prototype animal-drawn ridge tying implement. SAFGRAD acts as host organization to a number of research networks in Africa, including the West African Farming Systems Research Network (WAFSRN/RESPAO). In 1989 SAFGRAD offered to act as host to the secretariat of the West Africa Animal Traction Network.

Cameroon

PAFSAT (Project for Promotion of Adapted Farming Systems based on Animal Traction in the N. W. Province of Cameroon), Northwest Development Authority (MIDENDO), B.P. 558, Bamenda, Cameroon

Animal traction project that has been working on farming systems development involving animal traction. Emphasis has been placed on contour farming, and women's groups have been encouraged to adopt animal traction. Activities have included farmer training, equipment evaluation and the development of an animal-drawn knife roller to clear small farms.

TROPIC, Société camerounaise de metallurgie, B.P. 706, Douala, Cameroon Telex: 5316 KN

Manufacturer of a range of animal traction equipment including mouldboard plows, multipurpose toolbars and carts.

Camerounian Agricultural Tools Manufacturing Industry (CATMI), Bamenda, Cameroon

Small manufacturer of implements including plows and prototype weeder rollers.

Ethiopia

Institute of Agricultural Research (IAR),
P.O. Box 2003, Addis Ababa, Ethiopia

IAR has many programmes and cooperating sub-centres and its work includes several collaborative animal traction research programmes with ILCA. The Agricultural Engineering Department has been carrying out research relating to animal traction for ten years and current topics of research include the evaluation and development of implements for secondary tillage, land levelling, and seeding. IAR has an Agricultural Implement Research and Improvement Centre at Nazareth, which receives technical support from FAO.

International Livestock Centre for Africa (ILCA),
P.O. Box 5689, Addis Ababa, Ethiopia

Telex: 976-21207 ILCA

ILCA is an international research centre, with its headquarters in Ethiopia. ILCA has a very strong interest in draft animals and has a specific animal traction research "thrust". Studies on draft animal nutrition, equipment and systems of utilization have been carried out in Ethiopia, Niger, Nigeria and Mali. ILCA's library contains numerous documents relating to draft animals which have been listed in its animal traction bibliographies and bibliographic databases. ILCA's information department may assist research scientists in Africa to obtain photocopies or microfiches of relevant documents. ILCA coordinates an Animal Traction Research Network which aims to stimulate collaboration between different national and international research programmes. The network started publishing a newsletter in 1988. ILCA has produced several publications relating to animal traction.

France

Centre de Recherches CIRAD,
Avenue du Val de Montferriand,
B.P. 5035-34032, Montpellier Cedex, France

The agricultural research organization CIRAD (Centre de Coopération Internationale en Recherche Agronomique pour le Développement) has several institutes working on animal traction topics. Its main "Agropolis" campus is in Montpellier, and most CIRAD organizations including Institut de Recherches Agronomiques Tropicales (IRAT) and CEEMAT will be based there in the future. The CIRAD has hosted several seminars relating to animal traction and its Service de Do-

cumentation has produced three animal traction bibliographies in conjunction with CTA and other CIRAD organizations (CEEMAT, IRAT, IEMVT).

Centre d'Etudes et d'Expérimentation du
Machinisme Agricole Tropical (CEEMAT),
Parc de Tourvoie, 92160 Antony, France

Telex: 201296 CEEMAT F

CEEMAT is an agricultural engineering research and training institute sponsored by the French government through CIRAD. CEEMAT has long been associated with the development of animal traction, most notably in francophone Africa, but also in several countries in Asia and Latin America. Work includes the design and testing of alternatives to mouldboard plows including animal-drawn tines and rolling cultivators, economic studies, an animal traction bibliography and guidelines for rural workshops. It produces the quarterly journal *Machinisme Agricole Tropical*. CEEMAT also provides the European Secretariat for the agricultural engineering network ACEMA (Association Euro-Africaine des Centres de Mécanisation Agricole). The African Secretariat of ACEMA is based in CENEEMA in Cameroun.

Institut d'Elevage et de Médecine Vétérinaire des
Pays Tropicaux (IEMVT), 10 rue Pierre-Curie,
94704 Maisons-Alfort Cedex, France

Telex: 262017 IEMVT F

IEMVT is a veterinary and animal production institution financed by the French government through CIRAD. IEMVT has undertaken studies relating to draft animals in several francophone countries.

Groupe de Recherche et d'Echanges
Technologiques (GRET), 213 rue La Fayette,
75010 Paris, France

Telex: 212890 F

GRET is a centre for information exchange relating to research and development on appropriate technologies, including animal traction. GRET has many network contacts in France and developing countries, and it publishes a networking newsletter *Recherche et Développement*. It has a documentation centre and produces books and technical pamphlets, which include publications on harnessing, animal powered pumps and animal traction equipment.

Groupe de recherche et de réalisations pour le
développement rural dans le tiers monde (GRDR),
8 rue Paul-Bert, 93300 Aubervilliers, France

GRDR is an NGO working in development research and training, both in France and in several

West African countries. Research activities in co-operation with GRET, IT-Dello, ENDA and other organizations include the development of animal-powered water pumps. It has produced animal traction publications in cooperation with GRET and FAO. Practical training with working animals and animal-powered pumps is given at its training farm in France.

Institut Technologique Dello (**IT-Dello**),
Le Moulin Rouge, 60410 Verberie, France

Appropriate technology organization that has been involved in the development of animal-powered pumps.

Association de Recherche sur la Traction Animal et le Portage (**ARTAP**), 54570 Trondes, France

ARTAP is an association of people interested in animal traction research and development and many of its members use working animals on their farms in France. Since 1983 it has produced a lively and informative quarterly bulletin dealing with many different aspects of animal traction, with most information based on French and European experiences.

Ste Nouvelle Mouzon, B. P. 26, 60250 Mouy
(Oise), France Telex: 150990 MOUZON F

EBRA-Överum, 28 rue du Maine, B.P. 404,
49004 Angers Cédex, France Telex: 720348 F

Bourguignon S.C.A.D., B.P. 37,
26301 Bourg-de-Péage Cédex, France
Telex: 345951 F

French manufacturers of animal traction equipment. All make plows and multi-purpose toolbars. Ebra-Överum is noted for its seeders, while Mouzon specializes in the Jean Nolle range of implements including the Ariana toolframe and Tropicultor wheeled toolcarrier.

Bureau pour le Développement de la Production Agricole (**BDPA**), 202 rue de la Croix Mivert,
75738 Paris Cedex 15, France

Compagnie Française pour le Développement des Fibres Textiles (**CFDT**),
13 rue Monceau, 75008 Paris, France

Broadly-based development organizations that have carried out research-development studies relating to animal traction and have provided technical assistance for draft animal extension programmes in Africa.

The Gambia

The Gambian Agricultural Research and Diversification Project (**GARD**),
Department of Agriculture, Cape St. Mary,
The Gambia Telex: 2229 AMEMB GV

A USAID-assisted development project that is supporting work on animal traction.

Germany (Federal Republic)

Deutsche Gesellschaft für Technische Zusammenarbeit (**GTZ**), D - 6236 Eschborn 1,
Postfach 5180, Germany (FRG)

GTZ is financing several projects in Africa undertaking research and development on animal traction. GTZ and its specialized division German Appropriate Technology Exchange (**GATE**) has published several books on animal traction. GATE is currently supporting research and development on animal powered gears, mills and water-lifting devices in Africa, Asia and Latin America. GATE publishes a quarterly journal *GATE Questions-Answers-Information*.

Fachbereich 15 Internationale Agrarentwicklung,
Institut für Agrarbetriebs und Standortökonomie,
Technische **Universität Berlin**,
Im Dol 27-29, D-1000 Berlin 33, Germany (FRG)

Animal traction has been one of the research interests of the Technical University of Berlin for a number of years and staff have been involved in evaluating animal traction programmes in Bangladesh, Ethiopia, Togo, Zambia and West Africa. A questionnaire survey on the use of animal traction equipment and techniques in several parts of the world was carried out in 1988-89. Staff of the university took part in a research programme in Brazil designed to develop an animal-drawn seeder capable of planting through mulch.

Institut für Agrartechnik, **Universität Hohenheim**,
Garbenstraße 9, P.O. Box 700562, 7000 Stuttgart 70,
Germany (FRG) Telex: 7255202 ATHO D

Staff of the University of Hohenheim have been carrying out animal traction research in collaboration with the ICRISAT Sahelian Centre, Niger. Studies have concentrated on the working power of different draft animals, the draft forces imposed by tines, ridgers and plows, stationary animal-powered systems and animal-drawn carts.

Institut für Landtechnik, **Universität Gießen**,
Gießen 1, Germany (FRG)

The agricultural engineering department of the University of Giessen has been involved in the development of animal-drawn implements. One pro-

ject involved the design and testing of weeder-rollers, in conjunction with TIRDEP, Tanzania.

Deutsche Landwirtschafts-Gesellschaft (DLG),
Zimmerweg 16, D-6000 Frankfurt 1,
Germany (FRG)

DLG, the German Agricultural Society, has held various seminars relating to agricultural equipment, including one in 1987 on north-south co-operation in the manufacture of implements.

Ghana

Department of Agriculture Regional Office,
P.O. Box 171, Tamale, Ghana

The Department of Agriculture regional office at Tamale is responsible for a workshop, established with GTZ assistance, for the manufacture of ox plows, cultivators and carts.

Guinea

Usine des Outillages Agricoles (USOA),
Mamou, Guinea

Agricultural implement factory, build with Chinese technical assistance. It is responsible to the Ministry of Industries and manufactures lightweight mouldboard plows and harrows. Due to infrastructural problems it has not been working at capacity or meeting national requirements. Refurbishment with the backing of a Belgian company appears likely.

India

Central Institute of Agricultural Engineering (CIAE), Nabi Bagh, Berasia Road,
Bhopal 462 018, India

The national CIAE has been undertaking research on animal-drawn implements for many years. It has published numerous research reports and papers on the subject. It has cooperated with AFRC-Engineering in field trials of computer-based data-logging equipment that measures a range of factors relating to force, power and work output of animal-implement combinations in the field.

International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru P.O.,
Andra Pradesh 502 324, India

Telex 152 203 ICRI IN

ICRISAT is an international research centre with its headquarters in India. It is expanding its ICRISAT Sahelian Centre in Niger into an important secondary research station and base for many of its programmes in Africa. ICRISAT has been very closely involved in the development of draft ani-

mal power, particularly within its Resource Management Programme. Between 1974 and 1987 ICRISAT was closely involved with the development of wheeled toolcarriers. Most of its animal traction research and publications were centred on these implements. Other animal traction work has included economic studies (Burkina Faso) and the development of prototype rolling crust-breakers (India) and ridge-tiers (Burkina Faso).

Mekins Agro Products Pvt Ltd.,
6-3-866/A Begumpet, Greenlands,
Hyderabad AP 500 016, India Telex: 155-6372

Mekins is a company that manufactures and exports animal traction implements. It cooperated closely with ICRISAT in the development of wheeled toolcarriers.

Coscul and Co. Pvt. Ltd.,
123/367 Industrial Area, Fazalgunj, Kanpur-12,
Uttar Pradesh, India. Telex: 0325-309 COSL

Coscul is a manufacturer and exporter of relatively simple and cheap steel implements, including animal-drawn plows, harrows and ridgers.

Italy

Food and Agriculture Organization of the United Nations (FAO), Via delle Terme di Caracalla,
00100, Rome, Italy Telex: 616022 FAO I

FAO is the major UN agency concerned with agricultural development. It sponsors, and/or provides technical assistance to, numerous agricultural research, development, extension and training projects some of which are directly or indirectly related to animal power utilization. The Agricultural Services Division (AGS) has chaired the FAO inter-departmental draft animal power liaison committee. FAO has published several books relating to animal traction. In 1988 FAO commissioned GRDR to prepare an animal traction extension manual, and CEEMAT and AFRC-Engineering to prepare "state of the art" reports on animal traction.

Kenya

Rural Technology Development Unit (RTDU),
P.O. Box 470, Nakuru, KENYA

The Land Development Division of the Ministry of Agriculture has responsibility for many animal traction activities in the country, including the RTDU. The RTDU has over the last ten years tested over 150 agricultural implements, and recommended four items of animal traction equipment: a lightweight mouldboard plow, a longbeam plow, a multipurpose toolbar and carts using saw-

dust-packed tyres. These implements have yet to be widely adopted.

University of Nairobi, Kabete Campus,
P.O. Box 30197, Nairobi, Kenya

The Department of Agricultural Engineering has been working for several years on animal traction equipment including the use of toolbars fitted with Indian-style "Desi" plow-bodies, made of steel, for inter-row weeding. The Animal Draft Power Development Project has been carrying out research on use of three-pad harnesses for cattle and donkeys and the employment of donkeys for crop cultivation. It has organized training course for the local production of three-pad harnesses.

Ideal Casements E.A. Ltd., P.O. Box 45319,
Nairobi, Kenya

Steel Fasteners Ltd., P.O. Box, Nairobi, Kenya

Mamuki Industries, P.O. Box 88, Ruiru, Kenya

Appropriate Implements Project, Lugari Extension
Programme, P.O. Box 125, Soy, Kenya

Manufacturers of plows and cultivators.

Lesotho

Northern Lesotho Steel and Diesel Engineering,
Mapotsoe, Lesotho

Manufacturer of scotch carts.

Lesotho Steel Products, P.O. Box 1564,
Maseru, Lesotho Telex 4235 LO

Manufacturer of agricultural implements that has been supported by UNIDO to develop animal drawn implements. Its multipurpose Matlama simple toolbar has attachments for plowing, cultivating, harrowing and seeding, although some of these attachments are still undergoing development. Steel yokes are also fabricated.

Madagascar

Centre National de l'Artisanat Malagasy (CNAM),
B.P. 540 Antananarivo, Madagascar

**SIDEMA (Société Industrielle pour le
Développement du Machinisme Agricole)**,
B.P.14, Antananarivo, Madagascar

**Société Malgache des Constructions Métalliques et
du Matériel Agricole (COMAG)**,
Antananarivo, Madagascar

Manufacturers of animal traction equipment.

Malawi

Agrimal (Malawi) Ltd., P.O. Box 143,
Blantyre, Malawi Telex: 4750 MI

Commercial manufacturer of basic plows, ridgers and toolbars. Some export sales.

Petroleum Services Ltd.,
P.O. Box 1900, Blantyre, Malawi

Manufacturer of animal drawn carts.

Mali

**Compagnie Malienne pour le Développement des
Textiles (CMDT)**, B.P. 487, Bamako, Mali

Telex: 554 CIMATEX

CMDT has been the major organization promoting the use of animal traction in southern Mali. In cooperation with other organizations, it has provided a comprehensive range of services to the farmers including credit, the provision of equipment, animals and animal health requisites, extension and training services and support to village blacksmiths. It has carried out research on cotton/maize rotations using animal traction and on anti-erosion measures. CMDT has been responsible for implementing a World Bank-sponsored development project involving animal traction promotion. With Dutch finance and technical support from the Dutch firm "Rumpstads" it is starting to fabricate animal traction implements in small workshops.

**Projet ARPON (Amélioration de la riziculture
paysanne à l'Office du Niger)**, B.P. 1, Niono, Mali.

Project ARPON, supported by Dutch technical cooperation, is promoting the use of animal traction for irrigated rice production. It has a workshop to fabricate plows and harrows and has been cooperating with the Dutch firm "Rumpstads".

**Division de Recherches sur les Systèmes de
Production Rurale (DRSPR)**, Institut d'Economie
Rurale (IER), B.P. 9030, Bamako, Mali

DRSPR Volet Fonsébougou,
B.P. 186, Sikasso, Mali

DRSPR is its farming systems research section of IER, part of the Ministry of Agriculture. The Volet Fonsébougou based in Sikasso is carrying out research relating to animal traction including harnessing systems, cultivation techniques and implements. It is working closely with the CMDT blacksmith programme.

Opération Haute Vallée (OHV),
B.P. 178, Bamako, Mali

OHV, supported by USAID, has been promoting animal traction in the area surrounding Bamako. A blacksmith training programme has been developed for the fabrication of equipment and spare parts. A larger workshop for making animal traction implements has been established in conjunction with a private firm. Jigs and components

have been supplied by Rumpstad of The Netherlands.

Société Malienne d'Etude et de Construction de Matériel Agricole (SMECMA),
B.P. 1707, Bamako, Mali

Large-scale manufacturer that has supplied most of the animal traction equipment used in Mali. It has fabricated thousands of implements and its main range includes the simple TM plow, the Ciwara toolbar (a multiculteur similar to the Houe Sine), seeders, harrows and donkey carts. In the period 1985-1988 SMECMA was severely constrained by lack of capital, and was unable to meet the national demand for animal traction equipment.

Mexico

Centro Internacional de Mejoramiento de Maíz y Trigo (CIMMYT), A.P. 6-641, Londres 40, 06600 Mexico, D.F., Mexico Telex: 383-1772023 CIMTME

CIMMYT is the international maize and wheat improvement centre, with headquarters in Mexico. Its economics programme for eastern and southern Africa encouraged farming systems research on the constraints to draft animal power for maize production and it convened a workshop on this subject in Swaziland in 1983.

Morocco

Institut National de la Recherche Agronomique (INRA), B.P. 290, Seitat, Morocco Telex: 28921 M

INRA, a national research institute, is involved in animal traction research through its INRA-MIAC arid lands project (Projet Aridoculture), supported by USAID. Equipment evaluated has included wheeled toolcarriers. Studies of animal power in agriculture have included assessments of the working characteristics of donkeys, camels, mules and oxen in various combinations. Measurement of power output has been carried out in co-operation with AFRC-Engineering, UK.

Institut Agronomique et Vétérinaire Hassan II,
B.P. 6202, Rabat Institutes, Rabat, Morocco
Telex: 31873 AGROVET or 32089 M

The Département de Machinisme Agricole has co-operated in a wide range of animal traction projects. Research studies have included the mechanics of traditional ard plows, the use of animal power for pressing olives, the potential for animal traction in irrigated agriculture and the measurement of the work output of donkeys. One project financed by FAO, involved sending Moroccan arti-

sans to Mauritania to train local people to use animal power for water raising and crop production.

Agricola, 34 rue Beni Amar, Casablanca, Morocco
Manufacturer of plows, harrows and ridgers.

Mozambique

Agro-Alfa (Fabrica de Alfaias Agricolas),
C.P. 1318, Maputo, Mozambique

Telex: 6405 AGRAL MO

Agricultural implement factory revitalized with supported from SIDA (Sweden). Technical support has been contracted to the Swedish implement manufacturer Överum. The range of equipment includes mouldboard plows, zig-zag harrows and kits comprising an axle and two large steel wheels for carts. The factory has surplus capacity and has met some export orders.

The Netherlands

Deventer College, Brinkgeversweg 69, P.O. Box 7,
7400 AA, Deventer, The Netherlands

The Department of International Agricultural Education of Deventer College organizes several courses relating to tropical agriculture including one course specifically relating to draft animal power and harnessing techniques.

Koninklijk Instituut voor Tropen (KIT),
(Royal Tropical Institute, Institut Royal des Régions Tropicales), Mauritskade 63,
1092 Amsterdam, The Netherlands

Telex: 15080 KIT NL

Institute supporting a programme of animal traction research in Mali.

Rumpstad B.V., P.O. Box 1, 3243 ZG Stad aan't Haringvliet, The Netherlands

Rumpstad is a commercial manufacturer of agricultural equipment in The Netherlands. It has been working with several organizations in Africa to develop appropriate equipment designs that can be locally manufactured by blacksmiths or small workshops. It is prepared to send samples of its equipment free-of-charge to organizations willing to provide technical feedback.

Technical Centre for Agricultural and Rural Cooperation (CTA), De Rietkampen,
Galvanistraat 9, Ede, Postbus 380,
6700 AJ Wageningen, The Netherlands

CTA financed by the EEC and based in The Netherlands is involved in gathering and disseminating information relating to rural development in tropical Africa and elsewhere. Animal traction is an area of interest of CTA and it is publishing ani-

mal traction books in cooperation with CIRAD, France and CTVM, UK.

Niger

Projet Recherche, Formation et Production pour l'Utilisation de Matériel Agricole en Zone Sahélienne ("Projet FAO"), B.P. 171, Tahoua, Niger
Telex: 5389 FOODAGRI NI

The project, supported by FAO, is testing and evaluating animal traction equipment and tillage practices for the cultivation of millet, sorghum and cowpeas. It is undertaking applied research and surveys relating to animal power utilization. Training activities include work with village blacksmiths and extension agents. It works closely with ACRE-MA both in the manufacture of prototypes and in the development of production runs of animal traction equipment. Publications include training manuals and training film-strips relating to animal traction.

Projet Productivité du Département de Niamey, B.P. 10231, Niamey, Niger

PP Niamey has a "Cellule de l'Artisanat Rural et Machinisme Agricole" (ARMA), which is undertaking animal traction equipment development work including prototype design and modification. Areas of interest include development of lighter weight plows than the predominant Arara toolbar and improved cart designs.

ICRISAT Centre Sahélien (ISC), International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), B.P. 12404, Niamey, Niger

Telex: 5406 ICRISAT NI

The ICRISAT Sahelian Centre makes routine use of animal-drawn Nikart wheeled toolcarriers on its extensive research farm. On-station cropping systems trials have involved comparisons of different types of animal-drawn implements including plows, ridgers, Arara toolbars, seeders and wheeled toolcarriers. Off-station work in cooperation with ILCA has included nutritional studies relating to the feeding of draft animals. A four-year, multidisciplinary research programme on draft animal power has been initiated in cooperation with the University of Hohenheim, FRG. This will involve measuring the draft characteristics of local oxen, donkeys, horses and camels, the testing and evaluation of cultivation equipment and an animal-powered mill.

Atelier Coopératif Régional de Fabrication de Matériel Agricole (ACREMA)

Union Nigérienne de Crédit et de Coopération (UNCC), Niamey, Niger

Unité Construction Matériel Agricole, B.P. 296, Niamey, Niger

Workshops making animal traction equipment.

Nigeria

John Holt Agricultural Engineers Ltd., New Industrial Estate, P.O. Box 352, Zaria, Kaduna State, Nigeria
Telex: 75253

Manufacturer of animal traction equipment including mouldboard plows. It is particularly noted for its Holtag Emcot ridger widely used in northern Nigeria and which has been exported to other countries in the region. It also manufactures animal drawn weeding implements for ridges.

International Institute of Tropical Agriculture (IITA), P.M.B. 5320, Ibadan, Nigeria

Although not closely involved in animal traction IITA has been working with SAFGRAD in Burkina Faso on animal-drawn tied-ridging implements.

Peru

Proyecto de Herramientas e Implementos Agrícolas Andinos (Herrandina), Casilla 42, Cusco, Peru

Project that has evaluated traditional animal-drawn tillage implements and has developed a modified multipurpose ard plow.

Philippines

International Rice Research Institute (IRRI), P.O. Box 933, Manila, Philippines

Telex: 40890 RICE PM; 45365 RICE INST PM;

IRRI has an international mandate relating to rice production in the tropics. In 1986 the Agricultural Engineering Department developed the "Conopuddler" designed for use with a single buffalo. The Rice Farming Systems Program has organized a network of farming systems research organizations in 13 countries in southeast Asia and many of its members are actively working on aspects of animal traction.

Regional Network for Agricultural Machinery (RNAM), University of the Philippines, Los Baños, College, Laguna, Philippines

Telex: 3432 PTLB PU

RNAM, whose sponsors include FAO and UNIDO, links agricultural engineering institutions in several Asian countries through information dissemination, meetings and exchanges. Details of forthcoming events, research activities and new implement designs, together with more general ar-

ticles are provided in the RNAM Newsletter, distributed free-of-charge three times a year.

Senegal

Institut Sénégalais de Recherches Agricoles (ISRA), B.P. 3120, Dakar, Senegal

Telex: 61117 ISRA SG

ISRA is a large research organization within the ministry of rural development. Its Bambey Centre was the base for many animal traction studies in the 1950s and 1960s. More recently the farming systems department of ISRA (Département Systèmes) has carried out research on animal traction in several parts of the country. Areas of research have included socio-economic aspects of animal power, tine tillage, draft cows, the use of animal traction for rice production, equipment distribution and maintenance and the role of blacksmiths in animal traction. Many detailed research reports have been produced. ISRA hosted an international workshop on animal traction in 1988.

SISMAR (Société Industrielle Sahélienne de Mécaniques, de Matériels Agricoles et de Représentations), B.P. 3214, Dakar, Senegal,

SISMAR is one of the largest manufacturers of animal traction equipment in Africa. SISMAR was formed after the financial problems of the previous manufacturing company "SISCOMA", by which name much of its equipment is still known. Due to limited local demand it is still running well below its large capacity. It is most famous for the Nolle-designed multipurpose Houe Sine toolbar and the Super Eco seeder which have been widely sold both within Senegal and in neighbouring countries.

ENDA (Environment and Development in the Third World), B.P. 3370, Dakar, Senegal

ENDA is an internationally-financed non-governmental organization with its headquarters in Dakar. It publishes the journal African Environment in French and English. It has been cooperating with GATE (Germany), GRDR and IT Dello (France) and local blacksmiths in the development of animal powered systems for raising water and grinding food. It has published several pamphlets on these subjects.

Sierra Leone

Sierra Leone Work Oxen Programme,
Private Mail Bag 766, Freetown, Sierra Leone

Telex: 3418 PEMSU SL

The Work Oxen Programme is responsible for a workshop at Rolako which makes Pecotool tool-

bars, harrows and carts. The Programme is involved in research-development activities and is particularly interested in rice cultivation using draft animals, the social implications of animal traction adoption, work-disease interactions and the potential for making greater use of traditional animal husbandry techniques.

South Africa

FEDMECH, P.O. Box 677,

Vereeniging 1930, South Africa Telex: 743058

Historically Southern African Farming Implements Manufacturers (SAFIM) was the major manufacturer of animal traction equipment in the region. The SAFIM designs of large plows, cultivators and seeders that have changed little in thirty years, are now manufactured by FEDMECH, although the implements are still commonly referred to by the well known SAFIM trade name. In addition to meeting the demand of the domestic market in South Africa, it exports to several neighbouring states.

Sudan

Western Savannah Development Corporation (WSDC), P.O. Box 190, Nyala, South Darfur, Sudan
(Khartoum Office: P.O. Box 9025 (KTI), Sudan)

Telex: 22523 WSDC SD

WSDC is a broadly based rural development project. The animal traction component of WSDC is promoting the use of donkeys and, to a lesser extent, oxen. Equipment evaluated and locally manufactured from scrap materials includes single mouldboard ox plows and donkey-drawn seeder/weeders. Research interests have included donkey-harnessing and water-raising systems.

Jebel Marra Rural Development Project (JMRDP),
P.O. Box 9010, Khartoum, Sudan

Large development project, supported by EEC, in the remote west of Sudan. In the project area donkeys are used for transport and packing, horses are used for riding and some cart pulling, and some camels are used for plowing. JMRDP has been promoting camel plows made by local artisans. It is now emphasizing the use of donkeys, as these are much cheaper, and it has been developing a lightweight donkey plow and weeder.

Nuba Mountains Rural Development Programme,
P.O. Box 143, Khartoum, Sudan

Large development project, supported by SATEC, with an animal traction component. Research relating to animal traction has included a study of the economics of ox carts.

Swaziland

Usutu Pulp Company Limited, Private Bag,
P.O. Mbabane, Swaziland Telex: 2003 WD

Forestry company with 25% of logging operations based on extraction by mules. 220 mules are maintained and work 200 days/year and extract 160 logs (20 tonnes) per mule per working day.

ISICO, P.O. Box 417, Mbabane, Swaziland
Telex: 2213 WD

Distributor of Agrilis animal-drawn equipment of SAFIM type, including plows, harrows, cultivators and seeders.

Sweden

AB Överum Bruk, S-590 96 Överum, Sweden
Telex: 3957 OVERUM S

A company manufacturing large-scale agricultural implements that has also been involved in rehabilitating facilities for local production of animal traction equipment in Mozambique and Angola. Following the the formation of the Överum-Ebra company in France it is now associated with the Ebra range of animal-drawn seeders and other implements.

Switzerland

International Labour Organisation (ILO), CH-1211
Geneva 22, Switzerland Telex: 22271 BIT CH

ILO (the French acronym is BIT) is a UN agency with particular interest in developing activities and technologies which generate employment and improve working conditions. Animal traction, blacksmithing, village carpentry and animal-drawn transport fall within this mandate. The Technology and Employment Branch of ILO sponsored several national workshops relating to animal traction in eastern and southern Africa, and published the proceedings.

Bellerive Foundation, P.O. Box 6, 1211 Geneva 3,
Switzerland Telex: 429835 MURO CH

The Bellerive Foundation works on environmental issues, and has been involved in the development and local production of three-pad harnessing systems for Africa, based on Swiss designs.

Swisscontact, Fondation suisse de coopération au développement technique, Döltschweg 39,
CH-8055 Zurich, Switzerland Telex: 814308

Swiss Development Cooperation (DCA),
Département fédéral des affaires étrangères,
CH-3003, Bern, Switzerland Telex: 911340 EDA CH
Swisscontact, supported by Swiss Development Cooperation (part of the Swiss foreign affairs min-

istry), is working with groups in Latin America to develop animal traction technologies. Among other activities, it has provided technical personnel to assist the Proyecto Herrandina in Peru.

Tanzania

Ubango Farm Implements (UFI), P.O. Box 20126,
Dar es Salaam, Tanzania Telex: 41206

The parastatal UFI factory is the largest manufacturer of agricultural implements in the country, with a capacity to manufacture 60 000 plows a year. When demand has exceeded production, UFI has imported plows.

Zana Za Kilimo, P.O. Box 1186,
Mbeya, Tanzania Telex: 51133

A parastatal factory in the southwest of the country manufacturing a range of animal traction equipment. Cooperating with the Mbeya Oxenization Project.

Themí Farm Implement and Engineering Company, P.O. Box 286, Arusha, Tanzania

Small workshop producing some plows and carts.
Centre for Agricultural Mechanization and Rural Technology (CAMERTEC),
P.O. Box 764, Arusha, Tanzania. Telex: 42126

Established in 1981 through the merger of TAMTU (Tanzania Agricultural Machinery Testing Unit) and the Arusha Appropriate Technology Project, CAMERTEC is charged (among other activities) with developing and testing animal traction implements and promoting national liaison in this field. It has workshops for producing prototypes and small production runs. Some of its initial designs included heavy double-mouldboard plows and harrows, and also ox carts.

Tanga Integrated Rural Development Programme (TIRDEP), Kilimo Tanga,
P.O. Box 5347, Tanga, Tanzania

TIRDEP is a development project (with GTZ support) in the northeast of the country that has been trying to introduce animal traction into an area where previous schemes had been disappointing. In addition to extension and training, its activities have included equipment development and the design of a prototype rolling weeder/brush cutter. The high demand for carts has been partially met by importing old car axles from Germany.

Mbeya Oxenization Project,
P.O. Box 723, Mbeya, Tanzania

Development project, supported by CIDA, working with existing organizations to improve and increase the use of animal traction in the Mbeya re-

gion of the southwest. Specific objectives include work on inter-row cultivators and ox carts. The project is cooperating closely with the ZZK factory in the development and production of animal-drawn implements.

Togo

Projet pour la Promotion de la Traction Animale (PROPTA), B.P. 82, Atakpamé, Togo

PROPTA is a national ministry of rural development project assisted by USAID and EEC and is responsible for ensuring adequate liaison between the 20 different donor-assisted projects and financial institutions involved with animal traction in Togo. PROPTA promotes information exchange through the quarterly newsletter *Force Animale* and the circulation of documents. It has established standards for credit terms and has coordinated the supply of equipment and spares from the UPROMA factory.

Unité de Production de Matériel Agricole (UPROMA), B.P. 111, Kara, Togo

Workshop established with UNIDO/UNDP assistance that manufactures a range of animal traction implements notably simple mouldboard plows, triangular toolbars and ox-carts.

United Kingdom

Overseas Division, AFRC-Engineering, Wrest Park, Silsoe, Bedford MK45 4HS, UK

Telex: 825808 G

The Overseas Division of AFRC-Engineering (formerly NIAE) has been involved in animal traction implement development for many years. Recently it has been developing techniques and instrumentation for measuring and logging many of the mechanical and physiological parameters associated with animal draft. Field trials with draft animals are being undertaken in cooperation with national and international institutions in Africa and Asia. It is hoped to use the information obtained from the data loggers to develop a scoring system to facilitate the comparison of different animals and implements.

Centre for Tropical Veterinary Medicine (CTVM), Easter Bush, Roslin, Midlothian EH25 9RG, Scotland, UK

Telex: 727442 UNIVED G

The CTVM of the University of Edinburgh is carrying out research on the nutritional and physiological implications of draft work, using cattle, buffaloes, horses and donkeys. Several interactions are being studied including nutrition-work, work-milk production and work-disease, and it is hoped

to establish criteria for selecting draft animals. CTVM has developed equipment and techniques to establish work output under both controlled and field conditions. CTVM publishes "Draught Animal News" twice a year. It runs courses on animal traction, in cooperation with Deventer College in The Netherlands.

Intermediate Technology Development Group (ITDG), Myson House, Railway Terrace, Rugby CV21 3HT, UK

Telex: 317466 ITDG G

IT Publications, 103-105 Southampton Row, London WC1B 4HH, UK

IT Transport, Old Power Station, Ardington, Oxon, OX12 8PH, UK

ITDG is a non-governmental appropriate technology organization that has been associated with the development of animal traction technologies in several countries. Its publications arm, ITP, has produced several books relating to animal traction and it publishes the quarterly journal *Appropriate Technology*. IT-Transport is the section of ITDG that concentrates on transport, including animal-drawn vehicles.

Development Technology Unit, University of Warwick, Coventry CV4 7AL, UK

Telex: 311904 UNIVWK

The Development Technology Unit of the University of Warwick (in collaboration with partner organizations in Africa and Asia) is carrying out research and development work on the use of animal power to drive stationary machinery for water-lifting and crop processing.

Commonwealth Secretariat, Marlborough House, Pall Mall, London SW1Y 5HX, UK

The Food Production and Rural Development Division of the Commonwealth Secretariat has supported the development of regional appropriate technology networks in Africa. It has published the proceedings of sub-regional meetings which have included aspects of animal traction.

Geest Overseas Mechanisation Ltd, White House Chambers, Spalding, Lincs PE11 2AL, UK

Telex: 32494 GSTGOM G

Manufacturer of agricultural equipment including wheeled toolcarriers.

Farmkart Ltd., St Andrews Industrial Estate, Bridport, Dorset, DT6 3DB, UK

Telex: 417232 PARAK G

Farmkart is a company specializing in animal-drawn carts. It sells complete kits and can collaborate in local production initiatives.

Project Equipment Ltd, Industrial Estate,
Oswestry, Shropshire SY10 8HA, UK

Telex: 35367 PROJEQ G

Project Equipment is a small firm that designs and manufacturers animal traction equipment. It has assisted small workshops in Africa to establish the local fabrication of plows and toolbars. It runs basic, practical training courses in the design and production of animal-drawn implements.

Shuttleworth Agricultural College, Old Warden
Park, Biggleswade, Beds SG18 9DX, UK

Agricultural College that has held short-duration highly practical courses on animal traction and animal-drawn implements.

United States of America

AT International, 1331 H Street NW,
Washington DC 20005, USA

AT International is a non-profit trust working with appropriate technology organizations in several countries. Involvement with animal traction includes cooperation with RIIC, Botswana, and ENDA, Senegal, in the development of animal-powered water pumps and mills.

Agency for International Development (USAID),
Washington DC 20523, USA

USAID is the official US bilateral aid agency that funds numerous projects in developing countries, including many with draft animal components.

TILLERS International, 1402 Hillcrest Avenue,
Kalamazoo, Michigan 49008, USA

Tillers International, a non-profit corporation, works with both old and new animal-powered technologies on a small farm where horses and oxen are employed and prototypes constructed. Small numbers of interns are trained in animal traction techniques. Tillers publishes an illustrated, quarterly newsletter *The Tillers Report* which aims to stimulate discussion and debate on a wide range of issues relevant to animal traction utilization in developed and developing countries.

Volunteers in Technical Assistance (VITA),
1815 N. Lynn Street, Suite 200,
Arlington, Virginia 22209-2079, USA.

VITA is a non-profit organization specializing in disseminating information on appropriate technologies, including animal traction. It has a comprehensive documentation centre, with a large range of documents relating to draft animals and animal-drawn implements. It publishes a quarterly newsletter *VITA News*.

Zaire

Secrétariat des Organisations Non-Gouvernementales pour la Traction Bovine (SOTRABO),
c/o **Projet Rural**, B.P. 1144, Mbuji mayi, ZAIRE

SOTRABO was established to coordinate the animal traction programmes of several NGOs in Zaire. Projet Rural has worked closely with village blacksmiths and carpenters to encourage the village-level production and maintenance of equipment, including wooden-beam plows and wooden ox carts.

Zambia

Animal Draft Power Programme,
Agricultural Engineering Section,
Ministry of Agriculture and Water Development,
P.O. Box 50291, Lusaka, Zambia

Telex: 44370 AGRIMI ZA

The national animal draft power programme, with support from Dutch technical cooperation, is coordinating various activities relating to animal traction including training and research-development studies. Work has been undertaken on harnessing systems and the local production of suitable implements.

Animal Draft Power Research and Development Project, Agricultural Machinery Research and Development Unit,
Magoye Regional Research Station,
P.O. Box 11, Magoye, Southern Province, Zambia

Magoye Station of the Ministry of Agriculture has long been associated with animal traction. AD-PRDP, with Dutch support, is developing standardized testing procedures for equipment evaluation as well as studies on tillage techniques using animal power.

Northland Engineering, P.O. Box 71640,
Ndola, Zambia Telex: 33310 NORTHLAND ZA
Lusaka Engineering Company (LENCO),
P.O. Box 33455, Lusaka, Zambia Telex: 41720 ZA
SKF, P.O. Box 20133, Kitwe, Zambia
Telex: 51230 ZA

MDM Engineering Contractors,
P.O. Box 21977, Kitwe, Zambia

Turning and Metal,
P.O. Box 31608, Lusaka, Zambia

Manufacturers of animal drawn equipment. Northland has been the main producer of ox-plows, ridgers and cultivators, and also makes some carts. LENCO makes both ox-carts and plows. Turning and Metal make ox-carts; MDM

manufacture tines and spare parts; SKF makes stub axles for carts with roller bearings.

Zimbabwe

Institute of Agricultural Engineering,
P.O. Box BW 330, Borrowdale, Harare, Zimbabwe
Telex: 2455 AGRIC ZW

The Institute of Agricultural Engineering of the Ministry of Agriculture undertakes research, testing, development, training and extension in the field of agricultural engineering. The activities of its Research Centre are primarily aimed at the small-scale farming sector and include conservation tillage methods to reduce both soil erosion and the draft power requirements. Work also covers the development of animal-drawn implements, animal-powered water pumps and the standardization of testing procedures. The Agricultural Engineering Training Centre (AETC)

provides extension staff, farmers and teachers with training in animal power and the use and maintenance of implements and has produced some illustrated training manuals. Basic blacksmithing courses are designed to upgrade skills in the repair and manufacture of animal-drawn implements.

Bulawayo Steel Products, P.O. Box 1603,
Bulawayo, Zimbabwe Telex: 3257 ZW

Zimplow Ltd., HIS Steelworks Road,
P.O. Box 1059, Bulawayo, Zimbabwe
Telex: 3372 PLOUGH ZW

Bain Manufacturing Company (Pvt) Ltd.,
P.O. Box 1180, Harare, Zimbabwe
Telex: 4696 ZW

Large manufacturers of animal traction equipment including plows, harrows, ridgers and cultivators.

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