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**FARM MACHINERY:
16 PROVINCES IN AFGHANISTAN,
ANALYSIS AND RECOMMENDATIONS**

**Prepared for:
DEVELOPMENT ALTERNATIVES, INC.
PESHAWAR, PAKISTAN**

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EXECUTIVE SUMMARY

The overall objective of the Farm Machinery Study is to evaluate the requirements and demand for farm machinery by Afghan farmers, recommend appropriate manufacturers and suppliers and to recommend how the Afghan Agricultural Sector Support Project (AASSP) can create a program to fill these requirements and demand.

The study evaluates six groups of farm machinery; Tractors and tractor pulled implements, Small engined tillers and attachments, Man-Powered implements, Animal pulled implements, Improved hand tools and PTO (Power-Take-Off) powered vs. self-powered threshers of one ton per hour capacity and one-half ton per hour capacity.

Twelve leading Pakistani manufactures and suppliers are listed as primary sources for farm machinery. These manufacturers meet the quality, price and location criteria presented in the report and are leading manufacturing firms in their own right.

Tractors of the 45 h.P. class and the tractor pulled implements are too expensive for the average or typical Afghan farmer to afford, especially in the absence of any formalized credit system. Therefore, full-sized tractor services will, in all probability, be supplied to the typical Afghan farmer on a custom hire basis.

Small engined tillers of the IRRI design, while not currently produced in Pakistan, can easily be manufactured by two of the firms on the recommended list. Both of these firms have degreed engineers on staff, have looked into manufacturing tillers before and are very willing to work with the project. Power tillers have many advantages being versatile, plowing, cultivating, reaping, pumping water and transporting material. Although small engine tillers have not been successful in Pakistan or India, knowledgeable Afghans find them very attractive. Additionally, according to the analysis, small engined tillers could be affordable to many small Afghan farmers.

Man powered implements such as seeders, cultivators and reapers can be made available through a Pakistani manufacturer who has manufactured these items in the past and is willing to work with the project. These man powered implements are of IRRI designs and being less than RS. 1000 per copy, seen to be very affordable.

Animal pulled plows and cultivators are still manufactured by a firm in Mian Channu and cost RS. 250 each. These are designed to be pulled by one ox and upon inspection appear to be lightweight and durable.

The improved hand tools I have seen on the local market are typically made of low quality steel, poor design and workmanship.

Consultations with knowledgeable Afghans have revealed that they hold the same view and would prefer high quality items from the United States. High quality, long handled shovels are available from suppliers in the USA for around \$15.50 or RS.330 per copy. Freight will add to the cost, of course, but still may find a ready market. Complete options on hand tools are presented in the report and recommendations section.

PTO powered threshers of one ton capacity per hour made in Pakistan are heavy (preventing easy movement), expensive (RS.30,000 per copy) and require either a 45 H.P. tractor or a 30 H.P. diesel engine as a power source. Tractors are a scarce resource in Afghanistan and considered too valuable, considering the small planting window, to be used as a power source for threshers. Again, the weight of these machines requires a tractor or a truck/jeep to transport. Additionally, adding a 30 H.P. diesel engine to the thresher runs the price up to the RS.60,000 level, making the whole package very expensive.

Pakistani threshers of one-half ton capacity per hour are much lighter (two or three men could move it about), can be powered by a 12 H.P. diesel and cost approximately RS. 33,000 for the entire package. Once the threshing season is over, the engine could be utilized to pump water, power a flour grinder, fodder chopper or any other machine requiring a remote power source. Additionally, the price makes the machine much more affordable to a wider range of Afghan farmers.

The recommendations section of the study proposes steps that the AASSP can take to stimulate the private sector and facilitate the sale and flow of agricultural machinery into Afghanistan. The recommendations fall into five overall categories and include, inter alia:

- I. Market information systems to provide farmers with information on the availability of inputs and markets for farm outputs, modern farm methods, economics of machinery and basic record keeping, weather and transportation reports.

- II. Easy access to a wide array of farm machinery through the trade centers.
- III. Availability of operational, maintenance and repair training and assistance.
- IV. Incentives to manufacturers and suppliers to reduce transportation, inventory and new product development costs.
- V. Incentives and programs to Afghan purchasers of agricultural machinery to increase farmer awareness of modern farm methods and to increase the purchasing power of the Afghan farmer and Agribusiness entrepreneur.

Once AASSP has provided these basic support items, competitive market forces will determine the machinery mix utilized by the agricultural sector of Afghanistan.

Introduction

By all accounts, the agricultural sector of Afghanistan has been devastated by 11 years of war. Probably half the population are refugees; perhaps 40% of the oxen population (for farmers who remained in 1987), the primary source of draught power prior to the war, have been killed, surface irrigation systems and karezes suffer from war damage or neglect, some fields are mined and have bomb craters. According to Dr. Azam Gul (Swedish Committee) and Dr. Gene Saari (CIMMYT Consultant to DAI) overall agricultural output has been cut in half.

The second report on Farm Power by the Agricultural Survey of Afghanistan (ASA) of the Swedish Committee estimates that the natural regeneration of the oxen population will require between twelve to fifteen years overall, with some provinces requiring twenty-five years to regenerate the oxen population. Although this is a very questionable conclusion, draught power on Afghan farms has been seriously reduced and the time required to breed new oxen a major constraint to increased farm production.

Importing replacement oxen faces serious physical and economic constraints. Losses due to disease and climatic conditions are reported to be high for imported oxen.

Economic pressure from the competition for land to grow fodder and feed grains rather than wheat or other cash crops further constrains imports of oxen. To maintain an ox a farmer must grow berseem (clover) or other fodder and supplement its diet with grain, traditionally barley.

Given that prior to the war oxen provided the bulk of farm draught power, with 10% or less of the farmers owning or renting custom tractor services, and that an estimated 40% of the ox herd became war casualties (farmers who remained in 1987), physical demand for draught power is tremendous.

Tractors obviously offer a solution to the farm power problem. However, tractors are expensive to purchase and operate and difficult to maintain in a country with few mechanics and very few spare parts. Most farms are too small to economically justify a tractor but groups of farmers can share a machine and custom operators can provide tractor services to many farmers.

The future of agriculture in Afghanistan will include a growing market for tractors, implements and related machinery. The AASSP objective is to assist the private sector develop that market and to assist farmers achieve the highest possible returns from equipment investments.

Therefore this report shall: Present a short-list of appropriate suppliers of agricultural machinery equipment and tools relevant to Afghanistan. Define the criteria used to select these manufacturers and :

- o Detail the level of effort the manufacturers are prepared to make vis-a-vis the Afghan market including inter-alia: Sales outlets, training programs, spare parts and service facilities.
- o Recommend measures for AASSP to encourage and facilitate the creation of Afghanistan targeted marketing programs by these companies.
- o Assess market demand for machinery, equipment and tools with attention to specific regional or provincial requirements.
- o Recommend incentive mechanisms to enhance demand for agricultural machinery equipment and tools in Afghanistan.
- o Estimate, based on existing information on losses of draft animals, requirements for tractors and implements over the next three years.

- o Assess requirements for threshers based on manpower shortages and cropping practices make recommendations to supply threshers through commercial channels. Recommend thresher specifications with special attention to the comparative advantages of self-powered vs. PTO-powered threshers.

Recommended Manufacturers and Choice Criteria:

Quality Considerations

In Pakistan, the manufacture of agricultural implements and machinery is dominated by a plethora of small scale local blacksmiths operating at a very low technological level. As a result, standardized designs and quality controls are virtually non-existent at the majority of these manufacturers. Further, the quality of the inputs used in the manufacturing process varies widely from company to company.

Therefore, the major criteria in the selection process must be standardized designs, manufacturing procedures, quality controls both for inputs and output, technical engineering ability and overall reputation for quality products.

All of the manufacturers on the short-list are the larger manufacturing firms and meet these criteria. These firms manufacture equipment to international and local standards which are often set by the Massey-Ferguson licensee in Lahore, Millat Tractors Limited. Indeed, many of these manufacturers produce implements and equipment sold through Millat dealerships nationwide and enjoy strong brand-name loyalty by Pakistani farmers. Additionally, the manufacturers on the recommended list have degreed agricultural engineers on their staff and are capable of designing and producing quality custom orders.

Price Considerations

One of the benefits from having an industry dominated by a plethora of small, independent units is strong price competition. Most local blacksmiths are capable of making copies of implements manufactured by the larger firms, albeit with sub-standard production techniques and materials. The Pakistani farmer is very cost-conscious and will buy sub-standard implements.

When the implement fails, the local blacksmith or the farmer himself will simply hammer it back together. However, this does keep strong pressure on the larger manufacturers to keep their prices low.

Additionally, many of the firms on the recommended list either produce or are capable of producing similar, competing implements and equipment. Therefore, the competition between firms on the recommended list will keep prices in line with the overall Pakistani market.

Location Considerations

The lion's share of Pakistan's agricultural output is located in the Punjab. Naturally, the primary implement manufacturing centers are also located in the Punjab. Lahore, Sheikupura, Gujranwala, Daska, Faisalabad and Mian Channu are major centers of manufacturing for agricultural implements and equipment in Pakistan. Each of these manufacturers tends to specialize, manufacturing items particular to demands in the surrounding area: tractors, pumps and tillage equipment in Lahore and Sheikupura; drills and reapers in Daska; blades, trolleys and hydraulic equipment in Gujranwala; threshers, drills, pumps and backpack sprayers in Faisalabad; boom sprayers, barrow mounted sprayers, cotton cultivating and fertilizing equipment in Mian Channu.

Again, while firms on the recommended list produce their particular specialty, a certain amount of commonality exists. This tendency also drives price competition. The NWFP, Sind and Balochistan also produce implements and other machinery, however, typically they tend to be the smaller, local level blacksmith producing only 20 or 30 pieces of equipment each year. Therefore, in selecting the larger manufacturers with standardized outputs, quality controls on inputs and output, and high levels of technical ability (relatively) I went to the larger manufacturing centers in the Punjab.

Sales Outlets, Training and After-Sales Service

All of the firms on the recommended list have expressed very strong interest in locating sales agents and representative implement and equipment inventories at our trade centers in Peshawar and Quetta. In fact, the major question was how soon would DAI's trade centers be operational so they could get started! All of the recommended firms are willing to provide operational, repair and maintenance training programs as well as spare parts and service facilities. All of the firms on the recommended list expressed strong interest in locating Afghans to become implement and equipment dealers, spare parts dealers and repair shop operators. Recommendations to encourage and facilitate Afghanistan targeted marketing programs will be detailed in the recommendations sections of this report.

Recommended Manufacturers

I. Tractor Powered Implements and Equipment

ITEM

- | | |
|---|---|
| 1. Millat Tractors Limited
Sheikupura Road
P.O. Box 1147
Lahore, Pakistan
Contact: Sohail Bashir Rana,
GM, Marketing
Phone: 711020, 711021-25 | <u>Tractors</u>
MF-240 (45HP)
MF-375 (65HP) |
| 2. Farm Development Industries
(Pvt.) Ltd.
PIR Bahar Shah, Lahore Road,
Sheikupura
Contact: Nazir Alwi, Owner
Phone: (04931) 4123, 4110, 470 | <u>Tillage Implements</u> |
| 3. United AGGRO Engineers
Circular Road, Daska
Contact: Mirza Mohammad Younas
Managing Director
Phone: Off: 750 Res: 720 | Drills/Reapers/
m a n p o w e r e d
equipment and can
make small engine
power tillers/
tillers/reapers
and threshers. |
| 4. Javaid Engineering Company (JECO)
Nr. Shama Cinema
GT. Road, Gujranwala
Phone: Off: 81343, 82777
Res: 82453 | Blades/Front
Loader/Hydraulic
Arms/Developing
a Back-Hoe
attachment. |
| 5. Naeem and Company
Sammundri Road, Faisalabad
Contact: M. Saleem Mirza
Managing Partner
Phone: Off: 45771, 40723
Res: 45942 | Drills/threshers
Bar Harrows/
Blades. Will make
anything you
want. |
| 6. The Punjab Engineering Co.
Sammundri Road, Faisalabad
Contact: Ch. Ghulam Qadri
- Owner
Phone: Off: 45415, 45115
Res: 41117 | Threshers/fodder
choppers/pumps/
stainless steel
B a c k - p a c k
sprayers/ Can
make small engine
hand trolley
sprayer. |

7. GHAZI Industries Ltd
Mian Channu
Contact: Sarwar Ghazi
- Partner or
M. Arshad Ghazi
- Director
Phone: Off: 877, 777
Res: 705
- can make
- Boom Sprayer
Hand-trolley
sprayer,
Full line
Agricultural
Implements
plus Animal
Powered
Implements, and
small engine
powered tillers,
and reapers.
8. Jamal Industries
G.T. Road, Mian Channu
Contact: Mohammad Rafiq Mughal
Managing
Partner
Phone: Off: 3699, 3299
Res: 3894
- threshers/Bar
Harrow/Disk
Harrow/Cotton
Seed drill,
Cotton inter-
culture equip.
tillage equip.
9. KSB Pumps Company Limited
16/2 Sir Agha Khan Road
Lahore
Contact: Senior Sales Manager
Phone: 304173, 304174
- Pumps of all
kinds. Leading
manufacturer
in Pakistan.
10. Sargroh Farm Aids (Pvt) Ltd.
72-P, Model Town, Lahore
Contact: Ms. Teresa S. Day
Islamabad Ph. 821765
(Butler)
or Asif Sharif, Chief
Executive
Phone: Lahore 867072-3
- threshers/Grain
Handling equip.
and full line
of tillage
equip.
11. Pak-Zaree Industries (Pvt) Ltd.
National Highway, Hyderabad
Contact: H.M. Saleem
- Phone: 610257
- Complete line
tillage equip.
- trolley/water
tankers/disk
harrow.

12. General Export International
(pvt.) Ltd.
5th Floor V.M. House West Rd.
P.O. Box 10257, Karachi-2
Contact: Tariq M. Rangoonwala
- Managing Director.
Phone: 200627, 203084, 2415630

Note: Tariq is an excellent source for
imported hand tools and power tillers
- he is very motivated and gets the
job done.

NOTE:

Please see office files for complete product line and price list
for each manufacturer.

Animal Powered Equipment

Since the introduction of tractors in Pakistan in the 1960's,
animal-pulled implements have all but disappeared from the markets.
Local village blacksmiths now produce for local demands on a
"booked order" basis.

However, one major manufacturer, Ghazi Industries of Mian Channu,
still produces a "Rabbi" plow pulled by a single bullox. I have
inspected the plow and it appears quite light and durable. In
addition, Ghazi Industries used to produce a complete line of
animal powered equipment back in the sixties and expressed interest
in supplying the Afghan market. Please see the files for a
detailed product and price list.

Ghazi also produces high quality wheel barrows for the Punjab
highway authority. Ghazi worked with USAID back in the sixties,
developing the first land plane in Pakistan and worked with USAID
and IRRI on Power-tillers, seeders and reapers at that time. Sawar
Ghazi expressed sincere interest in working with DAI along these
lines.

Small Engine Powered Equipment

Small engine powered tillers, transplanters and reapers have not
been successful in Pakistan and therefore are not currently
manufactured. However, blueprints are available from
IRRI/Philippines as are working machines from shops in the
Philippines. These blueprints could be shipped in with working
machines for models and manufactured here in Pakistan. United Agro
of Daska and Ghazi Industries of Mian Channu, have expressed
serious interest in working with DAI on such equipment.

Man-Powered Implements

Man powered seed drills, cultivators and reapers are available through United Agro of Daska. Mohammad Younas tried to produce and sell these items (IRRI designs) a number of years ago, however, the market in Pakistan would not support such items. M. Younas will gladly supply such items for sale to Afghanistan through DAI's trade centers.

Improved Hand Tools

By and large, the shovels, hoes, rakes, pruning shears and wheelbarrows, I have seen offered for sale on the local market are made of low quality steel, crude handles and of generally poor design. As a result, these tools are unwieldy, heavy and wear-out rapidly. Dr. S. Iqbal Ahmad, Director of PARC's Agribusiness relations cell has informed me that PARC has developed a line of improved hand tools and animal drawn implements. He indicated his willingness to arrange a display of these improved tools in Peshawar at DAI's convenience. In addition, I have discussed this issue with Tariq Rangoonwala in Karachi and he assures me that plenty of inexpensive, good quality, primarily Chinese, tools are available. A quick one or two day trip should suffice to check the situation in Karachi.

If hand tools of sufficient quality are not available locally or off-the-shelf in Karachi, then high quality hand tools are available from suppliers in the U.S.A. (please see files). Tariq Rangoonwala has expressed serious interest in working with DAI in the regard, importing required items and selling them through our trade centers.

Demand for Tractors and Associated Implements

Table 1.0 Physical Tractor Demand estimates based on approximate pre-war irrigated and rain-fed wheat areas of the 16 target provinces of the AASSP. Developed from data provided by Dr. Gene E. Saari, a CMMYT consultant to DAI, January 1990. If oxen were to be totally replaced by tractors, then Table 1.0 would be the physical requirement.

According to the consensus of opinion of knowledgeable Afghans, 2,500 to 3,000 tractors of all makes currently exist in Afghanistan, many of which require repairs.

These tractors are probably concentrated around Kandahar and in Helmand province. In any case, these are far from the numbers required for total coverage of the pre-war acreage in the sixteen provinces.

Table 1.0 PHYSICAL TRACTOR REQUIREMENTS
16 PROVINCES AFGHANISTAN

<u>Province</u>	<u>TC</u>	<u>Total Hectares</u>	<u>45HP @ 50/HA/yr Tractors Required</u>
Kandahar	Q	98,900	1,978
Ghazni	P	79,400	1,588
Kunar	P	22,100	442
Paktiko	P	95,400	1,908
Helmand	Q	48,600	972
Zabul	Q	31,100	622
Laghman	P	23,800	476
Logar	P	18,600	372
Wardak	P	93,300	1,866
Bamian	Q	18,800	372
Kabul	P	39,500	790
Kupisa	P	24,400	488
Nangarhar	P	56,900	1,138
Paktia	P	47,800	956
Parwan	P	27,500	550
		<u>722,100</u>	<u>14,442</u>

PHYSICAL DEMAND FOR TRACTORS

Table 1.0 shows that given prewar cultivated acreage and assuming coverage of 50 HA./year @ 45 H.P. tractor, 14,442 tractors are physically required in the 16 provinces targeted by AASSP.

However, considering that one-half the Afghan population are either external or internal refugees and that 500,000 oxen have been killed, how much of the pre-war acreage is currently under cultivation?

Reviewing the data presented in the ASA records, I see that average farm size in the 16 AASSP provinces has declined from 18.26 jeribs (1978) to 6.66 jeribs in 1987. (Table 2.0) Therefore current farm size is only 36% of prewar levels. Again considering that perhaps one-half the population are either external or internal refugees and that 40% of the oxen herd (traditional farm power source) have been killed, it is estimated (Dr. Gul and Dr. Saari) that land currently under cultivation would be 66% of prewar levels or approximately 476,586 HA. currently under cultivation in the sixteen target provinces.

Given coverage of 50 HA./year for 45 H.P. tractors, then 9,532 tractors are physically required to cultivate the acreage currently under cultivation in the 16 target provinces. Spread over three years equates to 3,177 tractors per year. Total value of 9,532 tractors at current Millat prices equals \$74,734,460.00 @ RS 21.30 = 1 USD.

TABLE 2.0
AVERAGE FARM SIZE AND DISTRIBUTION
Sixteen Target Provinces

Province	1978/Jeribs	1987/Jeribs	Distribution	
			Jeribs	#Prov.
Kandahar	36.02	27.11		
Ghazni	31.93	19.43	0 < 2	2
Kunar	8.39	1.93	2 < 4	7
Paktika	11.91	2.67	4 < 6	4
Helmand	47.32	13.25	6 < 10	0
Zabul	27.99	5.13	10 < 15	1
Laghman	5.31	2.33	> 15	2
Lowgar	14.44	4.46		
Wardak	8.71	3.12		
Urzghan	37.78	n/a		
Bamyan	10.07	5.37		
Kabul	13.55	2.50		
Kapisa	7.23	2.45		
Ningrehar	11.58	3.72		
Paktia	12.34	4.20		
Parwan	7.48	2.16		

Average Farm Size in 1978 for the sixteen target provinces was 18.26 jeribs. In 1987, average farm size had dropped to 6.66 jeribs, 36% of prewar average farm size.

There are 5 jeribs to one HA. and two jeribs to one acre. Modal value for farm size of the sixteen provinces shows to be between two and four jeribs. Statistics in table 2.0 from the Swedish ASA.

TABLE 2.1

AVERAGE NO. OX PER FAMILY
Farmers who Stayed in 1987

<u>Province</u>	<u>1978</u>	<u>1987</u>	<u>Net Change</u>
Kandahar	1.64	0.20	-1.44
Ghazni	1.27	0.36	-0.91
Kunar	1.49	1.33	-0.16
Paktika	1.20	0.51	-0.69
Helmand	0.68	0.22	-0.46
Zabul	1.32	0.21	-1.11
Laghman	1.21	1.14	-0.07
Lowgar	1.58	1.04	-0.54
Wardak	1.40	0.92	-0.48
Urzghan	n/a	n/a	n/a
Bamnyan	1.52	1.08	-0.44
Kabul	1.88	0.88	-1.00
Kapisa	1.79	1.61	-0.18
Ningrehar	1.52	1.25	-0.32
Paktia	1.61	0.83	-0.78
Parwan	1.09	0.52	-0.57

Table 2.1 shows that the average number of ox has declined from 1.4 per family in 1978 to .81 ox per family in 1987. In other words, the average number of ox per family is 58% of pre-war levels for the sixteen provinces. Statistics from Swedish ASA.

EFFECTIVE DEMAND FOR TRACTORS

Discussions with the Peshawar MF dealership revealed that Afghans have purchased four or five MF 240's over the past six months. The Fiat dealer in Peshawar reports the same results. Extrapolating this for the year yields cash sales of between 16 to 20 tractors (45 H.P.) to private Afghans. In addition the MF dealer reports cash sales of twelve Chinese 12 H.P. tractors in the past year for RS. 38,000 each. The Fiat dealer reports cash sales of approximately eight Mitsubitshi 20 H.P. tractors to private Afghans over the same time frame.

Mr. Haji Emayatullah requested in a letter to DAI/Peshawar to assist him in importing \$200,000 worth of spare parts from Massey Ferguson of the United Kingdom. \$200,000 worth of spares for Millat (MF) tractors is about twice the required inventory of parts maintained by Millat dealerships in Pakistan.

According to Mr. Bob Haskel and Mr. Weiss (DAI/Peshawar) , wheat is currently selling, depending on location, in Afghanistan for 10,000 Afs/100 kgs or \$0.21/kg @ 472 Afs = 1 USD.

Table 1.2 was developed from estimates of current wheat yields and expected wheat yields from a package of improved seeds, fertilizer and irrigation with the perspective of four probable crop rotations. Total value from cultivation of one Hectare of irrigated land was calculated using current prices. However, prices fluctuate widely in Afghanistan depending the time of year, transportation costs, quality of material and specific area. The prices for maize, rice and cotton were graciously supplied by Dr. Azam Gul (Swedish Committe) based on his considerable knowledge and experience.

According to PARC/CIMMYT paper No. 89-3, 1989, the cost of harvesting, threshing and marketing wheat in the Punjab accounts for 30% of total returns.

Table 1.3 shows 10% profit levels for production of one irrigated hectare in probable crop rotations. With current yields for wheat in a wheat/maize/wheat rotation, producing #1 quality maize, (rotation I.a.) 10% profit on one hectare (five Jeribs) is estimated to be \$105 or RS.2,237. Profits from this rotation could possibly range between \$100 (10%) to \$200 (20%) per rotation.

Once the improved seed package (rotation Ic.) impacts the farmer then profits could range between \$180 (10%) and \$360 (20%) per rotation. This would equate to approximately RS.3,900 to RS.7,800 per rotation.

Rotation II., wheat/rice/wheat, yields the highest values per Hectare but is difficult to achieve, according to Dr. Gene Saari (CIMMYT Consultant to DAI). This is due to the tight harvest/planting window and the far greater amounts of labor required to prepare and plant rice. Also, only areas that have the better soils for rice, water retention capabilities and plentiful supplies of water can take advantage of this possible rotation. Land leveling equipment and improved irrigation systems could increase the potential for this rotation. With the improved package (rotation IIb.) profits per hectare could range between \$300 (10%) to \$600 (20%) per rotation.

Rotation III, wheat/melons or vegetables/wheat, shows potential with the use of the improved seed package, but the range of profit potential would depend on the melon/vegetable grown and the market price at that time. Similarly, rotation IV., Cotton/wheat/summer vegetable, would depend heavily on the vegetable grown and market conditions at the time of harvest. Market information and forward contracting would greatly aid farmers utilizing rotations III & IV.

Table 2.0 shows average farm sizes for the sixteen target provinces for 1978 and 1987 and the distribution of those farm sizes. Average farm size has declined from approximately 18 jeribs (3 hectares) in 1978 to just 6.6 jeribs in 1987. The provincial distribution of these sizes points out that a typical size farm (modal value) ranges between two to four jeribs.

Table 2.1 depicts the net change in numbers of oxen per family for those who remained in Afghanistan in 1987 against the average number of oxen per family in 1978. For the sixteen provinces, average oxen per family has declined by 0.61. As could be expected some provinces suffered worse than others, however when viewed with the decline in farm size over the same period, a serious shortage of farm power exists.

On the positive side, as conditions improve inside Afghanistan and increasing farm power and improved tools begin to impact the typical farmer, average farm sizes should begin to increase. Clearly this would put more effective purchasing power into the farmers hands, enabling him to purchase additional farm inputs.

Viewed from this economic perspective, custom tractor services, tillage, planting, reaping and threshing would appear to be the only economically viable vehicle to providing full-sized tractor services to the majority of Afghan farmers.

SMALL ENGINE POWERED TILLERS AND REAPERS

Small engine powered tillers (4-6 H.P. Diesel) of IRRI design have many positive attributes. The machine plows, cultivates, reaps, transports and can be used to power water pumps. Costs are far less than the full-sized tractors and implements. The single most expensive input in its manufacture is the engine. An 8 H.P. diesel engine costs approximately RS. 11,500 in Peshawar bazaars and I am getting a quote on a quantity from Tariq Rangoonwala in Karachi. Figuring another RS. 10,000 to construct the rest of the machine, total costs would be around RS. 21,000. Calculating yearly payment based on eight year payout and simple interest on the declining balance @ 15% yields a first year payment of RS. 5,775 or \$271.12 @ RS.21.30 = 1 USD.

Contrasting this payment estimate against the estimated discretionary income (Table 1.3, rotation Ic) from a typical small wheat farmer (\$186.) shows a shortfall of \$85.00. This is very close, economically, and two farm families, however, pooling their resources could reasonably purchase such a machine.

Mirza Mohammad Younas, Managing Director of UNITED AGGRO ENGINEERS of Daska, and Sawar Ghazi, Partner, GHAZI INDUSTRIES ltd., of Mian Channu have stated their willingness to cooperate with DAI in the manufacture and sale of these small engine tillers to the Afghan market through the trade centers. M. Younas is currently negotiating with another Pakistani firm to produce such machines and has looked into the IRRI designs in the past.

Sawar Ghazi of Ghazi Industries stated that he and his brothers worked with USAID and IRRI back in the sixties to develop a power tiller for the Pakistani market. Although the Pakistani market did not accept the smaller machines, Ghazi industries has experience in this field.

ANIMAL PULLED IMPLEMENTS

GHAZI INDUSTRIES of Mian Channu developed a line of bullock pulled implements back in the sixties in conjunction with USAID. Today they are still producing a "Raja" plow for RS.250 and a three tine cultivator for RS. 250. Although they no longer make animal pulled wheat drills, Sawar Ghazi stated they could easily manufacture these items once again. Sawar quoted Rs. 3,000 for a wheat or cotton drill with fertilizer attachment and RS. 2,000 without the fertilizer attachment. Photos of the models are in the file.

According to Tom Morrison, Director of AGRISYSTEMS, improved animal harness designs can be provided by Mr. Louis Renner of UNDP, recently arrived in Peshawar.

Clearly, for farmers who still own oxen or can borrow one, these inexpensive implements are easily within financial reach.

MAN PUSHED IMPLEMENTS

At the present time improved man pushed or pulled implements are not manufactured in Pakistan. However, M. Younas of UNITED AGGRO ENGINEERS of Daska did try to manufacture and sell IRRI designed, man pushed seeders, cultivators and reapers back in the sixties. Although these tools did not catch on in Pakistan, M. Younas states that he would be happy to cooperate with DAI along these lines. He could not give me an exact price quote at that time due to the time elapsed since he made these items, he did state that they would be less than RS 1,000 per copy. Here again, the price of these implements would be in reach of the small Afghan farmer.

IMPROVED HAND TOOLS

Consultations with Dr. Wakil (VITA) revealed that Afghan farmers greatly desire high quality hand tools. Long handled shovels, irrigating and weeding hoes, rakes, sycles, mattocks, pruning shears (and pruning sealer) and wheelbarrows are the most important and desired tools. Long handled shovels can be purchased in lots of six from SEEDBURO (please see files) for 12.50 each. Other hand tools can be purchased through SEEDBURO or other suppliers in the USA in the same price range. Clearly these are in the price range of most Afghan farmers. If hand tools of comprable quality are not availble (please see recommendations), then tool orders could be placed through Tariq Rangoonwala.

TABLE 1.1

INCOME MATRIX FOR MAJOR CROPS IN AFGHANISTAN

<u>CROP</u>	<u>AFS/KG</u>	<u>KG/HA.</u>	<u>AFS/HA.</u>	<u>USD/HA.</u>	<u>RS/HS.</u>
Wheat	100	900^	90,000	191	4,047
Improved	---	2,800	280,000	596	12,662
Rice #1	393	2,450	962,850	2,040	43,452
Maize #2	71	1,838	130,463	276	5,887
Maize #1	171	1,838	314,213	666	14,180
Cotton	79*	385	30,261	64	1,369
Ginned	286	---	110,110	233	4,969

* Unginned.

Note: Table was constructed from Statistics provided by Dr. Azam Gul (Swedish Committe), Dr Gene Saari (CIMMYT consultant to DAI) and Bob Haskell, (DAI). ^ Current wheat yields range between 800 Kgs./HA. to 1,100 Kgs./HA..

TABLE 1.2

USD ESTIMATED VALUE PER HA.
FOUR CROP ROTATIONS
IRRIGATED FARMS - AFGHANISTAN

<u>Rotation</u>	<u>Crops</u>			<u>Total Value</u>
I.	Wheat	Maize	Wheat	
Curr.Yield	\$191	\$666	\$191	\$1,048.00
		\$276		\$ 658.00
Imp. Seed	\$596	\$666	\$596	\$1,858.00
		\$276		\$1,468.00

II.	Wheat	Rice*	Wheat	
Curr.Yield	\$191	\$2,040	\$191	\$2,422.00
Imp. Seed	\$596	\$2,040	\$596	\$3,232.00

III. Wheat / Melon*/ Wheat
 Curr. Yield \$191 ? \$191\$ 382.00+?
 Imp. Seed \$596 ? \$596\$1,192.00+?

IV. Cotton*/ Wheat / Veg*
 Curr. Yield \$233 \$191 ?\$ 424.00+?
 Imp. Seed \$233 \$596 ?\$ 829.00+?

* Notes: Two prices for maize, #1 quality and #2 Quality. Price for cotton is the ginned price, no deduction for ginning. Summer vegetables or melons can be grown, prices vary per season and area.

Imp. Seed refers to the expected yields from Dr. Gene Saari's package on irrigated farms.

TABLE 1.3
ESTIMATED PROFIT LEVEL
FOUR CROP ROTATIONS
FOR ONE IRRIGATED HA. - AFGHANISTAN

Rotation	Total Value	10% Profit	RS. Value
I.	a. \$1,048	\$105	2,237
	b. \$ 658	\$ 67	1,427
	c. \$1,858	\$186	3,962
	d. \$1,468	\$147	3,131

II.	a. \$2,422	\$242	5,154
	b. \$3,232	\$323	6,880

III.*	a. \$ 382	\$ 38	809
	b. \$1,192	\$119	2,535

IV.*	a. \$ 424	\$ 42	895
	b. \$ 829	\$ 88	1,874

* Note: Figures do not include revenue from melons or summer vegetables in the rotation. Again Ginning Costs not reflected.

PHYSICAL DEMAND FOR THRESHERS

Table 3.0 shows estimated physical requirements for threshers in Afghanistan for three different wheat yield and area scenarios. Scenario I assumes that cultivatable acreage is 66% of pre-war area (GUL & Saari) coupled with current wheat yields of around 900 kg/HA.. Scenario II assumes the cultivatable area as above but coupled with the expected yields from the improved seed package. Scenario III assumes pre-war area and the yield from the improved seed package.

Utilizing Pakistani manufactured threshers with threshing capacities of one-ton per hour, scenario I. would require 1,191 machines operating 12 hours per day for 30 days to thresh the estimated wheat output from the sixteen target provinces.

Power-Take-Off (PTO) powered threshers of this size sell for approximately RS.30,000, thus the total value of the threshers required under the above assumptions would total \$1,676,928. Utilizing self-powered threshers (30 H.P. Diesel engines) jumps the price to RS. 60,000 per machine for a total value of \$3,355,047.

As one might expect, as wheat yields and hectares under cultivation climb under scenarios II and III, the number of threshers required jumps dramatically (please see table 3.0).

Table 3.1 utilizes the same yield and area assumptions as above but calculates the number of threshers required on the basis of machines with threshing capacities of one-half ton per hour. Under the minimum scenario, 2,382 threshers would be required to thresh the entire wheat crop with the machines operating 12 hours per day for 30 days. The total value for this scenario is \$3,689,718. Under senario III. the number of threshers rises to 11,232 for a total value of \$17,398,368.

It is interesting to note that while the total values of the threshers required under senario I for self- powered one-ton and the self-powered one-half ton machines is approximately the same, the total value of the PTO powered machines required to perform the same work is less than half.

TABLE 3.0
ESTIMATED PHYSICAL THRESHER DEMAND
AFGHANISTAN

Estimates based on threshers of One Ton Capacity per Hour.

Output Senario	No. Threshers Required	USD value/PTO Drive @RS. 30,000	USD value/w/30HP Diesel @RS. 60,000
I.	1,191	\$1,676,928	\$3,355,047
II.	3,707	\$5,219,456	\$10,442,619
III.	5,616	\$7,907,328	\$15,820,272

TABLE 3.1
ESTIMATED PHYSICAL THRESHER DEMAND
AFGHANISTAN

Estimates based on Threshers of One-Half Ton Capacity per Hour.

Output Senario	No. Threshers Required	USD value @ RS. 33,000 Self-powered w/ 12 HP Diesel
I.	2,382	\$3,689,718
II.	7,414	\$11,484,286
III.	11,232	\$17,398,368

Note: Senario I is based on estimated current HA. under cultivation at 66% of pre-war HA. in the sixteen target provinces and estimated current yields for wheat. Base statistics provided by Dr. Gul (Swedish Committe) and Dr. Gene Saari (CIMMYT consultant to DAI), 1990.

Numbers of threshers physically required based on the above threshers working 12 hours for 30 days. Therefore, Tables 3.0 and 3.1 indicate number of threshers required to thresh the entire wheat crop in 30 days.

Senario II is based on expected yields provided by the improved seed, fertilizer and irrigation package being recommended by Gene Saari with HA. at 66% of pre-war levels.

Scenario III is based on the expected yields from the improved package and assuming pre-war HA. under cultivation.

EFFECTIVE DEMAND FOR THRESHERS

The constraints facing, at least initially, the use of one-ton capacity threshers driven by tractor PTO's are formidable. Tractors are very scarce resources in Afghanistan with less than 10% of pre-war farmers either owning or renting tractor services. In the context of the very short harvest/planting window in Afghanistan, tractors are viewed as having far higher value preparing the land for the next crop as opposed to utilizing its ability to drive threshers with the PTO. One-ton capacity threshers in Pakistan are designed to operate off 45 H.P. tractors and would require a 30 H.P. diesel engine or a 25 H.P. electric motor to operate properly. The price of the self-powered one-ton thresher is approximately RS. 60,000. Additionally, the machine weighs a great deal and therefore would require a tractor or jeep/truck to move locations.

Half-ton capacity threshers have the advantages of being lighter, around 110 kgs (two or three men could transport) and when equipped with a 12 H.P. diesel engine, cost approximately RS.33,000 (\$1,550). Based on an eight year payout with 15% simple interest on the declining balance the first years payment on such a machine would be RS. 9,075 (\$426.00). Referring to table 1.3, farmers using rotation Ic. and II would be potential purchasers, especially those with more than 15 jeribs or farmers who could pool their thier resources.

Once the threshing season is over, the farmer could use the diesel engine to power a pump, fodder chopper, flour mill, generator or any other machine requiring a remote power source.

RECOMMENDATIONS

- o Send letters to the manufactures on the short list thanking them for their cooperation and interest in participating in our trade centers. Also state that they will receive proper advance notice of the centers becoming operational.
- o Contract with Dr. S. Iqbal Ahmad, Director of the Agribusiness Cell at PARC for a farmer day demonstration in Peshawar of PARC's improved hand tools and animal pulled equipment. If the improved hand tools are not satisfactory, then arrangements should be made to supply improved hand tools through Tariq Rangoonwala in Karachi, either chinese or American made. Mr. Rangoonwala will cooperate with DAI in any way possible.
- o Purchase two one-half ton capacity threshers from Sargroh of Lahore for testing and demonstration purposes. These are self-powered using a 12 H.P. diesel engine. Cost, ex-factory, is RS.33,000. Contact Ms. Teressa Day in Islamabad or Lahore.
- o Contact IRRI in the Philippines and acquire blueprints for their power-tiller, cultivator and reaper. Also ask for any blueprints they have on man-pushed seeders, cultivators, reapers and man-operated threshers. Purchase three power-tillers with cultivator and reaper attachments either from IRRI or a manufacturer they recommend in the Philippines. Also acquire IRRI's blueprints for their one-half ton thresher and purchase two models.
- o Contact UNITED AGRRO ENGINEERS of Daska, Punjab and place an order for a set of his man-powered cultivator, seeder and reaper for testing and demonstration. Also, UAE is one of my choices to manufacture the IRRI tiller equipment.
- o Contact GHAZI INDUSTRIES of Mian Channu, Punjab and order his bullox pulled plow, cultivator and seeder for testing. Ghazi can also manufacture the IRRI equipment. Also order two of their wheelbarrows for testing.
- o Prepare a catalog of machinery to be offered at the trade centers. Distribute catalogs through the 12 target bazaars.
- o Prepare demonstration videotapes explaining the benefits to the farmer from the various kinds of machinery. Also to demonstrate proper farm methods, operation, maintenance and safety.
- o Prepare and distribute (in the target bazaars) booklets that outline modern farm methods and basic economics of farming and basic record keeping.

- o Provide transportation assistance, physical or monetary, to purchasers of machinery for shipment into Afghanistan.
- o Explore with relevant Pakistani officials a proposal to have the trade centers declared "Tax-free Export Zone". Pakistani taxes include: Sales tax is 12 1/2%, Icara (education) tax is 7% and Octroi is 1%. Therefore, having the Trade Centers declared tax-free export zones would reduce the cost of machinery by approximately 20%.
- o Explore possibilities of importing, through Millat, fully reconditioned and warranted MF-240's from Massey of U.K., according to correspondence, this would reduce the price of a 240 by 40%. Aaron Jones, MD Massey U.K., suggested offering the GOP 5% of the value as consideration for above.
- o Once sales of tractors begins, recruit Afghans willing to become tractor mechanics and either train them at the trade centers (Millat will send teams out) or have them trained on the line at the Lahore plant.
- o Sikander Khan and Sohail Bashir Rana of Millat have stated that Millat will provide set of tools and package of high volume spare parts to graduate mechanics at cost. Project could underwrite part of the tools and parts costs to trusted Afghans. Please see file for Bashir's letter outlining Millat's interest.
- o Recruit, through the target bazaars and camps, Afghans willing to become spare parts and equipment dealers. Project should consider providing vetted applicants with some level of inventory credit to start-up shop. Provide training in record keeping to applicants.
- o Establish Currency Window at trade centers to exchange Afghans for Rupees to be used to purchase machinery. Exchange rate can be set to give the Afghani higher value against rupee to strengthen purchasing power of the Afghans. Only for Afghans and the premium could be rebated once equipment passed through target bazaars.
- o Prepare inventory lists for each supplier at the trade center to insure proper coverage of machinery and to manage duplication of inventories.
- o Provide participating (TC) manufacturers with inventory credit for 90 days. Once sales start, inventory credit can be withdrawn. Provide transportation rebates to participating manufacturers for equipment shipped to TC's.

- o Manufacturers on the recommended list have all stated their willingness to provide training for Afghans who purchase machinery. If additional training is required then project should contact the PAK-GERMAN TRAINING INSTITUTE just outside of Multan, Punjab.
- o Project should establish and operate a MARKET INFORMATION SERVICE to provide regular farm reports concerning prices, commodity trading activity at the 12 bazaars, transportation costs between key points, events at the trade centers, weather reports and forecasts if obtainable and information on market outlets (buyers). Radio broadcasts are a natural and periodic leaflets can be distributed in the 12 bazaars.
- o Project could offer transportation to and lodging subsidy (small) for Afghans who wish to purchase equipment at the trade centers.
- o Project should recruit Afghan entrepreneurs, demonstrate the economics of custom agricultural services, threshing and full line of tractor services to stimulate the formation of custom tractor service firms in Afghanistan.
- o Project should recruit Afghan to become commissioned sales agents for the manufacturers at the trade centers.
- o To "kick-off" the opening of the Machinery offices at the trade center, a "Grand Opening" should be arranged and publicized in the Afghan communities in Peshawar and Quetta. Free food and beverage would ensure a strong turn-out, as would having free buses transport interested farmers from the camps.
- o Project should recruit Afghan entrepreneurs and demonstrate the economics of forward contracting (not Loansharking!) to stimulate the formation of such enterprises and thereby stimulate the Afghan farm sector. This would be especially helpful with the marketing of summer vegetables and melons.

These recommendations have been formulated to present the widest possible array of farm machinery, equipment, services and opportunities to the Afghan market by minimizing basic costs of information, access, training and transportation. In the final analysis, competitive forces of the open market place will determine the future machinery and equipment mix utilized by Afghanistan's agricultural sector.

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