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Note: This paper is intended as a working draft for discussion. The author would welcome comments, corrections and suggestions.

Discussion Paper No. 8

**FORMULATING A CONSISTENT STRATEGY TOWARD
ON-FARM LAND DEVELOPMENT IN TURKEY**

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SUMMARY

Two separate and potentially conflicting strategies have developed toward on-farm water development in Turkey. The one in use within State project areas - most notably Seyhan and Gediz - features government financed, government executed on-farm development. The other developed primarily outside State Project areas in the Izmir area centers around farmer financed, private contractor executed on-farm development.

The growth of the force account strategy and increasing concentration on Seyhan and Gediz has left Topraksu few resources for other activities and projects. In the 4 years 1968-1971 80% of all Topraksu irrigation development investment went to these 2 projects. Ironically it was in part the lack of Topraksu resources in Izmir that led to the creation of the alternative strategy of farmer-financed contractor-executed development.

While the "Seyhan strategy" has proved effective in bringing rapid on-farm development to selected projects, this approach irrevocably links to the size of the Topraksu budget the amount of development that can occur. While increasing the size of that budget from 21% to one-third of the total agricultural investment budget might permit more than doubling Topraksu's equipment pool, the backlog of 400,000 hectares of undeveloped land in State Project areas would continue to grow. Moreover, this approach does nothing toward the development of the million or so hectares of irrigated land outside State Project areas i.e. nearly twice as much land as is inside. Since the Izmir strategy uses not general budget revenues - but the increased income due to development - to finance land development, there is no ceiling on development as there is under the Seyhan approach.

A comparison of the two strategies reveals other key differences:

1. Returns on government investment (as opposed to total investment) are far higher under the Izmir strategy. Since a shortage of lira has sharply curtailed government investment, this is an important consideration.
2. The right combination of machinery currently used in Izmir can do many of the same jobs in the same time at less cost than the heavy imported equipment in Seyhan.
3. The Izmir approach creates more opportunities for both employment and entrepreneurship than does the Seyhan.
4. The Izmir strategy does not increase income inequality as sharply as does the Seyhan approach since in Izmir the beneficiaries of development pay the cost. In the period 1966-1970 half of the levelling in Seyhan went to 152 farmers. This government investment has added on the average about TL 766 thousand to each farmer's annual income. For the 23 largest farmers, government investment has increased annual average income per farmer by over TL two million.

When the Seyhan project was undertaken, on-farm land development was a new and unproved concept. No demonstrable alternative to the force account strategy existed. Indeed, there were neither land development contractors nor domestic land shaping equipment. However, a field tested alternative now exists with many advantages to commend it. Since in many respects the two strategies are mutually incompatible there is an urgent need to formulate a consistent national strategy toward on-farm land development, one embodying the best elements of two proven alternative strategies. This paper suggests that two key elements of such a strategy should be breaking the link which ties the pace of land development to the size of the Topraksu budget and removing existing barriers to the creation of a strong private sector land-development capacity. A program to provide credit to the farmer appears to be a key requirement of such a strategy.

FORMULATING A CONSISTENT STRATEGY TOWARD
ON-FARM LAND DEVELOPMENT IN TURKEY 1/

I. TWO STRATEGIES FOR ON-FARM LAND DEVELOPMENT

One of the priority development problems of Turkish agriculture as identified by both the Government of Turkey and outside donors such as the World Bank is the large gap which exists between land where primary water delivery systems have been completed and the far smaller amount of land for which the tertiary, quaternary and on-farm works have been completed. Therefore a key development objective is completing the distribution systems, the land-leveling, drainage, etc. needed to use effectively all the water which can already be made available through the primary irrigation systems.

In effect there are two different systems of irrigation in operation. One of these systems comprises the state developed irrigation works and the other the privately developed irrigation works which, generally speaking, are considerably smaller in size.

1/ On-farm land development as used in this paper includes leveling, drainage and similar works falling under the authority of Topraksu (Soil and Water Directorate). Levelling is by far the most important element.

Of the total irrigated land in Turkey, approximately one-third is under state water command and the remaining two-thirds is outside of state water projects. The approach to farm level irrigation development under the two systems has been quite different although both are generally supervised by Topraksu. A previous paper has described some of the key differences between the two systems. 1/

In contemplating the objective of speeding farm level development to make full use of available irrigation water, it is useful to examine what has been happening under the two systems. Such a study can assist in the formulation of a strategy efficiently and effectively to capture the full potential of the already existing large irrigation investment.

Within the state project areas the approach to date has been to finance most if not all on-farm development activities through the governmental (Topraksu) budget. For present analytical purposes it makes little difference whether the work is carried out by private contractors or by the state since the key constraint on the speed of development is ultimately the size of Topraksu's budget. 2/

1/ Charles K. Mann, Government of Turkey's Policies Relative to On-Farm Land Development, Discussion Paper No. 4, USAID/Turkey.

2/ It should be noted, however, that the private sector has a far higher equipment utilization rate, thus for any given budgetary allocation, private contractors should be able to develop a larger area.

Obviously if the budget could be expanded indefinitely other constraints would develop such as insufficient numbers of trained personnel, lack of equipment, etc., but in any event under the present arrangements, it is impossible to expand the pace of development beyond what Topraksu's budget can cover. Under the private system in effect outside state project areas this limitation does not exist since individual farmers pay the cost of the on-farm development although in many cases the engineering work, etc. is done by Topraksu. Here there are other constraints as will be discussed later.

Several aid donors have devoted major attention to attempting to close the gap between actual and potential irrigated land. The World Bank has focused its effort in speeding the pace of development on expanding Topraksu's machinery capacity for use within the state project areas. AID's primary emphasis to date has been on strengthening both Topraksu and the private sector's capacity to carry out on-farm development work in areas outside the state project areas. In the sense that AID's efforts have focused on land outside state project areas and the Bank's on land inside, the two approaches have been complementary although quite different in general strategy. Topraksu has recently expressed an interest in AID financing for heavy equipment to expand its force account capability. Doing so would represent a considerable shift in AID's philosophy toward on-farm development, and thus it seems appropriate to examine in some detail the results

of the two general approaches. Such an analysis can assist in formulating a consistent and comprehensive strategy toward speeding land development.

A. The Government Financed Force Account Strategy (Seyhan)

The pending AID proposal by Topraksu and both on-going and proposed IBRD projects involve an expansion of Topraksu's force account capacity (ie: Topraksu owned equipment). Therefore, it seems appropriate to begin the analysis with an examination of what has been happening under that approach. In general since this approach has been confined to state project areas (irrigation works developed by the state), generally those works developed by DSI, the analysis will focus on those areas.

A logical starting point for the analysis is to examine the changes that have occurred in Topraksu's budget over the past few years under the force account expansion approach. The changes in the budget over the period clearly reflect the decision to adopt this approach to land development and the general policy of using government revenues to finance such development. As Table I shows, the budget has roughly doubled from 1965 to 1971. In absolute terms, the amount of TL committed to irrigation development remained roughly constant at about TL 60 million through 1970 when it increased to TL 72 million. In 1971 it rose sharply to TL 130 million. Reflecting the force account machinery build up, the resources devoted to machine and equipment has risen from TL 10 million in 1965 to TL 85 million in 1971. Over the same period, investment in small water projects has fallen from TL 54 million in 1965 to TL 39 million in 1971.

TABLE: I

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TOPRAKSU INVESTMENTS

<u>YEARS</u>	<u>TOTAL</u>	<u>IRRIGATION DEVELOPMENT</u>	<u>SMALL WATER PROJECTS</u>	<u>DRAINAGE AND LAND REC.</u>	<u>SOIL PROTEC. & WATER SHED</u>	<u>VEHICLE-MACHINE AND EQUIPMENT</u>	<u>SOIL AND WATER COOPERATIVES</u>	<u>RESEARCH-STUDIES & PROJECT PREPARATION</u>	<u>BUILDING-MAPPING REVOLVING FUND AND OTHERS</u>
<u>A. IN TL 1000's</u>									
1965	175.6	65.3	53.9	16.9	22.3	10.0	-	-	7.2
1966	197.0	59.3	54.8	13.2	15.1	17.8	14.0	20.0	2.8
1967	229.7	37.0	79.1	12.7	11.8	37.5	20.0	24.5	7.4
1968	280.6	61.9	66.6	12.9	8.6	62.6	36.2	24.6	7.3
1969	291.3	61.9	73.6	13.1	9.1	41.3	49.4	29.5	13.4
1970	282.4	81.1	47.7	7.3	6.8	65.9	29.9	31.7	12.0
1971	365.0	130.5	38.8	4.4	4.4	85.6	55.7	41.8	4.9
<u>TOTAL</u>	1.822.6	497.0	414.4	80.2	78.0	320.7	205.1	172.1	55.0
<u>B. IN PERCENTAGE</u>									
1965	100	37.2	30.7	9.6	12.7	5.7	-	-	4.1
1966	100	30.1	27.8	6.7	7.6	9.0	7.1	10.1	1.4
1967	100	16.1	34.5	5.4	5.1	16.3	8.7	10.7	3.2
1968	100	22.1	23.7	4.6	3.1	22.3	12.9	8.8	2.6
1969	100	21.3	25.3	4.5	3.1	14.2	16.9	10.1	4.6
1970	100	28.7	16.8	2.6	2.4	23.3	10.6	11.2	4.2
1971	100	35.7	10.6	1.2	1.2	23.4	15.2	11.4	1.3
<u>TOTAL</u>	100	27.2	22.7	4.4	4.1	17.6	11.3	9.4	3.0

SOURCE: SPO, ANNUAL PROGRAMS

Soil protection and watershed investment has dropped from TL 22 million to TL 4 million over the same period, while drainage and land reclamation has dropped from TL 17 million to TL 4 million. Soil and water cooperatives, a non-existent category in 1965, have grown to TL 56 million over the period. Much of the work funded in this category is for small water projects done by cooperatives with help from Topraksu.

Perhaps the changes which have occurred can be seen most clearly by expressing the amount of TL budgeted on each category in 1971 as a percentage of that budgeted for the same category in 1965.

Table II below shows the results of these calculations.

TABLE II	Topraksu:	Budget line items: 1971 compared to 1965		
		TL MILLIONS		INDEX 1965=100
		1965	1971	1971
	Irrigation development	65.3	130.5	200
	Machines and equipment	10.0	85.6	856
	Small water project	53.9	38.8	72
	Soil protection and watershed	22.3	4.3	19
	Drainage and reclamation	16.9	4.3	25
	Soil and water cooperatives	- 1/	55.7	-
	Research, studies and project preparation	- 1/	41.8	-
	Other	7.2	4.9	-
	TOTAL	175.6	366.0	208

1/ These categories were not separately identified in 1965

Having traced the changes over time, in assessing the impact of this policy it is necessary next to examine the geographic distribution of irrigation investment, the category under which most on farm development is funded. ^{1/} Table III shows only the 7 largest projects since the share of others in the total is negligible. The Seyhan project has received the bulk of the investment with its share ranging from a low of 23% in 1966 to a high of 62% in 1968.

As activity has increased in Gediz, its share has grown to around 30%. The next single largest item is all the investment in Konya province which accounts for 4% of the seven year total. Taken together, for the most recent 4-year period 1968 - 1971, Seyhan and Gediz account for 80% of all Topraksu irrigation development investment. This regional concentration has resulted from a policy decision by Topraksu, the IBRD and the European Investment Bank to focus on realizing the productive potential of these two large projects as rapidly as possible.

1/ While similar data is not readily available to permit geographic distribution of the machinery category it is reasonable to assume that it parallels the distribution of the irrigation development category. If anything, machinery investment is probably more geographically concentrated.

TABLE III

GEOGRAPHIC DISTRIBUTION OF TOPRAKSU
IRRIGATION DEVELOPMENT: 1965-1971

<u>YEARS</u>	<u>IRRIGATION DEVELOPMENT</u>	<u>(Seyhan) ADANA</u>	<u>(Gediz) MANİSA</u>	<u>(Çivril) DENİZLİ</u>	<u>İÇEL</u>	<u>KONYA</u>	<u>ANTALYA</u>	<u>TOKAT</u>
<u>A. IN TL 1000's</u>								
1965	65.3	23.3	2.2	1.5	5.9	3.7	1.9	-
1966	59.3	13.5	2.5	2.2	2.9	2.6	-	-
1967	37.0	18.0	5.0	-	1.6	-	3.0	1.0
1968	61.9	38.6	10.9	-	-	-	-	1.9
1969	61.9	28.5	23.7	-	-	3.9	-	2.0
1970	81.1	49.0	23.9	-	-	3.2	-	0.9
1971	130.5	55.8	38.0	-	-	4.9	-	-
<u>TOTAL</u>	497.1	226.7	106.2	3.7	10.4	18.3	4.9	5.8
<u>B. IN PERCENTAGE</u>								
1965	100	35.7	3.4	2.2	9.0	5.7	2.9	-
1966	100	22.8	4.2	3.6	4.8	4.4	-	-
1967	100	48.6	13.5	-	4.4	-	8.1	2.7
1968	100	62.4	17.5	-	-	-	-	3.1
1969	100	46.0	38.2	-	-	6.3	-	3.1
1970	100	60.4	29.5	-	-	3.9	-	1.1
1971	100	42.8	29.1	-	-	3.8	-	-
<u>TOTAL</u>	100	45.6	21.4	0.7	2.1	3.7	1.0	1.2

SOURCE: SPO, ANNUAL PROGRAMS

To guarantee the land development requisite to full production, the government has financed it and in most cases done it on force account. In the sense that there is no major lag in land development in these two projects, the policy has been successful.

B. The Private Investment Strategy (Izmir)

As is apparent from the shifts over time in budgetary allocations, Topraksu's policy of concentration has left the agency few resources for other projects. Thus when Topraksu and AID in 1968 set out to speed the pace of on-farm development outside the major state project areas, the undertaking was predicated on the non-availability of significant Topraksu resources. This was in contrast with the IBRD and European Investment Bank (EIB) undertakings which were predicated on being able to command whatever was needed of Topraksu's budgetary resources. Not surprisingly, a very different strategy of development emerged under the Topraksu/AID approach. This approach, presently confined to the Izmir region, was to have Topraksu provide technical assistance to farmers outside state project areas for planning the improvement of his land. The farmer himself would then finance the actual land improvement.

Many problems confronted the small team of Topraksu engineers and AID technicians assigned to implement this strategy. First, most of the equipment for improving land by leveling, drainage, small

channels, furrowing, and cultivating had been assigned to Seyhan and Gediz as had most of the trained engineers and technicians. Second, uniform standards and guides for planning and designing soil and water management practices did not exist for this area nor did detailed information on the nature and characteristics of the soil. Third, private contractors for doing the needed type of work were generally not available. Lastly, the fabricators of farm machinery were not producing any of the specialized types of equipment needed for this work.

The approach to resolving the above problems was first to design types of equipment which could be operated with the smaller horsepower tractors owned by farmers and which would not require a long training period to learn how to operate. (It takes about 90 days full-time to train an operator for a large caterpillar D-7 or equivalent unit.) The equipment was to be relatively low cost and require only locally available materials and workmanship. Second, training courses were prepared to teach government engineers and technicians how to examine a farmer's soil and water resources, how to plan with him for the improvement and management of these resources, and finally how to design and supervise the necessary improvements to the land and to the water control system. Third, guides and standards were developed for use by planning engineers. Fourth, machinery shops and manufacturers were encouraged to produce the needed types of equipment. The

equipment was initially produced as prototype models with purchase guaranteed by the government. Each line of equipment was tested and demonstrated under field conditions with farmer handling. After passing each test favorably the sale price was established at a level that would not only make it profitable for the user to buy but also profitable for the manufacturer to produce. Lastly, it was necessary to demonstrate the benefits to farmers of utilizing the advisory assistance and engineering services of Topraksu engineers. At first an incentive approach was prepared which would provide for sharing some of the costs of land improvement for those farmers who agreed to undertake improvements and to follow a farm plan of operations. However, this cost-sharing was found to be unnecessary and was terminated in 1970.

The equipment designed under this project was considerably different in scale from the large earth-moving equipment provided by the IBRD and EIB. The equipment included two sizes of mechanically operated scrapers, a one cubic meter and a 1.5 cubic meter size, one 3 cubic meter hydraulically operated scraper, a scraper float, land plane, subsoiler, chisel, lister, border disc ridger, two way plow, and a 4 row seed drill. All equipment designed except the 3 cubic meter hydraulic scraper can be operated with normal farm tractors equipped with a three point hitch. The equipment was produced entirely with locally available materials and workmanship. By 1971 there were at least a dozen firms making this equipment in the Aegean region. A survey of five of the major firms indicate substantial production and sales.

TABLE: IV EQUIPMENT PRODUCED AND SOLD BY FIVE
FIRMS IN THE AEGEAN AREA 1968 -1971

<u>Type of Equipment</u>	<u>Units Sold To Government</u>	<u>Units Sold To Individuals</u>
1 m ³ Scraper	112	288 <u>a/</u>
1.5 m ³ Scraper	24	65 <u>a/</u>
3 m ³ Scraper <u>b/</u>	34	-
Scraper Float	45	111
Land Plane	8	-
Subsoiler	42	435
Chisel	46	245
Lister	37	80
Two way plow	36	-
Seed drill	17	25
Border disk	49	103

a/ Recent discussions with manufacturers suggests that this figure is considerably understated.

b/ An additional 104 of these units were purchased by Topraksu from MKE in 1970. Another 20 were purchased in 1969 from SUDE Manufacturing Co. in Istanbul.

SOURCE: Topraksu: Report on the Büyük Menderes
On-Farm Water Project, 1972.

Table V shows the potential capacity of small scrapers produced in Turkey between 1968 and the end of 1971 in hectares per year of land leveling.

TABLE: V SCRAPER CAPACITY IN Ha/YEAR ^{1/}

Size of Scraper	Number owned by		Unit Capacity Ha/Yr.	Annual Capacity	
	GOV'T	PRIVATE		GOV'T Ha/Yr.	PRIVATE Ha/Yr.
1 m ³	112	288	20	2,240	5,760
1.5 m ³	24	65	25	600	1,535
3 m ³	158	-	30	<u>4,730</u>	<u>-</u>
			SECTOR TOTALS	<u>7,570</u>	<u>7,295</u>
			GRAND TOTAL	<u>14,950 Ha/Yr. ^{1/}</u>	

As Table V indicates, in just three years the potential capacity represented by this relatively small scale equipment has grown to about 60% of Topraksu's actual total force account capacity of 25,000 hectares. Moreover, half of that capacity is in the hands of the private sector.

1/ Capacity estimated on the conservative assumption that all equipment is used 100 days per year. As noted above, number of units in private hands may be significantly understated.

The reason for the rapid growth in private on farm-development is evident from cost-benefit calculations based on typical farms in the area. ^{1/} Cotton yields before land-development and use of approved practices were 175 Kg/da or TL 612 at 350 Ku/Kg. Production expenses both before and after were 500 TL/da. However, yields rose to 375 Kg/da and gross income to TL 1312. Thus net income rose by TL 700 from 112 TL per da to 812 TL per da. The cost of leveling per da was 235 TL per da so that the total investment could be recovered the first year with over 465 TL/da remaining. Furthermore, no further land investment was necessary to sustain the new level of production.

As a result of these high profits demand for leveling has soared in the Izmir region. There are already 9 small scale and 3 large scale contractors in the region with many other groups contemplating setting up operations. ^{2/} It should be noted that this has occurred in the face of policies which have discouraged rather than encouraged such private development (For fuller discussion of this problem, see Discussion Paper No. 4, op.cit.)

1/ Source: Topraksu, Buyuk Menderes, op.cit.

2/ One of the key constraints is land engineering skills. Topraksu with 9 engineers and 12 sub-professionals can meet less than 1/2 of the requests for engineering assistance.

There is reason to believe that with policies favorable to more rapid growth of private activity, particularly to contracting, the pace of development could be accelerated dramatically.

II. COMPARING THE TWO STRATEGIES

Having described the two strategies of land development which have grown up side-by-side - one government financed and executed, one privately financed and executed - it is now appropriate to make some point by point comparisons. In addition to traditional cost/benefit considerations, there are several other criteria that may be useful in such a comparison. These follow from several fundamental problems facing the Turkish economy as identified in the recently published strategy for the Third Five Year Plan. Among these are a critical need for government revenues to finance necessary investment, a desire to substitute domestic production for imports, the need to foster employment creation but not at the expense of efficiency, and the need to improve income distribution. In addition to cost/benefit calculations these would appear to be appropriate factors to consider in formulating a strategy of land development.

A. Return on Total Investment (Cost/benefit) and

Return on Government Investment:

In principle, given comparable land quality, management practices etc., return on total investment (the cost/benefit ratio) should be the same regardless of whether the costs are borne by the farmer or Topraksu and regardless of whether the work is done by force account or private contractors. In practice, there are variations due to differences in soil quality, work quality, different costs for the same work, etc. However, one must bear in mind that the objective is accelerating the pace of land development, and that the crucial constraint is the government's investment budget. Thus a more relevant criterion than simple return on total investment is return on the government's investment. In this respect, the two systems are vastly different.

Under the force account approach, a government land levelling investment of 260 TL per decare yields an increased income stream, say, of 600 TL/da per year.^{1/} Under the private contracting arrangements in Izmir, the government investment is only about 25 TL per decare in engineering services. Thus under the government financed approach in Seyhan one TL of government investment generates TL 2.3 in annual income where as in Izmir it generates TL 24 or about ten times as much.

^{1/} This assumes the Izmir increase of 200 Kg/da of cotton but prices it at TL 3 per Kg rather than the TL 3.50 realized in 1971.

While Topraksu has expanded its share of the agriculture sector's investment budget from 16 percent in 1968 to 21 percent by 1971, the size of the agricultural sector investment budget has remained relatively constant. Moreover, given the intense domestic revenue squeeze and the low priority accorded agriculture in the third five year plan strategy it is likely to remain so. Thus while Topraksu may continue to enlarge its share, its resources are limited. If instead of devoting its scarce resources to government financed land development, the Izmir strategy were used, each added TL of Topraksu budget could generate TL 24 of annual income instead of TL 2.3. One further point should be made. While it is a fact that current practice in Izmir is for the government to provide free engineering services there is no particular reason why this practice need continue indefinitely. On the one hand, demand for engineering far exceeds supply at the effective zero price, yet on the other hand, contractors are inhibited from providing engineering since farmers are reluctant to pay when the government offers the service free.

The long run goal should be for contractors to do the field engineering as part of their package of service. Their performance would be subject to standards and supervision provided and enforced by Topraksu. Shifting Topraksu engineers and resources from field engineering to a certifying and supervisory role would extend further the number of hectares that could be developed and raise still further the potential income generation per TL of government resources.

B. Relative Costs Under the Two Systems

In addition to the criteria of return on government investment, another criteria useful in comparing the two alternative strategies to land development is that of comparative costs. Such a comparison also sheds light on the disincentives hampering the creation of a strong private contracting capacity. Table VI compares the equipment cost of moving a cubic meter of earth under two separate systems, each having a roughly equal daily capacity of 54 cubic meters per day. The first is a D-7 with 9 m³ scraper. This work unit is in common use in Seyhan achieving an hourly earthmoving rate of 54.6 m³. To show the effect of omitting customs, interest and amortization in the government's accounting system, recorded government cost and actual private costs are shown separately for the D-7 units. The 3 tractor unit with a comparable hourly capacity of 54 m³ is commonly used in Izmir.

TABLE: VI

COMPARATIVE EQUIPMENT COSTS (TL) OF MOVING
ONE CUBIC METER OF EARTH UNDER 2 SYSTEMS
WITH EQUAL HOURLY CAPACITY

	<u>D-7 w 9 yard scraper</u>		<u>Work unit of 3 Wheeled Tractors, $\frac{1}{3}$ 1-1/2 m³ scrapers and one chisel plow</u>
<u>Hourly fixed costs</u>	<u>Government Accounting</u>	<u>Full Cost Accounting</u>	<u>Full Cost Accounting</u>
Amortization including customs	-	56.2	18.1
Interest	-	<u>4.2</u>	<u>1.4</u>
Fixed cost/hour		60.4	19.5
Fixed cost per m ³		1.11	.36
<u>Hourly variable Costs</u>			
Fuel	22.2	22.2	50.6
Oil & Lubrication	7.7	7.7	10.5
Repairs	28.1	56.2	18.1
(Parts)	-	(28.1)	-
(Labor)	(28.1)	(28.1)	
Operators	<u>10.0</u>	<u>10.0</u>	<u>16.5</u>
Variable cost/hour	68.0	96.1	95.7
" " /m ³	1.25	1.76	1.77
<u>Total Costs</u>			
Total cost /hour	68.0	156.5	115.2
" " /m ³	1.25	2.87	2.13

1/ Ford Super 5000 or equivalent

Notes on Table VI

Topraksu estimates it will work its equipment 12 hours per day, 120 days per year. With a 10 year life this is 14,400 hours of tractor life. The standard U.S. tractor life - tracked and wheeled - for estimating purposes is 10,000 - 12,000 hours. Since tractors are used longer in Turkey than the U.S., 14,400 hours seems a reasonable figure. Salvage value is omitted in both columns. Actually it may be greater for the wheeled tractors, reducing further their relative costs. Repairs in both cases are 100% of original cost over the machine's life, 50% parts and 50% labor. Interest charged on 1/2 the equipment cost is 15% which is that charged by TSKB.

Sources: Wheeled Tractor: Topraksu; Farmer's Credit Project on Activities related to land development. Crawler: (a) Topraksu; Preliminary Report on Planning The On-Farm Development Projects for State Irrigation Systems, (1971)
(b) International Harvester; Basic Estimating
(c) University of Wyoming; Bulletin 482 Using Farm Machinery Efficiently (1967)

Two of the major arguments for force account work, aside from the issue of whether the government or the beneficiary pays for it are, first, that there are few established contractors and, second, that large scale equipment is needed for work on large fields to get the work done quickly and at lower cost.

On the first point, the table shows why there are few contractors. In the Yenipazar State Project Area, Topraksu pays the contractor 1.80 TL per m³ of earth. With his wheeled equipment, this just pays his variable costs but does not cover fixed costs. A rational entrepreneur would use otherwise idle capacity to do the work but clearly would not purchase equipment only for leveling work since it does not cover fixed costs. Outside the State Project Area in Izmir, private land-owners who forsee no free Topraksu leveling pay TL 2.62 per m³ which covers full equipment costs plus 18% for non-equipment overhead, supervision and profit. No major growth in contracting can be expected until the price for the work rises to where it covers fixed and variable equipment costs plus a rate of return competitive with other non-farm returns on capital.

On the question of cost and speed of large scale equipment - the economies of scale argument - Table VI is equally revealing. When all costs are counted, the cost of moving a cubic meter of earth is over a third more costly using government operated heavy equipment than it would be with smaller equipment. Furthermore, if the 3 tractor unit is used there is not any reason why the work should go slower. In-

deed since much of Topraksu's force account equipment is normally idle in part for lack of parts and repair, the locally made tractor units with no spares problem might accomplish more. ^{1/}

On grounds of doing a given job at least cost - omitting the question of who pays that cost - clearly the domestically produced units are more cost effective than the heavy imported force account equipment. ^{2/} From Topraksu's viewpoint, however, since IBRD resources are additional to its budget, there is effectively no capital cost to imported equipment whereas there would be for domestic. However, since IBRD loans ultimately represent a claim on foreign exchange for the economy as a whole one can question the use of costly imported system when a domestically produced one could do the job at considerably less cost.

^{1/} Actually, in Gediz after deducting a normal down time of 10%, only 55% of the available machinery was being utilized. Of that 55%, the equipment was reportedly only in field operation about 5 1/2 hours per day due to restrictive work rules, etc. This implies a utilization efficiency of less than 40% of the fleet's potential. The equivalent figure for the Gediz private contractor is about 90%.

^{2/} There are some tasks where small equipment simply is too light to do the job, so there will always be a role for heavy equipment. Moreover, since equipment is operated far more efficiently by private operators, heavy imported equipment is most competitive when in private hands.

C. Employment effects of the two land development strategies

The employment effects of the two approaches are sharply different in two important respects. First, in general, irrigated agriculture is more labor intensive than dry land in that it often involves substitution of such labor intensive crops as cotton, vegetables, etc. for less labor intensive crops such as wheat. Under the force account approach, Topraksu activity appears to have shifted toward improving already irrigated land rather than opening new land to irrigation (small water projects) or doing labor intensive land conservation work. Moreover, within the land development budget it has concentrated Topraksu resources on the country's largest and most mechanized labor-saving farms in preference to developing medium and smaller size farms where operations tend to be more labor intensive.

On the other hand, the Izmir strategy, being farmer financed, does not use many of Topraksu's budget resources. Were this approach applied to all on-farm development, more Topraksu resources would be available for expanding income and employment generating small scale water projects, conservation, and most importantly expanding engineering and extension type work to reach far more farmers and far more decares than the Seyhan strategy can ever reach.

The second major difference in the employment impact of the two strategies is inherent in the type of equipment used. The Izmir approach has generated a flourishing implement industry and has increased

demand for domestically produced tractors. Not only has this increased manufacturing employment, but has enlarged entrepreneurial activity, promoted industrial capital formation and had important secondary multiplier and linkage effects. The force account/imported equipment approach has captured none of these benefits. Indeed, it has fostered reliance on the government by the farmer, has co-opted the richest potential market for contractors by providing services free to those who could most easily pay for them, and has hurt sales of domestically produced equipment by facilitating subsidized rentals of imported equipment.

D. Income Distribution Effects of the Two Strategies

Of all aspects of the differential effects of the two strategies, the difference in their effect on income distribution is most striking. Of a total investment in irrigation development by Topraksu of TL 488 million in 1965 - 1971, TL 227 million (46%) has gone to Seyhan. As shown in Table VII, the Seyhan project has the most concentrated land ownership pattern of any of the 8 largest state projects with nearly 80% of the land owned by 20% of the people.

This data is plotted graphically on Chart I. In these diagrams the diagonal represents equal distribution. The concentration ratio is the proportion of the triangle's area lying between this line of equal distribution and the "sagging" line of actual distribution. The more "sag" in the line, the less equal the distribution and the higher the concentration ratio. "Perfect" equality implies a ratio of 0.00 and one man owning everything a ratio of 1.00.

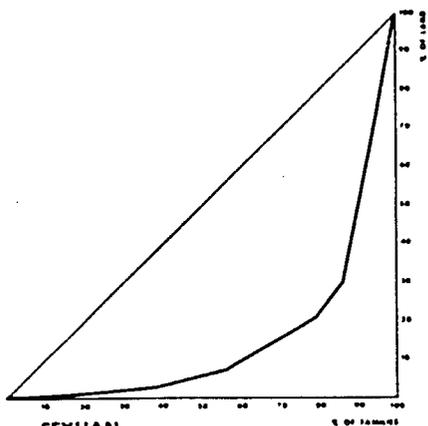
TABLE: VII

DISTRIBUTION OF LAND OWNERSHIP
IN 8 LARGEST WATER PROJECT AREAS

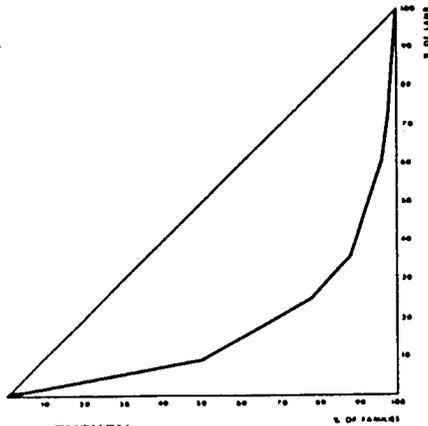
PROJECT NAME	TOTAL PROJECT AREA (Ha.)	LAND OWNED BY TOP 10% OF FAMILIES (%)	LAND OWNED BY TOP 20% OF FAMILIES (%)	LAND OWNED BY TOP 30% OF FAMILIES (%)	LAND OWNED BY TOP 50% OF FAMILIES (%)	LAND OWNED BY BOTTOM 20% OF FAMILIES <u>1/</u> (%)
SEYHAN						
(Land Own)	58,400	50.0	78.0	84.5	94.0	1.3
" Leveled)	38,864	59.0	71.5	82.5	91.0	2.0
KONYA	45,000	35.0	48.5	62.0	82.0	3.1
AHMETLI	36,090	44.5	59.0	72.0	94.0	4.0
IĞDIR	26,730	24.0	38.0	52.5	79.5	6.1
ESKIŞEHİR	17,940	44.5	56.0	67.0	83.0	4.0
ULUIRMAK	17,750	23.0	39.0	55.0	74.5	5.8
MENEMEN	15,360	58.0	73.0	80.0	91.0	3.6
TOKAT	14,900	28.0	35.5	43.5	58.0	17.0
<u>TOTAL</u>	232,170					

SOURCE: D.S.I.

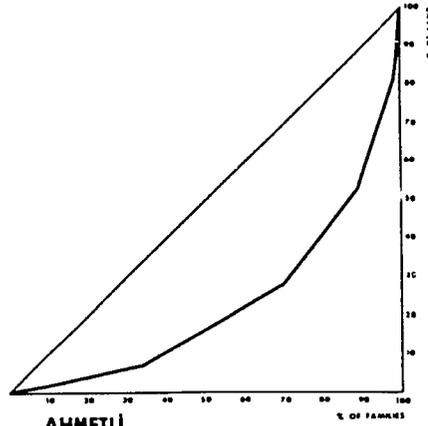
1/ By "top...%" or "bottom"... is meant the percentage of families having the largest or smallest holdings in the project area.



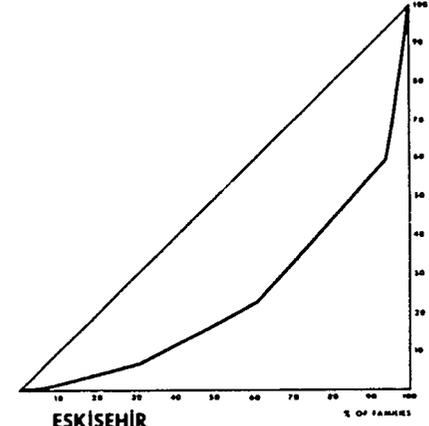
SEYHAN
 CONCENTRATION RATIO : 69
 PROJECT AREA : 58,400



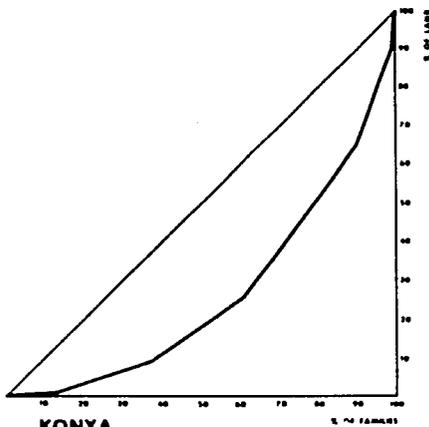
MENEMEN
 CONCENTRATION RATIO : 66
 PROJECT AREA : 15,360



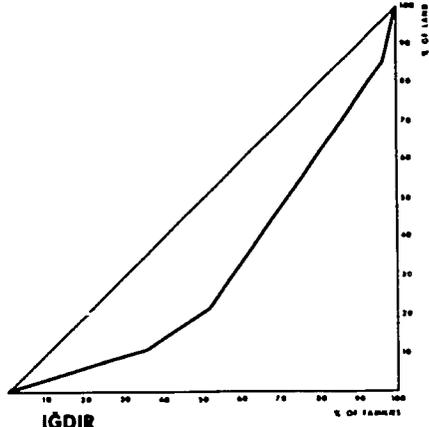
AHMETLI
 CONCENTRATION RATIO : 54
 PROJECT AREA : 36,090



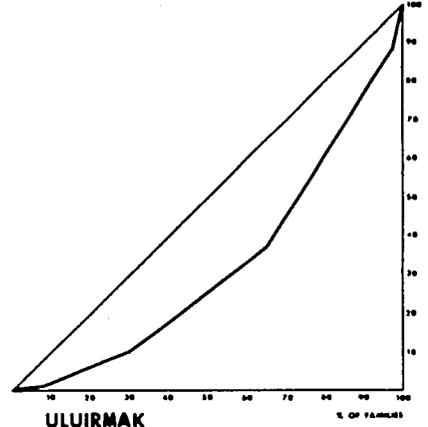
ESKİŞEHİR
 CONCENTRATION RATIO : 52
 PROJECT AREA : 17,940



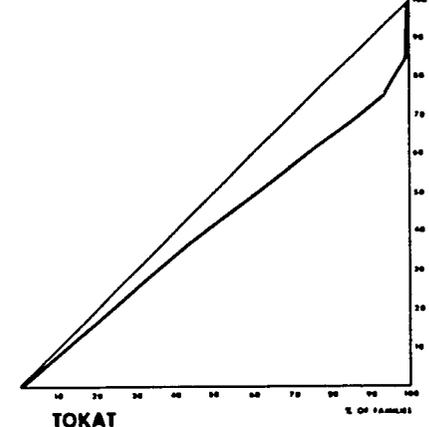
KONYA
 CONCENTRATION RATIO : 47
 PROJECT AREA : 45,000



İĞDIR
 CONCENTRATION RATIO : 36
 PROJECT AREA : 26,730



ULUIRMAK
 CONCENTRATION RATIO : 36
 PROJECT AREA : 17,750



TOKAT
 CONCENTRATION RATIO : 36
 PROJECT AREA : 14,900

CHART I MEASURES OF LAND OWNERSHIP CONCENTRATION

For the Seyhan project, data is available not only on the size distribution of land, but on the distribution of land which has been leveled. This data is presented in Table VIII. Of 2,488 farmers who have had some land leveled in Seyhan in the period 1966-1970 the largest 152 farms have received half the leveling and the largest 23 one fifth. At an average cost of TL 260 per decare leveled, ^{1/} roughly TL 50 million of investment has gone to 152 farmers in the period 1966-1970. Thus this group received a government investment nearly equal to the total amount spent on "soil protection and water-shed" for all Turkey over these 5 years. Put another way, for the 152 farmers, this amounts to about TL 332 thousand of government investment per farmer - for the top 23 over TL 900 thousand per farmer. Using the Izmir data, net income per decare probably has increased at least 600 TL per decare as a result of development. ^{2/} Thus for each TL of the government's initial investment about TL 2.3 of added annual income accrues to the farm owner. This implies that the government's investment has yielded this group of 152 roughly TL 116 million annually in increased income, or about TL 766 thousand per farmer. For the top 23 farmers, the government's investment on their land on the average has increased their annual income by over TL 2 million per farmer.

1/ Total 1964-1970 government funded levelling cost including engineering - number of decares levelled.

SOURCE: Consortium Tahal-Eci-Suis Consulting Engineering
Analysis and proposals for Irrigation Water Charges
For the Seyhan Irrigation Project, 1971 (p.23)

2/ See note 1/, p. 16

TABLE: VIII DISTRIBUTION OF LAND LEVELING IN SEYHAN: 1966-1970

<u>DECARES</u>	<u>NUMBER OF FARMERS</u>	<u>% OF TOTAL FARMERS</u>	<u>LEVELED LAND (DECARES)</u>	<u>% OF TOTAL LAND</u>	<u>AVERAGE SIZE (DECARES)</u>
Under 10	223	9.0	1,696	0.4	7.6
10 - 20	360	14.5	5,652	1.4	15.7
21 - 50	668	26.9	25,169	6.4	37.7
51 - 100	492	19.8	35,228	9.0	71.6
101 - 300	469	18.9	81,300	20.8	173.3
301 - 500	124	5.0	47,691	12.2	384.6
501 - 1000	92	3.7	62,630	16.0	680.8
1001 - 200	37	1.5	51,487	13.2	1391.5
2001 - Over	<u>23</u>	<u>0.9</u>	<u>80,043</u>	<u>20.5</u>	<u>3480.1</u>
	2,488	100.0	390,897	100.0	157.1

SOURCE: Topraksu

In the Izmir project, while there are also some large farmers, average size of land levelled per farmer is only 27.5 decares compared to 157 in Seyhan. Since the Izmir farmers provide their own investment funds there is not the same transfer from general revenues to already wealthy farmers that has occurred in Seyhan. Even using the force account approach, concentrating in projects areas having a more equal distribution and, within those, on smaller farms would improve the distribution impact of government land development. As the EIB has shown the force account approach can also play a useful role in bringing about land consolidation.

III. AN ON-FARM DEVELOPMENT STRATEGY FOR THE FUTURE

When the World Bank undertook the Seyhan project in 1965, there were no land contractors and little appreciation by the farmers of the tremendous returns on such on-farm land development. The easiest and surest approach to capturing the full potential of this investment was to have Topraksu finance, manage and execute all the on-farm as well as off farm work.

However, now that the benefits of land development have been clearly established, it is time to rethink the overall strategy. The fact that over one thousand relatively small farmers in Izmir have financed their own levelling is a clear indication that once the demonstration effect has been established, at least in areas where agriculture

is relatively sophisticated, private capital will seize the investment opportunity as long as there is no prospect of the government doing it free. For example, the small village of Sevindikli near Nazilli levelled 3000 of its 7000 decares in the past two and a half years with a relatively small governmental technical assistance effort.

As noted earlier, a national strategy of government financed land development restricts the pace of development to the size of Topraksu's budget. Even if that budget were raised to 1/3 of the total agricultural investment budget, and force account capacity more than doubled, the present backlog of 400,000 hectares of undeveloped land would continue to grow. Moreover, to say nothing of the effect on income distribution, the present concentration on the richest areas means both using scarce government investment to displace private investment and taking under Topraksu force account potentially the richest market for private contractors. Not only does the Seyhan type approach miss tremendous opportunities for drawing added capital into land development, but it retards the formation of contracting services which could expand the supply of levelling, and starves the rest of the nation's irrigated areas of the government's financial and technical resources.

It is necessary to focus not on single projects but on the priority development problem identified by the IBRD, that of increasing nationally

the effective utilization of existing irrigation water. A strategy is needed which has the objectives of expanding both the effective demand for services and the supply of services. The income distribution and employment impacts of the strategy should be considered. A central feature of the strategy should be to avoid making direct government investment where there is reason to believe private investment would come forth.

The appropriate policy would seem to be one of government investment only where private investment is unlikely or where there are other problems such as land fragmentation which direct investment could help solve. For example, the farmers of the Ceyhan, as sophisticated as their Seyhan neighbors, with as much if not more wealth, with as large if not larger farms, with as good if not better soil, represent the group most likely to finance their own land development - far more so than the farmers of Izmir who are already financing their own. They also represent a tremendous market for potential contractors. While the Seyhan approach may have been necessary in 1965, a tremendous opportunity will be lost if that approach is used in Ceyhan and other high potential projects in the relatively sophisticated coastal areas.

The strategy chosen should be one which encourages private investment and private contracting, not one which discourages it. As private resources are mobilized, Topraksu resources could then be focused on

areas where capital, entrepreneurship and rich contracting markets do not exist. Only such a strategy of mobilizing private resources gives any prospect of working off the tremendous backlog of irrigated but undeveloped land. Now that the demonstration effect has been achieved, it would be a tragedy to continue to focus government resources on those areas with the greatest capacity and incentive for self-development.

IV. A SPECIFIC PROPOSAL

There are really two key issues to be addressed in designing a strategy toward on-farm development: (1) who pays? (2) who executes? On the first point the only strategy which offers any long-range prospect of bringing the pace of on-farm development up to that of irrigation development is one whose centerpiece is the mobilization of private capital to pay for on-farm investment. One of the most interesting proposals is one where on-farm development costs would be repaid by the farmer through a charge of 10% or so of the production increase resulting from the development. This could be estimated in the advance engineering work, discussed with and agreed to by the farmer in advance. A crop mortgage could be used to guarantee payment. This formula could be applied uniformly to both force account and privately contracted work. For private work, Topraksu would do the engineering and supervise performance. Topraksu or Agriculture Bank credit would finance the work and the 10% formula applied for repayment.

On force account work, the 10% payments could go to a fund in Topraksu (or the Agricultural Bank) which with a constant annual appropriation could then finance an ever larger amount of either force account or private work. This mechanism would harness a portion of the increased income due to development to the task of expanding the extent of that development. This approach has the great advantage of limiting the risk to be taken by the farmer: if heavy levelling limits short-term gain by exposing subsoil, for example, adjustment is worked into the repayment schedule in advance by the engineers.

Another alternative is an extension of a straightforward credit plan already in process of approval. Under this plan the Agricultural Bank funds the Topraksu supervised development with repayment over 7 years, 2 year's grace.^{1/} This scheme could be expanded by channelling Topraksu's on-farm investment appropriation into a credit fund instead of direct investment. The appropriation then would finance essentially the same work as it does now (the work could be done in whole or in part by either private or Topraksu equipment). The only difference is that farmer then pays for the work over the 7 year period. Even if the repayments went to general budget revenues and not back into levelling, Topraksu is no worse off than they are now, and the contractor's free

^{1/} A serious problem with the Agricultural Bank administering the whole credit program is its practice of using a land mortgage as collateral. Forty percent of the farmers - usually those most in need of credit - do not hold a registered title to their land. A simple crop mortgage system would serve the same purpose and make eligible far more farmers. There are some indications that the Agricultural Bank may be able to substitute other types of security for land mortgages.

competition would be removed. Either of the above systems has the advantage of being uniform for farmers inside and outside State Project Areas. As it is now, those outside pay, those inside do not. In this respect, either scheme is far superior to tacking a levelling charge on water rates since much of the levelling to be done is outside state areas. Furthermore, water charges so far have proved to be a wholly ineffective vehicle for capturing even O&M charges to say nothing of investment. They are perhaps better left with the useful objective of capturing the off-farm system costs without trying to saddle them with the burden of the on-farm recovery as well.^{1/} The farmer has amply demonstrated that he can and will pay for on-farm development.

Once some plan such as that above is developed for financing land development, most of the problems of who executes the development solve themselves. As long as Topraksu does not price force account work below cost by failing to consider interest, customs and equipment amortization, the cost of work to the farmer should be roughly equal whether it be done by force account or private account. Particularly if the work is priced to compete with alternative jobs contractors would be attracted to it as the threat of a competitor offering free services vanished. Where ample contracting capacity developed, presumably in the relatively richer regions, development could be left to the private sector. Force account work could then be concentrated where there are no contracting services available and where conditions make their

^{1/} In 1970 operations and maintenance costs were TL 80 million and O&M assessments TL 28 million. Less than TL 5 million was collected for system amortization against accrued costs of TL 3.4 billion.

development less likely and on areas with special problems. Additionally, if repayments augmented Topraksu's budget, more resources could be devoted to the small water project and conservation work which has been virtually abandoned under the expanded force account approach.

Rationalizing land development work along the lines suggested above would:

- (1) tremendously expand the return on government investment by augmenting it with private-investment,
- (2) increase both agricultural and industrial employment over the existing approach,
- (3) enhance the productivity of a far larger hectarage than presently contemplated,
- (4) improve the distribution of income not only by expanding employment but by facilitating land investment by small farmers while ending heavy subsidies to large ones.

Under the most optimistic assumptions the present approach foresees continued growth in the backlog of 400,000 hectares of irrigated but undeveloped land. Speeding up primary water development as contemplated in several recent DSI proposals would swell the backlog still further. A new approach is urgently needed, one which offers at least the possibility of a decreasing backlog of undeveloped land rather than the certainty of a growing backlog. The approach above offers such a possibility.

It is clear that in Turkey all the elements are present for a truly spectacular increase in the productivity of irrigated agriculture. Means of realizing this increase deserve the urgent attention of the Government of Turkey and of participating aid donors. The first step must be some incentive structure such as that above which works for rather than against realizing this breakthrough on a nation-wide scale. Anyone who says it can't be done should make a visit to Izmir. It is being done. The only thing that could stop it is a big force account project.

ECONOMIC ANALYSIS STAFF

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