INTEGRATING INDUSTRIAL PLANTS INTO THE MOSHAV ECONOMY — BENEFITS AND CONFLICTS

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ABSTRACT

This study is concerned with the incorporation of collectively owned industrial plant into the moshav villages, and analyzes the problems of income distribution within the moshav. The issue of equalization of the incomes of farmers and factory workers with both groups being moshav members is discussed in relative detail and the difficulties involved are pointed out.

A Moshav Model which provided the framework for the analysis of the income potential of the farming families is outlined in the Appendix.

INTRODUCTION

The Background

Collectives and cooperatives are the dominant social organization structures in Israeli agriculture. The kibbutzim[1] — collective settlements based on voluntary membership and democratic management with 150—800 members in each — produce about 40% of Israel's total agricultural output value. The share of the moshavim[2] — cooperative villages with 60—150 family farms — is also 40%.

Each family in a moshav cooperative has an endowment of a land plot and of other major factors of production, such as irrigation water and quotas of controlled and profitable products, such as milk. The family is responsible for the management of its farm, benefits from the income generated, and bears the losses. The village cooperative provides production and marketing services and acts as a mutual credit association. It also provides municipal services for the village.

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[1] Plural form for a kibbutz.
[2] Plural for a moshav.

Membership in the village cooperative is compulsory for the families, as is the payment of taxes collected by the cooperative.

The social philosophy underlying the moshav is a mixture of promoting individual initiative and cooperation. This is expressed in terms of (i) the equal initial endowment of resources and an equal opportunity for each family; (ii) mutual help in terms of credit granted in cases of disastrous events (such as sickness, or production failures due to factors which are beyond the control of the family).

Technological progress in agriculture, unmatched by an upward shift in the demand for agricultural products, the effect of which was the reduction in the demand for agricultural labour, led to two phenomena which emerged in Israel, in response to the above process: (i) part-time farming, typical primarily of family farms, and (ii) industrialization.

Industrialization is emphasized on kibbutz settlements; by the mid-eighties about one half of the total output value of the kibbutzim originated from industrial plants; almost each kibbutz owns at least one industrial plant and some have two or three. They are, in general, economically successful (Golan, 1980; Hebrew; Yaron et al., 1983).

On the moshavim, part-time farming with off-farm employment has been the traditional response to the decreasing demand for labour in agriculture. However, excessive reliance on part-time farming and off-farm employment may weaken the moshav as a viable economic entity; moreover, it is not a solution for moshav settlements in regions distant from urban centres where potential off-farm employment might be offered. Accordingly the moshav settlements and their national organizations have developed initiatives for promoting industrialization as a policy aimed at providing employment opportunities for their members.

The alternative types of industrial plants are:

1) Private plants owned and operated by one family or by a partnership of 2—3 families, with authority granted to the village cooperative to restrict the number of workers hired from outside and the short and long term credit granted to the plants.

2) A »large« plant collectively owned by the moshav cooperative.

3) A »regional« plant owned by a partnership or a limited liability company formed by a few moshavim in a region, with or without a share owned by a large and experienced industrial trust.

The major characteristics of the profiles of the family and the collectively owned plants are summarized in Table 1. Regional plants might be similar to those owned by the cooperative or larger. The issue under debate by the moshav settlements and their nationwide organizations is which type of plant ownership is the most appropriate from the socio-economical point of view. The various facets of this issue are too numerous to be discussed in detail here and they are only briefly mentioned.

Table 1

*Major characteristics of the profiles of family and
collectively owned plants*

Type of Plant Economic Indicator	Family Owned		Collectively Owned	
	Average	Range[1]	Average	Range[1]
Employees, No.	7	3—10	52	23—95
Fixed Capital, mil dollars	0.2[2]	.05—.50	2.3	.65—4
Sales, mil dollars	0.3	.09—.48	3.0	.60—8
Fixed capital per worker, thousand dollars	22	6—30	53	16—100
Sales per worker, thousand dollars	42	14—72	60	23—89

Sources: Family owned — survey and analysis of family owned plants in rural areas by Pelevsky — Segev (1983).
      Collectively owned — survey analysis of kibbutz plant by Golan (1980).

1. Excluding extreme values, 12.5% at the lower tail and 12.5% at the upper tail of the distribution.
2. Not including building on the assumption that an existing farm building might be used. Investment in building amounts to $16,000 per worker.

The major advantages of the family plant are: private initiative and entrepreneurship; the possibility of utilizing part-time, low-cost labour of family members; that the aspects of quality of work, generally important in the large plant, lose their importance — there is a bult-in safeguard against poor quality work, since family members are personally involved in the management of the plant and its future; the risk basically taken by the owner family (ies) with the risk to the moshav cooperative being minimal (Shavit, 1984). The major disadvantages of the family plant are: lack of functional specialization; the necessity to restrict the growth of the plant within limits compatible with its existence within a cooperative village; the need to control such growth way become a source of conflict between the village cooperative and the plant owners, even though the relationship between the cooperative and the plant would be formally documented.

The major advantage of a collective plant owned by the cooperative is its size. Establishment of such a plant elevates the cooperative village to a relatively high level of industrialization. The difficulties involved in such plants on moshavim is the subject matter of this paper, with emphasis placed on income distribution problems.

More details concerning a multi-attribute comparison of the family plant with the collective plant as alternative means of industrialization for moshavim, can be found in Yaron and Palevski-Segev (1984, Hebrew; with summary results in English obtainable upon request).

This paper is concerned with the issue of income distribution within a moshav which owns a factory with some of the moshav members — initially a minority — working on the plant and the others continuing to operate their farms. Other socioeconomic problems involved in pursing this alternative for the industrialization of the moshavim will also be briefly addressed. The empirical background for the study was provided by a group of real moshavim in Israel in a real (though anomymous) region, which will be here referred to as the Sun Valley. Anonymity was chosen due to quotation of income data.

The Problem

The moshavim in the Sun Valley specialize in the production of winter vegetables and fruit crops for domestic markets and for export to Europe. These are highly input-intensive crops (in terms of both long and short-term capital, and labour) with a considerable element of risk. So far, agricultural production of the moshavim in the Valley has been highly profitable due to their sophisticated products developed and introduced with the aid of research institutions and the agricultural extension service. However, competition for the European markets is growing (mainly through the enlargement of the EEC with the accession of Spain and Portugal) and a fall in the profitability of these products is a worrying reality, with the uncertain future causing considerable anxiety. The moshavim in the Valley are therefore inclined to move towards industrialization and the alternatives for industrialization, describing above, are being discussed and debated.

A survey of attitudes conducted among 202 members in four moshavim (Yaron and Ratner, 1984, Hebrew) in the Valley revealed that: (i) While the preferred employment of the members is agriculture, the attitude towards industrialization and employment on industrial plants is favourable; (ii) The preferred types of ownership are the collectively owned and the family owned plant, which are ranked equally. Plants owned by a regional organization are ranked very low; similarly low ranked are cooperatives of 7 — 10 members within any individual moshav; (iii) There is a general tendency to restrict the number of employees on the plant hired from outside. More than 50% of the sample consider hiring workers from outside as a negative phenomenon.

While the moshav members ranked the collective and the family plants about equally, members of the moshavim management boards and even more so, the leaders of the nationwide organization to which the moshavim of the Sun Valley belong,[3] strongly promoted the idea of collectively owned plants, as opposed to family ones. Although re-

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[3] The moshavim in the Sun Valley belong to Tnuat Moshavim. There are a few other moshav organizations, some of which (e.i., Ha'ichund Ha'chaklai) promote the family plant.

cognizing the difficulties involved in the establishment of collectively owned industrial plants within a cooperative of individual family farms, their fear of the excentric effects of family plants is apparently stronger.

The major difficulty involved in collective plants seems to be the issue of income distribution in the moshav. It is assumed that: (i) At least one half of the workers on the plant will be members of the moshav cooperative who will lend most of their agricultural resources to the cooperative for a period of two years of more, for reallocation among other moshav members involved in full scale farming, or for collective use by the cooperative; (ii) Some agricultural resources will be left at the disposal of the factory workers for small-scale, part-time farming which will not interfere with their employment at the factory; a realistic possibility is growing fruit crops or vineyards; (iii) The wages of factory workers should equal conventional wage standards.

With gross wages of skilled workers in industry ranging between 7,000—15,000 US (1983) dollars per year, including fringe benefits, and the value added on family farms being as presented in Table 2, the question arises as to how the income of the members of the moshav cooperative involved in farming and those working on the collective plant can be equalized. This problem, which appears to the authors as the major difficulty in establishing collective plants in mos⁻ havim, is the subject matter of this paper. Other difficulties involving collective industrial plants in moshavim will be briefly addressed.

Table 2

Value added on family farms involved in horticultural production[1]
$ 000

	Moshav A	Moshav B
Normative Estimates[2]	*Range[3]*	
Optimistic Scenario	35—50	33—42
Pessimistic Scenario	13—20	20—28
Sample Data (1982)		
Mean[3]	23—39	—
Standard deviation	(22) (15)	—

1. Value added = gross income less current production costs = consumption + long-term debt poyments + cooperative taxes + social security allowance + saving & investment (production and consumption goods).

2. Computed with the aid of the Moshav Model presented in the Appendix.

3. The range values refer to different types of farms.

THE APPROACH

The study of the incorporation of an industrial plant into the moshav economy comprised two stages:

1) Analysis of the economic potential of the moshav with and without a collective industrial plant. This was performed with the aid of a linear programming Moshav Model outlined in the Appendix.

2) Analysis of the issue of income distribution within the moshav.

At the outset of the second stage two formal models were considered as candidates for the analysis of income distribution in a moshav with a collectively owned plant:

1) Shadow cost pricing of the resources lent by factory workers to the cooperative, and

2) Cooperative game theory models, and specifically the Nash-Harsanyi (Nash, 1950; Harsanyi, 1959) solution.

These approaches, which were found to be inappropriate, are briefly discussed.

Shadow Cost Pricing

An instinctive response of economists to the issue of pricing the resources transferred within the moshav is that it should be according to their shadow prices. However, under the conditions prevailing in Israel (as in many other countries), the major resources for agricultural production are allocated to farmers according to institutionally determined quotas. The price of the resources to farmers is either below their marginal value product, as in the case of irrigation water, or zero, as in the case of milk production quotas, major vegetables and other production quotas. Quite often the resources allocated to farmers yield a rent, which, under certain circumstances, is not negligible. With land and water viewed in Israel as natural resources owned and administered by the nation, it is claimed that farmers have the right to benefit from the rent derivable from these resources if, and only if, they use them for production. Were these resources a private property of the farmers the objection to farmers' benefits from rent would have been removed. A smilar situation prevails with respect to production quotas of major products.

Needless to say this institutionally determined quota system, while not necessarily solving the equity problem, leads to inefficiency. Although this system has been criticized by agricultural economists, and solutions which combine efficiency with income distribution considerations have been suggested (Yaron, 1971, Hebrew), the quota system still prevails in the mid-eighties and is referred to as a reality.

With respect to moshav villages, the dominating attitude is that the quotas are being allocated to the cooperative with a right granted to each member to use his share on his family farm, but not to make profit from leasing his share to others.

Cooperative Game Theory Approach — Nash-Harsanyi Solution

The cooperative game theory approach was considered as a possible formal model for the solution of the income distribution problem in a moshav with a collectively owned industrial plant. The problem involves both transfer of resources among families and direct income transfers (»side payments«) if needed, and falls within the transferrable or the non-transferrable utility category, depending on whether or not direct income transfers would be needed in order to equalize income of the factory workers with that of the farming families. On the basis of previous experience (Yaron and Ratner, 1985; Yaron et al, 1986), the Nach-Harsanyi approach was considered as conceptually suitable and technically convenient. However, a closer examination of the game theory approach leads the authors to the conclusion that it is inappropriate. The farming families face considerable risk in agricultural production and their incomes should be discounted by a risk premium[4] when compared with the income of factory workers. This leads to the necessity of an assessment of the utility functions of the farming families and thus to a two stage analysis: a) Assessment of utility functions, and b) Allocation of gains (or losses) from industrialization among the moshav members. This appears to be quite cumbersome. Moreover, a formal mathematical approach could be difficult to explain to the moshav members.

The Approach Followed

The above formal models were considered to be inappropriate, so the study followed a simple and technically less sophisticated approach. It comprised two parts: (i) A *survey of attitudes towards the income distribution problem;* and (ii) An analysis of income redistribution.

SURVEY OF ATTITUDES TOWARDS RESOURCE TRANSFERS AND INCOME DISTRIBUTION

A survey of attitudes towards the arrangements regarding moshav members employed by the collective factory (in and when established) regarding transfers of resources and the related compensation, was carried out on a sample of 43 members in four moshavim in the Valley, of which 20 have served in an administrative capacity in the moshav or in one of the regional or national moshav organizations during the last seven years. The major results of the survey were:

(i) There is a general approval of resource transfers and in particular of water, land and quotas of annual crops.

(ii) The majority supports *obligatory transfers* of all or some of the resources. This attitude is different regarding families with a po-

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[4] It may be considered as including an enterpreneurship premium.

tential heir (a son or a daughter) approaching maturity; in this case the majority (61%) favours *voluntary transfers* only.

(iii) A clear cut majority supports resource transfers fully coordinated by the village cooperative and objects to direct agreements made between the lessor and the lessee.

(iv) The resources transferred for the cooperative's disposal should be allocated to family farms which had faced temporary economic difficulties, as an aid to overcome them.[5] An overwhelming majority objects to the leasing of the resources transferred to partnerships of several moshav members, the reason being a fear of the creation of centers of power.

(v) The majority (77%) holds the view that the income of the moshav members employed by the collective factory should be composed of a wage and income from part time farming. Only 23% support direct income transfers to factory workers in order to supplement their incomes.

(vi) The majority (65%) maintains the view that those transferring their resources for the use of the cooperative should not be paid for the transfer.

(vii) In spite of the objection to direct income transfers, a clear-cut majority supports the position that the income of factory workers should be equalized to that of the farming families. A possible interpretation of this apparent conflict in views is that although the principle of income equalization is favoured, there is an objection to an explicit link between transfers or resources and direct monetary compensation. This attitude is consistent with the conception of the moshav cooperative as playing the dominant role in all issues related to resource transfers.

THE MECHANISM FOR INCOME REDISTRIBUTION AND RELATED DIFFICULTIES

Essential Income Transfers

It is obvious from the above results that the mechanism for income redistribution preferred by moshav members in the Valley is that of the income of moshav members who are factory workers being supplemented by part-time farming. Part-time farming with off-farm employment is indeed common in numerous moshav villages. Agricultural activities or products suitable for part-time farming are citrus, fruit crops and poultry.

However, a careful scrutiny of those alternatives suitable for part-time farming in the Valley indicates that there are not enough actual opportunities for providing the required supplementary income. (See Tables 3 and 4 for the different levels of supplementary income

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[5] Note that this is an expression of the egalitarian philosophy of the moshav members.

Table 3

Income transfers required to equalize incomes of factory workers and farmers with 60 farmers and 15 factory workers in a moshav

($ 000)

Income of farmers		Income of factory workers[1] 20				15				10			
Net Income	Net Income adjusted to risk	Income transfers				Income transfers				Income transfers			
		Total	Per Factory Worker	Per Farmer	Net Income After Transfer[3]	Total	Per Factory Worker	Per Farmer	Net Income After Transfer	Total	Per Factory Worker	Per Farmer	Net Income After Transfer
10	8	144	—9.6[2]	+2.4	10.4[3]	84	—5.6	+1.4	9.4	24	—1.6	+0.4	8.1
20	16	48	—3.2	+0.8	16.8	12	+0.8	—0.2	15.8	72	+4.8	—1.2	14.8
30	24	48	+3.2	—0.8	23.2	108	+7.2	—1.8	22.2	168	+11.2	—2.8	21.2
40	32	144	+9.6	—2.4	29.6	204	+13.6	—3.4	28.6	264	+17.6	—4.4	27.6

1. Income from factory wages including fringe benefits and income (normative level) from a fruit crops plot.
2. Minus sign means a transfer from factory workers to farmers.
3. Net income of factory workers after income transfer, being equal to net income of farmers adjusted to risk.

Table 4

Income transfers required to equalize incomes of factory workers and farmers with 50 farmers and 10 factory workers in a moshav

($ 000)

Income of farmers — Net Income	Income of farmers — Net Income adjusted to rask	Income of factory workers[1] = 20 — Total	= 20 — Per Factory Worker	= 20 — Per Farmer	= 20 — Net Income After Transfer	= 15 — Total	= 15 — Per Factory Worker	= 15 — Per Farmer	= 15 — Net Income After Transfer	= 10 — Total	= 10 — Per Factory Worker	= 10 — Per Farmer	= 10 — Net Income After Transfer
10	8	100.0	−10.0[2]	+2.0	10.0[3]	58.3	−5.8	+1.2	9.2	16.7	−1.7	+0.3	8.3
20	16	33.3	−3.3	+0.6	16.6	8.3	+0.8	−0.2	15.8	50.0	+5.0	−1.0	15.0
30	24	33.3	+3.3[2]	−0.6	23.3	75.0	+7.5	−1.5	22.5	116.6	+11.7	−2.3	21.7
40	32	100.0	+10.0	−2.0	23.3	141.6	+14.2	−2.8	29.2	133.3	+18.3	−3.7	28.3

1. Income from factory wages including fringe benefits and income (normative level) from a fruit croups plot.
2. Minus sign means a transfer from factory workers to farmers.
3. Net income of factory workers after income transfer, being equal to net income of farmers adjusted to risk.

required under a variety of situations). The realistic options for the Valley seem to 0.5 — 0.6 ha of vineyards or fruit crops per family of a factory worker. The income derivable from them is insufficient.

Moreover, the status of the moshav members employed by the collectively owned factory differs from that of part-time farmers elsewhere who have selected the type of off-farm employment that they pursue. The moshav members who work at the factory do so in compliance with the goals of the moshav. Accordingly, their claim for income equalization seems to be justified. Since the income from part-time farming is insufficient to ensure an equalization of income, income transfers are needed.

The following formulae are suggested as a basis for income equalization, with a distinction being made between normative and acual income:

(1) Normative income per factory worker $=$ Wages (fixed) $+$ Normative net income from fruit crops $+$ Income transfers $=$

$=$ Average income per farmer $-$ Average risk premium

(2) Actual income per per factory worker $=$ Wages (fixed) component $+$ Factory premium $+$ Actual net income from fruit crops $+$ Income Transfers

The required income transfers are derived from formula (1), which relates to the normative income. The difference between the normative and the actual income of the factory worker arises from (i) the exclusion of factory premium in the normative formula, and (ii) the difference in the income from fruit crops accounted for in the two formulae. The factory premium is intended to provide an incentive for the workers; it will be paid in terms comparable to these prevailing on similar plants in industry at large. According to Bell (1979) premiums are in the range of between 4—5% and the maximum od 15% of the net wages. While these levels are not high, they are believed to provide the necessary incentives. Similarly, the normative[6] rather than the actual, income from fruit crops is included in formula (1), in order to provide motivation.

The Determination of the Risk Premium

The risk premium to be deducted from the income of the farmers depends on income variability over time, the long-run average of the income and the individual attitude of the farmers towards risk

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[6] Based on regional averages for similar plots.

(i.e., their risk aversion). The desired outcome is an average risk premium which will apply to the average income of the farmers in the moshav in a particular year.

Background information for such an assessment can be achieved with the aid of auxiliary studies. (The conceptual approach to such problems can be found in Raiffa, 1967, or Keeney and Raiffa, 1976; examples of empirical studies are described by Roumasset et al 1969). The essence of the problem is to determine the certainty equivalent of the farmers' income at varying levels of $ 20,000, $ 25,000, $ 30,000 etc.

How will the level of the risk premium be determined? The survey of attitudes previously referred to, revealed the dominating tendency to view the moshav institutions as the ultimate authority on the moshav's socioeconomic arrangements. However, one should recall that, for many years to come, moshav member factory workers will be a minority; it therefore appears proper to submit the issue to a generally agreed arbitrator.

The order of magnitude of the income transfers required

The acceptibility of income transfers will most likely depend on their magnitude. Obviously transfers of negligible magnitude will not be opposed; transfers of significant amounts may lead to a strong objection on behalf of some or all moshav members involved in farming.

In Tables 3 and 4 the transfers required to equalize incomes of factory workers and farming families under a variety of situations are presented. Table 3 indicates that the highest amount to be transferred from a farmer's family to support the income of factory workers is $4,400; this occurs when the average value added of the family farms is $40,000 per annum ($32,000 when adjusted for risk) and the total income of factory workers amounts to $10,000 only. In Table 4 the highest transfer is $3,700 per annum (when the income per farming family is $40,000 and the income per factory worker is $10,000).

The income transfers from farming families to factory workers shown in Tables 3 and 4 do not appear to the authors to invalidate the approach; the problem they pose to the cooperative and the moshav members is more of a social rather than economic nature. They seem to be possible only if a high level of cooperation among the moshav members prevails.

Instruments aimed to avoid direct income transfers (even though the real ultimate result will be the same) can be designed. One possibility is the establishement of an Industrialization Trust in the moshav which will serve as an indirect channel for income transfers, with its sources of funds being profits of the cooperative, profits from the collective plant and levies on moshaw members. Another means towards equalization is the introduction of differential cooperative taxes, collected by the cooperative.

A significantly more difficult problem arises when the income of the factory workers is higher than that of the farming families. As

previously assumed the income of factory workers will be composed of wages, equal to those prevailing in similar industries, and the net income from fruit crops. If the principle of wages equivalent to those prevailing in industry at large is accepted, with the income from fruit crops being small, what justification for income transfers from factory workers to farmers can be offered? At this stage the authors do not foresee a reasonable solution, unless differential cooperative's taxes can provide one.

The mechanism for income redistribution discussed above is the 'best' that the authors are able to suggest. But it is cumbersome and difficult to apply. On the other hand, if the income of moshav member factory workers is not approximately equal to that the farming families, moshav members will not be willing to work at the factory.

Other alternatives for a collectively owned plant

Another alternative type of a collectively owned plant is one owned and operated by 2 to 3 moshav members who are managers and a main body of workers who are also moshav members or associate members, but are not the main income earners of the family (wives, sons, daughters). In such a case income redistribution will not be necessary. The disadvantage of this alternative with respect to the moshavim of the Valley is that it may only apply to the 2 oldest moshavim.

The last alternative for a collective plant — 2 to 3 managers with the main body of workers being hired from outside the moshavim is ruled out both for economic and social reasons.

To summarize the above discussion it appears that income distribution problems in a moshav with a collectively owned plant might prove very difficult to solve.

OTHER DIFFICULTIES

Other difficulties involved in a collectively owned plant in a moshav are briefly mentioned.

Risk

Investment in one central factory owned by the moshav cooperative, contrary to the policy of a mixed portofolio, involves an obvious risk. Even temporary economic difficulties lasting 3—4 years which may lead to a necessary levy being raised from the moshav fa-

milies to cover the losses can lead to a considerable social tension. A total failure may present the moshav cooperative with serious liquidity problems. However, the ability of the moshavim in the Valley to invest in more than one plant in the spirit of a mixed portfolio is quite limited in the foreseeable future.

Time span needed for the establishement of a collective plant

According to the experience of the kibbutzim, the time span needed to establish a factory and bring it to full working capacity is about 2 years for the search and selection of an appropriate factory; about 2 years for the planning, construction and acquisition of the equipment (after the desired factory had been decided upon); and about 3 years for full production capacity to be reached. This makes a total of 7 years for which the moshav must allocate both managerial and capital resources. This socioeconomic difficulty is one which any moshav moving towards industrialization should be ready to face.

SUMMARY

In this paper difficulties involved in establishing collectively owned plants on moshavim have been discussed. The main difficulty appears to be the problem of income redistribution and its equalization between the factory workers and the farming families. Such an equalization is considered essential to secure a main working body of moshav members in the factory. Other major difficulties are the risk involved in the investment in one central project; the possible levying of factory losses from the farming families; and finally, the relatively long time span needed to establish a factory and bring it to full-scale production.

A very strong spirit of cooperation among the moshav members to overcome these difficulties is required along with a strong belief that industrialization is the correct policy for overcoming the problems arising from over-production in agriculture. It is up to the moshav members in any particular moshav to decide whether such conditions prevail.

A means by which the issue of income transfers within the moshav may possibly be eased is the creation of an Industrialization Trust which could serve as a channel for income equalization and a source of support for any economic and financial difficulties. Such a fund, if properly administered, may obscure the link between levies put on the moshav families and the prevailing economic events in the factory or during its establishement period.

REFERENCES

1. Bell, D. W. (1979). *Industrial Participation*. Pitman.

2. Golan, D. (1980) *Profiles of Industrial Plants in Collective Settlements — Theoretical Discussion and Empirical Analysis*. M. Sc. Thesis, Hebrew University of Jerusalem, Faculty of Agriculture. Rehovot, Israel, (Mimeo, Hebrew, with English summary).

3. Keeny, R. L. and H. Raiffa, (1976). *Decision with Multiple Objectives — Preferences and Trade-offs*. Wiley and Sons.

4. Palvesky — Segev, A. (1983). *Industry in Cooperative Settlements (Moshav) — Empirical and Theoretical Analysis of Family Firms*. M. Sc. Thesis, Hebrew University of Jerusalem, Faculty of Agriculture. Rehovot, Israel, (Mimeo, Hebrew, with English summary).

5. Raiffa, H. (1968). *Decision Analysis — Introductory Lectures on Choices under Uncertainty*. Addison — Wesley. Reading. Mass.

6. Roumasset, J. A., J. Boussard and I. Singh. eds. (1979). *Uncertainty and Agricultural Development*. Agric. Development Council. N. Y.

7. Shavit, D. (1984). *Analysis of Future Development of a Moshav in the Sharon — with the Aid of an Economic and Financial Planning Model*. M. Sc. Thesis, Hebrew University of Jerusalem, Faculty of Agriculture. Rehovot, Israel, (Mimeo, Hebrew, with English summary).

8. Yaron, D. (1979) Economics of Irrigation and the Institutional and Pricing Systems of Water in Israel. *Agr. Water Management* 2: 203—216.

9. Yaron, D., A. Cooper, D. Golan and A. Reisman, (1983). Rural Industritlization: Analysis of Characteristics and an Approach to the Selection of Industrial Plants for Kibbutz Settlements in Israel. *Applications of Mngt. Sci.* 3:261:291.

10. Yaron, D., A. Palevsky-Segev, E. Ben Rephael and A. Yaron (1984). *Towards Industrialization in Moshavim*. Res. Report. Hebrew University of Jerusalem, Department of Agricultural Economics. Rehovot, Israel. (Hebrew).

11. Yaron, D. and A. Ratner. (1984). *Survey of Attitudes of Moshav Members Towards Non-Agricultural Employment*. Res. Report. Center for Agricultural Economic Research. P.O.B. 12. Rehovot, Israel, (Hebrew).

12. Yaron, D. and A. Ratner, (1985). *Efficiency and Game Theory Analysis of Income Distribution in the Use of Irrigation Water*. Rep. Ser. 14, Inst. of Agricultural Economics, University of Oxford.

13. Yaron, D., A. Dinar and A. Ratner (1986). *The Applicability and Usefulness of Cooperative Game Theory in the Analysis of Equity Issues in Regional Water Resource Problems*. Rep. Ser. 16, Inst. of Agricultural Economics, University of Oxford.

A P P E N D I X

THE MOSHAV MODEL[1]

GENERAL

The Moshav Model is based on the following assumptions:

1) There are several types of familly farms in the moshav, diffe-ring in the specialization of their production. Each farm type repre-sents a number of farms assumed to be homogenous.

2) Each type of farm has at its disposal a given endowment of resources and quotas of products, the production of which is res-tricted by the government (these restrictions aim to retain pro-fitability).

3) The moshav cooperative maintains a limited scale production activity in agriculture. The labour is provided by hired workers.

4) The moshav cooperative acts as a mutual credit association. All financial transactions of the families are carried out through the cooperative. All outside financial transactions of the cooperative are carried out through a bank.

5) The cooperative is authorized to limit the credit granted to each type of farm per each subperiod.

6) Current private consumption per annum of the families is pre-determined and is not dependent on the current income. At the end of each year decisions regarding investment in durable consumption and production goods are taken. These do depend on income.

A similar pattern applies to the cooperative's decisions regarding the current public consumption (services provided) and investment.

7) The model refers to one year with the year being subdiveded into several subperiods. The cash flows of the families and of the cooperative are detailed accordingly.

8) Payments (or charges) of interest take place at the end of each subperiod.

9) The farming families are assumed to act as rational income maximizers subject to restrictions on the resources available and pro-duction quotas. Some of these restrictions are of social nature (e.g. restrictions on the number of workers per family farm hired from outside).

Similary the moshav coooperative acts as an income maximizer with reference to its production sector.

Other assumptions are implicitly shown in the mathematical for-mulation of the model which follows.

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[1] Only the essentials of the Model are presented here. A detailed presentation of the Moshav Model can be found in Shavit (1984, Hebrew).

MATHEMATICAL FORMULATION

The moshav model is formulated in terms of a linear programming model. We first present the restrictions and model equations.

Technical restrictions

$$A_i \underline{X_i} \leqq \underline{b_i} \qquad i = 1, 2, \ldots I \tag{A.1}$$

where i is the index of farm type, A is the matrix of input output coefficients, X is the vector of activity levels, and $\underline{b}$ — the vector of limited resou ces and other restrictions.

Net periodical cash flow and end of period balance on family farms

$$N_i{}^t = r^* V_i{}^{*(t-1)} - r^{**} V^{**(t-1)} + \underline{d_i{}'^t} \underline{X_i} - D_i{}^t - C_i{}^t - GT_i{}^t - L_i{}^t \tag{A.2}$$

$$V_i{}^{*t} - V_i{}^{**t} = V_i{}^{*(t-1)} - V_i{}^{**(t-1)} + N_i{}^t \tag{A.3}$$

where t is the index of subperiod of the year (month, two-months or quarter; $t = 1, 2, \ldots T$); N^t — is the net cash flow during period t ($N^t \lessgtr 0$); V^{*t} and V^{**t} are, respectively, the positive and the negative balance of the farm at the end of supberiod t with r^* and r^{**} being the corresponding rates of interest.

Note that V^{*t}, $V^{**t} \geqq 0$ and that $V^{*t} > 0$ implies $V^{**t} = 0$; $V^{**t} > 0$ implies $V^{*t} = 0$. The vector $\underline{d}$ respesents the cash net inflow or outflow corresponding to the vector of activities X and the scalars D^t, C^t and GT^t are the taxes levied by the cooperative, family consumption, and government taxes (income tax and social security. L^t is the long--run debt servicing (capital and interest).

Note that: (1) D, C, and GT are predetermined for any particular year. (Alternative formulations with some of these variables being endogenous, were used in alternative models); (2) the initial value of V^* or V^{**} (for $t = 0$) is predetermined; (3) the negative balance of farm type i at the end of subperiod t is restricted by the cooperative i.e.,

$$V_i{}^{**t} \leqq K_i{}^t \tag{A.4}$$

with $K_i{}^t$ being the restriction level.

Production on the cooperative farm

$$A_c X_c \leqq b_c \tag{A.5}$$

where the index c denotes the cooperative and the other symbols are as in (A.1).

Net periodical cash flow and end of period balance of the cooperative

$$N_c{}^t = r_c{}^* V_c{}^{*(t-1)} - r_c{}^{**} V_c{}^{**(t-1)} + \underline{d_c}'^t \underline{x_c} -$$

$$- H_c{}^t + \sum_i n_i D_i{}^t - r^* \sum_i n_i V_i{}^{*(t-1)} + r^{**} \sum_i n_i V_i{}^{**(t-1)} - L_c{}^t \qquad (A.6)$$

$$V_c{}^{*t} - V_c{}^{**t} = V_c{}^{*(t-1)} - V_c{}^{**(t-1)} + N_c{}^t + \sum_i n_i T_i{}^t \qquad (A.7)$$

where $N_c{}^t$ is the cooperative's net cash flow resulting from its activities, $V_c{}^{*t}$ and $V_c{}^{**t}$ are respectively the positive and the cooperative's negative balance in its bank account with $r_c{}^*$ and $r_c{}^{**}$ being the corresponding rates of interest. H_c represents the cooperative's cost of administration and services (assumed to be predetermined, n_i is the number of family farms of type i and the other symbols are as defined in (A.2) and (A.3).

Note that (i) $V_c{}^{*t} > 0$ implies $V_c{}^{**t} = 0$ and $V_c{}^{**t} > 0$ implies $V_c{}^{*t} = 0$; (ii) the initial values of $V_c{}^{*t}$ and $V_c{}^{**t}$ (V_c for t = 0) are predetermined.

The objective function

The objective function is

$$F = (V_c{}^{*T} - V_c{}^{**T}) \qquad (A.8)$$

Maximization of F subject to (A.1) — (A.7) leads to an efficient solution in the sense that each family farm maximizes its income subject to the restrictions of the system, and so does the farming sector of the cooperative.

VARIANTS OF THE MODEL

Model A

The Moshav Model presented above, designated as Model A, maximizes the income of each family farm independently, subject to the restrictions posed by individual farms' resources and production quotas. Current capital is available to the cooperative at the rate of interest $r_c{}^{**}$ and to the family farms at the rate $r^{**} \geqq r_c{}^{**}$. When the supply of current capital to the cooperative is restricted it is allocated to the family farms according to its shadow cost $p_c{}^{**} > r^{**}$; in such situation current capital is the only common resource, the allocation of which among the family farms is subject to economic efficiency.

Note that moshav members and their managerial boards make a conscious distinction between short run and long run economic ef-

ficiency. While continuosly failing family farms are encouraged to leave the cooperative there is a tendency to support family farms which have suffered short run economic losses due to factors beyond their control (e.g., a loss due to plant disease). One of the means of such support is the allocation of short term credit, contrary to short run efficiency considerations.

Model B

Model B is similar to Model A except for enabling interfarm exchange of water quotas, production quotas of certain products and temporary transfers of land. The exchange of these resources is assumed to be directed by their shadow prices. Thus, Model B assumes a higher level of economic efficiency than Model A.

Model C

This is an extension of Model B which involves the inclusion of a factory as a collective activity with one half of its workers being the owners of the family farms who lease most of their agricultural resources to the moshav cooperative for reallocation either to the farming families or to collective agricultural enterprise managed by the cooperative.

INTEGRISANJE INDUSTRIJSKIH POSTROJENJA U »MOŠAV« PRIVREDU — PREDNOSTI I KONFLIKTI

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R e z i m e

U članku se razmatraju teškoće pri osnivanju industrijskih postrojenja u kolektivnom vlasništvu u mošavima, tj. zadružno organizovanim selima u Izraelu. Izgleda da je glavna teškoća u distribuciji dohotka i njegovom ujednačavanju između porodica fabričkih radnika i poljoprivrednih proizvođača. Takvo uravnoteženje dohotka smatra se nužnim da bi se obezbedio neophodan broj članova mošava koji bi radili u fabrici. Druge krupnije teškoće su u riziku koji sobom nosi invetsiranje u jedan veliki projekat; tu je i eventualno pokrivanje gubitaka fabrike iz prihoda porodice poljoprivrednika; i konačno, relativno dug vremenski period potreban od osnivanja fabrike do trenutka kada ona počne sa punom proizvodnjom.

Da bi se savladali pomenuti problemi, potreban je ne samo snažan duh saradnje među članovima mošava, već i vera da je industrijalizacija ispravan put za rešavanje problema izazvanih hiperprodukcijom u poljoprivredi. Od članova mošava u svakom konkretnom slučaju zavisi da li će zaključiti jesu li pomenuti uslovi zadovoljeni.

Sredstvo kojim se eventualno može rešiti pitanje transfera dohotka unutar mošava je osnivanje Fonda za industrijalizaciju, koji bi mogao da posluži kao kanal ujednačenja dohotka i kao izvor podrške u slučaju ma kakvih ekonomskih i finansijskih teškoća. Ukoliko takav fond bude u dobrim rukama, mogao bi zamagliti vezu između dažbina koje su nametnute porodicama u mošavu i prevalentnih ekonomskih zbivanja u fabrici tokom perioda njenog osnivanja.