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Group Farming in Mexico and Peru
A Multivariate Analysis of Peasant Cooperatives[1]

by

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The purpose of the present paper is to analyze the operation and performance of peasant cooperatives [2/] established within a land reform context. Multivariate analysis methods are used on a sample of reform beneficiary associations in Mexico and Peru.

It has been generally recognized that income and growth objectives of land reform cannot be fully attained unless some group action among the reform beneficiaries is promoted and sustained. Countries engaged in major land reforms have established different types of peasant associations to cope with the problems of production, delivery of inputs and marketing of output in the post-reform setting.

The experiences of Mexico and Peru in this sphere are of special interest, because (1) both countries are in the midst of a massive land reform program; (2) both have attempted to organize reform beneficiaries into cooperatives; (3) there are observable cases in both countries that were recently organized (since 1969).

[2/] The term "cooperative" is used here in its most general sense, encompassing all kinds of group action in the spheres of credit, farming proper, marketing, input delivery, processing and the like. Almost all groups examined here are of the "land use type", as described in section II below.

The empirical study of the performance of peasant groups has been hampered by the difficulty of evaluating the interrelationship of economic, social and political factors that explain their success or failure. Several studies have analyzed the economic dimension rather thoroughly, only to arrive at the conclusion that institutional and political elements are mainly responsible for the observed results. Similarly, sociologists and political scientists have examined the behavior of peasant groups from their professional angle, referring to the economic aspects as their reference basis.

In the present paper, the attempt is made to pull together these threads, and to examine empirically some of the ensuing interrelationships. Multivariate analysis techniques (specifically, factor analysis and canonical correlation) were used to analyze data derived from 54 case studies elaborated for this purpose in Mexico and Peru.

In the first section we shall briefly review the historical and institutional setting of peasant cooperatives within the specific land reform contexts of these two countries. Section II describes the source of the data and characteristics of the variables. The principal factors of group behavior, derived from factor analysis, are examined and compared in section III. In section IV the attempt is made to explain observed group performance with the aid of canonical correlation. Finally, section V presents some major conclusions and possible routes of further analysis.

I. The Land Reform Setting [3/]

The Latin American land system has been characterized as both oppressive and inefficient. Its main features are: high land concentration, a feudalistic agrarian structure, a relatively large agricultural labor force, poverty and

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3/ For references on the land reform setting in Latin America, particularly in Mexico and Peru, and on peasant coops within this context, see list at end of paper.

misery in the country-side, peasant unrest and a growing awareness of politicians and governments to these problems. All of these have paved the way to land reform in this continent.

1. Mexico

The first major land reform program was launched in Mexico, following the Revolution of 1910. Although the immediate cause of Diaz's overthrow in 1910 was his non-reelection as president, the agrarian problem soon turned into the central issue of the prolonged Civil War. Political stability was restored only in the mid twenties, when peasants all over the country felt that the Agrarian Law, incorporated into the Federal Constitution in 1917, would earnestly be implemented.

The land reform process was radicalized by President Cardenas, (1934-40) in three major respects: 1) rapid accelaration of land redistribution; 2) expropriation and reallocation of lands belonging to commercial estates and cotton plantations; 3) setting up of agricultural production cooperatives (the "collective ejidos") in those cases where dislocation of the original farming units threatened their productive potential. About 700 such production coops had been established by 1940, receiving full support from the Cardenas administration.

The pace of land redistribution dropped sharply afterwards, but has continued uninterruptedly to the present. By 1970, some 70 million hectares had been redistributed to two million ejidatarios (reform beneficiaries), cultivating about one half of the country's total of cropland. However, after 1940 collective ejidos lost the support they had enjoyed earlier. Often they were opposed on political grounds, due to their leftist inclinations. As a result, they lost their initial impetus, many of them disintegrated altogether, while others turned to mixed or partial type cooperation

in land use.

In 1970, President Echeverria launched a major drive of ejido reorganization, back into collective norms. By 1975, close to 800 ejidos all over the country had been "reorganized", i.e., persuaded to form a production cooperative usually around some new economic venture (tube-well, milk stable, etc.) with the assistance of promoters assigned and trained by the Land Reform Ministry. The present analysis is based on case studies of 31 such coops.

2. Peru

Peru's agrarian structure has been one of the most traditional and semi-feudal in Latin America. But over the last several decades considerable modernization took place. By the 1960's most coastal estates were mechanized, centrally managed and market oriented. In the Highlands, mechanization and market integration were less advanced, as most estates were cattle ranches operating with a more traditional, Indian population under a colonato system. But even these estates had begun to expel their colonos, introduce wage-labor systems and market a higher proportion of their output.

In 1964 a land reform law was written, but hardly implemented. The military government, which took over in 1969, decreed a new, more radical law, and initiated at once a new phase of accelerated land redistribution by expropriating the country's 12 large coastal sugar plantations and converting them into production cooperatives.

Elsewhere, all large estates and estates not managed directly by their owners are being expropriated, and handed over to their colono-workers. By 1976 about half the country's farmland was redistributed among one-third of the rural population. The government has put strong emphasis upon collectivization, and expropriated estates (or groups of estates) have been transformed into production cooperatives of different types.

By the end of 1973, close to 500 such coops had been organized throughout the entire country. The present analysis is based on case studies of 23 such peasant associations, as described below.

II. Description of Samples and Variables

1. The samples

In the course of a comprehensive study on experiences with land reform in Latin America [4/], case studies were elaborated on a sample of reform enterprises in each of several study countries. In two of the countries - Mexico and Peru - field researchers visited(during the latter part of 1973) production coops that had recently been organized under the auspices of the land reform agencies, and prepared case reports following a detailed open outline especially prepared for this purpose.

The Mexican sample covers 31 cases in 11 states (out of the country's 32), all of them in the Northern and Central Zones of the country[5/]. At the time of the survey, close to 100 coops had been organized in these states. The sample was chosen, more or less at random, from a smaller sub-population of coops that had been in operation for at least two years. Joint activities include crops (cotton, rice, maíz, alfalfa) livestock and cattle (extensive and intensive), and in one case fishery.

In Peru, 23 cases were visited in 6 reform zones that comprehend the different reform types found in the country's 12 zones. Nine of the cases are production coops in the Coastal area characterized mainly by a wage-labor system (chosen at random from a population of about 70 in the respective

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4/ See footnote 1.

5/ The states are: Sonora, Sinaloa, Coahuila and Durango in the north, Guanajuato, Queretaro, Michoacan, Tlaxcala, Mexico and Morelos in the center.

zones) all of them crop enterprises (cotton, sugar cane, rice, coffee). The remaining 14 cases are located in Peru's Highlands: 7 crop/cattle and 7 livestock enterprises. Eleven production coops were chosen in two zones, out of some 80; and 3 SAIS [6/], out of 13. Natural resources in these areas are poorer, and agriculture is less developed, than in the Coast and the colono system was widespread before land reform.

On the basis of these 54 field reports (31 from Mexico and 23 from Peru), 19 variables (enumerated below) were selected and scored by the same researcher, and then re-checked by the field workers. Scores vary from 1 through 5, with scores "pointed" from negative to positive results or manifestations.

The two samples thus have the following features in common: 1) they correspond to agricultural production cooperatives established within a land reform context; 2) land reform in both countries is massive, nation-wide, following a relatively radical agrarian policy with a heavy political or ideological content. 3) Group farming was instituted as an organic part of the post-reform property/management system chosen for the reform beneficiaries (in Peru this is generally true, in Mexico it is true of the "reorganized ejidos" that constituted our statistical universe). 4) All peasant groups had been organized during the last few years, and were in operation for at least two years when visited. 5) Case studies were written following the same guide prepared for this purpose. 6) Variables were scored on the basis of

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6/ Legally a SAIS is an enterprise owned and managed by a service cooperative, made up of the workers of expropriated estates, and by a number of peasant communities which have been designated by the Reform Agency as land reform beneficiaries. In practice, the SAIS operates as a production coop.

the field reports by the same "cabinet" researcher.

2. The variables

The 19 variables selected cover a wide range of socio-economic indicators specified to measure economic, social and political aspects of the behavior and performance of peasant associations under different social and institutional conditions.[7/] The variables fall under five broad categories, as can be seen in the following list:

Economic Indicators

1) Technological change (T), as reflected by the introduction of agricultural machinery and the adoption of new production techniques.

2) Output (Q), increase in production of the group.

3) Income (Y), increase in income of group members since the formation of the group.

4) Employment (E), creation of new sources of employment for group members.

Institutional Backing

5) Credit (C), access to credit from official or private sources to finance group activities.

6) Technical assistance (TA), provided by public or private institutions in the form of extension service, technical advice and the like.

7) Administrative assistance (AA), advice and guidance in the organization of

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7/The Mexican sample was subjected to a more thorough statistical examination. Close to sixty socio economic and political indicators have been specified, which we intend to analyze in different combinations, using close to ten factors of classification of the cases included in the final sample, planned to cover about one hundred peasant groups all over the country. In the present paper, we concentrate on a sub-set of 19 variables, that could be specified and scored consistently f r the Mexican and Peruvian samples.

the group, its management, administration and book-keeping.

8) Official support (OS), general backing of group by government agencies, and public officials in the course of their business activities.

9) Training of members (Tr), organization of and participation in training courses for group members.

10) Managerial personnel (M), professional managers in charge of group activities, hired either by group itself (in Peru, sometimes in Mexico) or by official agency (more usual in Mexico).

Social Conditions

11) Housing standards (H), type of construction of member dwellings, number of rooms, sanitary facilities.

12) Education (Ed), access to education of members' children, availability of primary, secondary or technical schools.

Social Issues

13) Leaders' capacity (L), managerial administrative capacity of elected leaders.

14) Member control (MC), involvement of group leaders and members in the decision taking process and in day to day management of group affairs.

15) Member participation (P), identification of base members with group activities through attendance of assemblies, and support of leaders.

16) Member admission (MA), openness of group to new members, ease of admission.

17) Internal harmony (Ha), absence of social friction and conflicts among members.

18) Honesty (Ho), integrity of leaders and functionaries in the fulfilment of their duties.

Political Dimension

19) Peasant unions (U), affiliation of the group with some regional peasant union or national organization.

Each of these 19 variables was scored according to the information contained in the case studies, from 1 to 5. The score 1 was given to the lowest level of performance (like "great decline" in output, income and employment, "no access" to credit or educational facilities, "unacceptable" housing conditions, "complete absence" of internal harmony or honesty, and so on); the score 5 was given to the highest level or most positive result (like "great increase" in output, unlimited availability of credit, close-by secondary and technical schools, very significant honesty and capacity of leaders, etc.); inbetween scores (usually three, sometimes one) were assigned accordingly.

Some descriptive statistics (means and standard deviations) on these variables are given in Table 1, for Mexico, for Peru, and for the combined sample. On the whole, score means are similar, with only four significant differences: changes in output and employment are higher in Mexico, so are housing standards. On the other hand, training programs were more widespread in Peru.

It follows, that if the comparison of peasant group performance in Mexico and Peru were based solely on their mean scores, not much could be learned from it. More elaborate models are needed in order to arrive at comparative assessments. This is the purpose of the present paper.

III. Principal Factors of Group Behavior

The interrelationship among the above 19 variables was first examined with the aid of factor analysis. This statistical method is very popular in the social sciences, and has mostly been used by psychologists and sociologists who as a rule handle a great number of variables over large samples.

Its use among economists is more recent, and less common. Adelman and Morris used factor analysis in 1965 to analyze socio-political and institutional influences upon the development process. The following is a precise statement of the objectives and limitations of the method, as set forth in the mentioned paper:

> Such an analysis, undertaken by economists, may serve two purposes. First, it may suggest hypotheses relating non-economic to economic variables which are both suitable for testing by more intensive analyses and relevant to the central concerns of development economics. Second, it may underscore the need felt by economists for more exact knowledge about the interrelationships of the development process and thus stimulate joint research efforts by economists and members of other disciplines.
>
> More especifically, an attempt is made in this paper to gain some semiquantitative insights into the interaction of various types of social and political change with the level of economic development. .. Nor should the relationship found be interpreted in a causal sense. The results of the factor analysis neither demonstrates that economic growth is caused by socio-political transformations nor indicate that variations in development levels determine patterns of social and political change. Rather they suggest the existence of a systematic pattern of interaction among mutually interdependent economic, social and political forces, all of which combine to generate a unified complex of change in the style of life of a community. (pp 556-7)

1. Factor analysis - outline of the method

In our particular case, we have 19 variables that jointly describe the socio-economic conditions and performance of 54 communities. Factor analysis is used to reduce the dimensionality of the variables to, say, three or five "common factors" or "principal components", which are easier to manage. All variables that are strongly intercorrelated would then be interpreted as one factor, a second set of variables would form a second factor, and so on, until most of the variance of the original data set (of 19 dimensions) is accounted for by the new factor set (of, say, 3 dimensions).

Such factors have been used for two purposes. First, to produce one - or several - composite scores that measure what all (or a subset of the) original variables have in common. Then, we could judge the performance of each peasant community by evaluating its score on a reduced number of factors rather than on the entire set of 19 variables. In our case, the first factor "represents" eight variables, as follows (see Table 3):

$$F_1 = .13T + .35Q + .02Y + \ldots + .27Ed$$

The composite factor score F_1 of any peasant group is obtained by multiplying its particular T score by .13, its Q score by .35, etc., and summing these products over all variables. We have thus reduced the eight original variables to one composite variable, that "tells their story" in one index. The factor score coefficients were calculated [8/] in such a way that F_1 extract the maximum variance from the original data set; or in other words, that the computed factor scores explain a maximum variance among individual observations (peasant groups).

The first factor, F_1, accounted for 29% of the variance of all 19 variables, and was significantly related to only eight of them. Therefore, a second factor F_2 is calculated, such that it be unrelated to F_1 (i.e., the correlation between factor scores F_1 and F_2 is zero), and that it extract the maximum possible variance remaining in the original data set after the

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8/ The present description of "factor analysis" is confined to a brief explanation of the results obtained and their interpretation, rather than to a formal specification of the mathematical model and methods of computation. Therefore, we omit the latter (which is amply discussed in the references listed at the end of the paper), and proceed with a non-rigorous presentation of the statistical model, aimed at readers who are familiar with multiple regression, but not with factor analysis.

effect of F_1 has been removed.

The second factor is related to five variables, different from the preceding eight, as follows:

$$F_2 = .56L + .06MC + .34P + .01Ha + .18Ho$$

The second factor F_2, accounts for an additional 15% of total variance. Similarly, additional factors are derived, as long as they account for a significant portion of the variance of the original variables (as a rule 5% and above), and subject to the constraint that they are unrelated to each other. In our case, six such factors were found, who together extract 73% of the variance, thus leaving 27% of the original data variance unaccounted for. Thus we can speak of six "common factors", that is, factors of peasant behavior common to all observed groups, that "explain" about three quarters of the differences observed among the groups; and of one "unique factor", [9/] that is, a factor specific to each particular group and responsible for the remaining quarter of differences.

Factor scores have many uses, which will not be pursued here. Rather, we shall concentrate on the second task of factor analysis, that of "construct seeking": "to find ways of identifying fundamental and meaningful dimensions of a multivariate domain" (Cooley and Lohnes, p.131). The question here is: can behavior of peasant groups, as measured in terms of 19 variables, be reasonably interpreted in terms of a few underlying principal factors, that could help us understand the basic structure (or construct) of the different variables, their

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9/ This term is used as a "catch-all factor" for the residual error of each variable. In fact, unexplained variance could a so be created by several small factors.

interrelationship, and hence the entire process of group performance and development (or decadence, as the case may be).

In this second context, we specify each variable in terms of the (six) common factors, as derived above. We thus have 19 equations (see Table 2[10/]):

$$T = .69\ F_1 + .25\ F_2 + .30\ F_3 + .21\ F_4 - .18\ F_5 + .09\ F_6$$

$$Q = .80\ F_1 + .27\ F_2 + .08\ F_3 - .07\ F_4 - .10\ F_5 - .14\ F_6$$

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$$U = .25\ F_1 - .02\ F_2 + .05\ F_3 + .13\ F_4 + .01\ F_5 + .06\ F_6$$

These equations can be interpreted as multiple regressions of each variable on factors F_1 through F_6.[11/] The coefficients of the factors are called "factor loadings", and they measure the change in (say) T caused by a unit increase in (say) F_1, after the effect of the other five factors has been allowed for (or, in other words, holding the other five factors constant). Since both variables and factors enter the computation in standardized form, these are "normalized regression coefficients", that is, changes in both T and F_1 are measured in standard deviations. Further, since the six F's are unrelated (factors were derived orthogonal to each other) the coefficients also represent the simple correlations between the factors and variables. It follows that $(.69)^2 = .49$ is the proportion of (unit) variance of T "explained" by F_1, after the contribution of the remaining factors has been eliminated.

10/ In table 2 only significant coefficients are reproduced; in the text we listed all values, for illustrative purposes.

11/ These are not regressions in a statistical sense, since the six F's are not independently observed variables but rather computed values derived from the 19 data variables, as described above. But the analogy is valid for interpretative purposes and we presume that readers are familiar with regression analysis.

Furthermore, the horizontal sum of coefficient squares ($.69^2 + .25^2 + \ldots = .71$), called the "communality" of T and denoted h_T^2, measures the portion of variance in T explained by all common factors taken together. It is analogous to R^2 in multiple regression analysis.

The mean of the vertical sum of squares $(.69^2 + .80^2 + \ldots)/19 = .29$, called V_1, gives the portion of the variances of all 19 variables, attributable to F_1. In this sense we stated above that the first factor accounts for 29% of total variance in the original variables.

Finally, the sum of all V's ($.29 + .15 + \ldots = .73$) shows the percentage of total data variance accounted for jointly by the six factors. Thus, our six factors "cover" 73% of the variations in peasant group behavior observed in the sample, where "behavior" is measured in terms of 9 variables or socio-economic indicators. This is also the average communality over all variables.

When the main purpose of the analysis is "construct seeking", like in the present paper, factor loadings serve as basis for assigning the different variables to their corresponding factors, and thus to identify and interpret the resulting common factors. We "assign" a variable to the factor (or factors) with which it displays a significant correlation.[12/] When each variable is

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12/ There are no clear statistical tests for 'significant loadings". In the present paper we shall adopt the following notation: a variable is considered as "included" in a factor whenever its loading (a) is greater than .40; it is considered of"minor" weight when $.30<a<.40$; $a<.30$ are ignored altogether. A variable will be called "bi-factor" when it has loadings greater than .30 on two factors and in that case it is considered of"primary importance" in the factor with highest a, of "secondary importance in factor(s) with lower a. This is accepted procedure in Factor Analysis (see references under D). We shall usually start variable names with small letters, factor names with capital letters.

assigned to only one factor (or none), with insignificant loadings on all others, we speak of a "simple structure". We shall refer to a variable as "bi-factor" when it is related to two factors These concepts will be further elaborated in section 4 below, with the aid of figure 1. But let us first turn to the interpretation of the factors derived from our sample.

2. Interpretation of Common Factors

Factor Analysis performed on each of the two countries, and on the combined sample, resulted in 6 significant factors. The first three factors are common to both countries, with slight but significant variations in their importance and composition between Mexico and Peru. The remaining three factors are specific to each country, and are difficult to interpret on an inter-country level (see Tables 2 and 4).

The first factor represents Socio-economic Performance. It depicts changes in income, output and employment, generated by technological change, based on access to professional management and to credit, and accompanied with acceptable social conditions. In short, it reflects Performance in the best development sense. This factor is made up of almost the same variables in the two countries, but the exceptions are striking: in Peru, unlike Mexico, income is not included in this factor (it derives more from minimum wage legislation than from productive achievements on the farm), but local leadership is playing a much more active role. In Mexico economic performance depends also on technical and administrative assistance, unlike Peru, where the local manager hired by the group as well as leadership have a much stronger say.

The second factor in the general structure, is Social Participation. It includes member control, member participation, good leadership, honesty and internal harmony. All the good traits mentioned in the literature.

On the whole, the composition of this factor is similar in both countries.

The third factor represents Institutional Support made up of a "minimum package" of 3 variables in both countries: technical assistance, administrative assistance and public support in general. Member admission also enters this factor, but with a negative sign. The rural associations covered in our sample are "closed groups", reluctant of admitting new members, due to their specific legal set-up and under the tutelage of the Institutional Support they enjoy. This is especially marked in Mexico, where ejidos are literally "closed".

In Mexico, managerial personnel, and to a lesser degree credit and technological change also form part of the institutional package; unlike Peru, where in spite of the great weight of this factor (it is the first factor), these three elements come tied in with Economic Performance, quite unrelated to the direct public support.

These three factors can be considered "common factors", because they are very clearly depicted in the "general pattern", and they appear again in each of the two countries. The weight of each factor (in terms of variance explained by it) and the deviations in its composition, reflect in quantitative terms the different land reform types and paths, described in the literature (see references under C).

The three remaining factors are specific to each country, but are of much lesser importance (as reflected by the percentage of variance explained by them). In both countries (when considered separately), employment generation is not always related to economic performance; that is, it did not always accompany increases in output and income but depended also on other factors (e.g., minimum wage legislation, official bank policy). Affiliation to peasant unions seemed to be unrelated to either economic or social performance. In Peru, F_4 is of special interest: we labelled it "Rupture of Tradition", since it depicts training and education, associated with affiliation to peasant unions - all of this together with a slackening in observed (or alleged) honesty of leaders and public employees.

Returning to the three common factors, it can be concluded that the development process of the peasant groups, as described by the 19 variables examined, is essentially composed of three main factors: Economic Performance, Social Participation and Institutional Support. These emerged as orthogonal (i.e., unrelated) factors: they constitute three independent dimensions by which the development process can be measured and assessed. It means that a high score on (say) Economic Performance of any one group was not observed to be associated with a similarly high score on either Social Participation or Institutional Support. They have not constituted one package, with all elements in it growing or declining together.

3. Correlation among factors

The above results are based on the assumption of orthogonality (or independence) of factors. In order to test this assumption, and explore the possibility of intercorrelation among the factors, we have re-run the data with an oblique model.[13/]

The same six factors emerged, both in the combined sample and in the two countries, although their order and in minor part composition changed somewhat. Hence, we shall omit the detailed description of the oblique factors,and pass on to examine their correlations (see Table 5).

The three common factors, in the combined sample, show correlation coefficients of .25 to .30. This could be interpreted as follows:Economic Performance, Institutional Support and Social Participation are in fact

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13/ This does not change the basic computation of the factors, but only the"position" of the reference axes and hence the interpretation of the resulting factors. This will become clearer in section 4 below.

separate factors that are clearly distinguishable (this is questioned when $r > .30$)[14/], but they are not entirely unrelated to each other (which they could be assumed to be if $r < .20$). Rather there is a positive correlation among all three, whereby some 6-10% of the variance in each factor is attributable to variations in each of the other two factors.

The correlation among factors differs between the two countries, when factors are derived on a within country basis.

In Mexico, both Economic Performance and Social Participation were related to (probably dependent on) Institutional Support (not so in Peru). However, there was no direct association between Economic Performance and Social Participation or, for that matter, with Internal Harmony. The latter two are important objectives per se, and are strongly related, but do not seem to be directly associated with achievements in the economic sphere.

Two coefficients exceed the .30 limit: Social Participation and Internal Harmony (which was to be expected) and Institutional Support and Peasant Unions (reflecting the close cooperation between the land reform agency DAAC and the official peasant union CNC in carrying out the most recent collectivization drive).

In Peru, significantly, none of the three "common factors" are associated. Economic Performance depends upon Management, but not at all on Institutional Support (after Management has been distinguished from it). Management is a basic development factor in Peru: it is related to Economic Performance, to Employment and somewhat, to Social Participation. Signifi-

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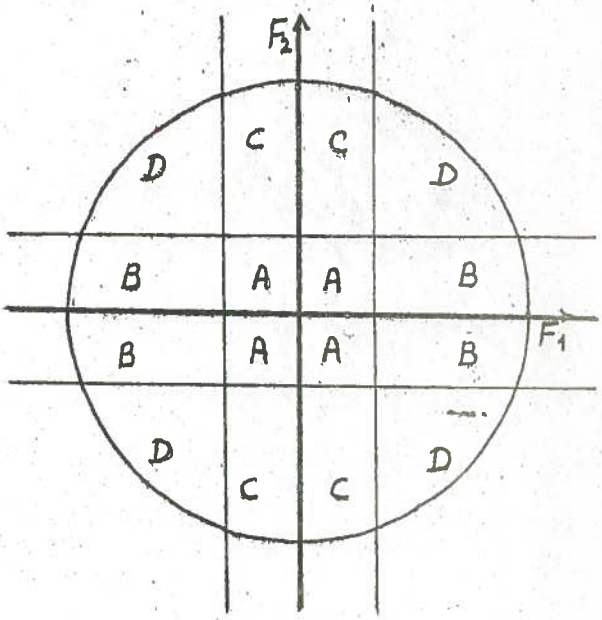
14/ There is no meaning to a test of significance of these correlations, since oblique rotation of axes is attempted for interpretative rather than inferential purposes. It is customary to consider $r < .20$ as negligible; when $r > .30$ the separation between the two factors is challenged; inbetween cases are subject to interpretation.

cantly, its lowest correlation is with Institutional Support.

4. Comparative Factor Analysis - a graphical presentation

A Factor Analysis pattern can be depicted graphically showing each pair of factors as axes in a two-dimensional plane, and each variable as a point in the plane with its "loadings" as respective coordinates. This is done in Figure 1 for the three common factors of the combined sample.

Loadings of less than .3 are considered insignificant. We have accordingly divided the plane into 4 areas, which are illustrated in the adjoining diagram.



Area A: variables in this area have no bearing on either factor.

Area B: variables in this area form part of F_1, but not of F_2; they can have positive or negative loadings on F_1.

Area C: variables form part of F_2, but not of F_1.

Area D: variables form part of both factors.

Since each loading represents the correlation between a variable and a factor, the variables are located within a circle drawn with radius of unity. Any variable lying close to the circle in area B is "almost" entirely explained by F_1 (and so for F_2 in area C); in area D it is explained jointly by both factors. The distance from the circle thus depicts the degree to which the variable is not attributable to either factor or both; it repre-

sents the possible association with any other factor in the model, or with the "specific factor" - that part of the variance not accounted for by all common factors derived. The latter part is analogous to the error term in regression models.

A "simple structure" is one where no variables lie in area D, in all factor planes; i.e., each variable is associated with only one factor.

Figure 1 represents the same information as Tables 2 and 3, but it is easier to grasp the relationships among all variables, and among them and the three common factors.

Socio-Economic Performance (F_1 in panels (a) and (b)) is made up of eight variables. Five of them are dominant (closer to the outer limit): output, employment and technology, in the economic sphere, housing and education in the social sphere. The remaining three are of lesser weight: income, credit and management (cf. Table 2). None of these variables is associated with Social Participation, and only two are slightly related to Institutional Support (income lies in area C in panel (b), and technology on the very border).

Social Participation is made up of five variables. The "top two" are member participation and leadership, almost exclusively explained by this factor. The remaining three have somewhat lower loadings - member control, honesty and harmony - but they, too, belong exclusively to this factor. None of these five variables is related to the other two factors (they lie entirely in area C of panel (a) and in area B of panel (c)).

Finally, Institutional Support consists of three variables, which lie "closely together" (i.e., they are highly correlated): technical and

administrative assistance and official support in general. However, this "closeness" does not imply that they measure the same thing: their correlations range between .66 and .74, which means that only about 50% of the variance in any one variable is attributable to any other. But of course, they are related. They not only "stick together", but are also close to and high up on this factor axis, implying that they are completely unrelated to the remaining two factors.

The emerging "general factor pattern" is hence of an almost perfectly simple structure. Only income appears once in a D area which means that it is the only bi-factor variable encountered, depending about equally on both factors (for reasons suggested above).

So far we have dealt with orthogonal factors (i.e. unrelated or right-angle axes). A "better fit" could be obtained if axes were allowed to rotate freely, so as to approximate as closely as possible the clusters of variables that make up each factor. This has been done, by free hand, in the same figure, marking the "corrected" factor axes as F'.

In panel (a), F'_2 fits the cluster of Participation variables better than F_2, forming an angle of $\alpha_1 \simeq 78°$, with F_1. The correlation between the two factors equals $\cos \alpha = .21$, which shows some association between the two factors. Similarly, "better" fits are obtained in the remaining two panels, yielding factor correlations of close to .30. This is the graphical interpretation of an oblique factor rotation, and of the coefficients offered in Table 5 (although those were derived in a mathematical "objective" way, hence the divergence in the resulting r coefficients).

The conclusion arrived at in the preceding section can now be corroborated. The three common factors are positively related to each other,

but not to the degree of "blurring" their identities (which would be the case it the axes would come closer to each other). The factors are thus clearly distinguishable, as shown by the distance between the variable clusters of which each of them is composed.[15/]

Let us now turn to a graphical comparison of the factor patterns derived in the two countries. Results are presented in the six panels of figure 2, one for each of the common factor pairs in each country.[16/]

The differences between Mexico and Peru, pointed out in the preceding section, stand out very clearly in these graphs. The structure in each country is not as simple as for the "general pattern" of the combined sample. More of the variables belong to the D area (common to two or more factors), and the factors themselves are not as clear cut.

Socio-Economic Performance in Mexico is very clear. The dominant variables are output, income, employment and technology; on a second level comes education; third, credit, official support, administrative assistance and housing.

In Peru, the picture is less clear. Economic variables are less pronounced than in Mexico, and significantly income is missing. On the other hand, management is significant, whereas in Mexico it was not.

Likewise, Social Participation in Mexico is very sharply defined, made up of the five "classical" variables, (participation, leadership,

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15/ The last statement must be qualified, because the basic factor pattern was derived imposing orthogonality on the factors - before the rotation of the axes. The distance between the clusters is meaningful with this in mind.

16/ These figures are based on Quartimax rotation confined to three factors only. This results in slightly different loadings, especially in four variables not included in the first three factors. On the whole, the patterns are similar to those summarized in Table 3.

member control, honesty and harmony),all forming a close cluster. In Peru, the same five variables spread over a wider area, reflecting the fact that there Participation is of a lower rank (cf. Table 4, and some of the variables also "serve" other factors.

On the other hand, Institutional Support is more clear cut in Peru: administrative and technical assistance, and official support form a close cluster entirely absorbed by this factor; they determine income and (hence) internal control and to some extent member participation. In Mexico, no such association with the Participation variables is observed, but there management is part of Institutional Support and not of Economic Performance (like in Peru). Significantly, in both countries the reluctance of groups to admit new members (MA. with a negative sign) forms part of the Institutional Support factor, but not of any of the other factors.

The same graphs show very clearly the correlations between the three factor pairs, and the linking (or bi-factor) variables. In Mexico Economic Performance is almost entirely unrelated to Social Participation. In contrast, in Peru the two are closely related: technology and output seem to be the result also of Social Participation, and leadership contributes to Economic Performance as well (they lie in area D).

On the other hand, Economic Performance is closely related to Institutional Support in Mexico, but not in Peru. There, variables forming one factor are absent in the other, whereas in Mexico administrative assistance and official support are "felt" in Economic Performance, with technology and credit serving as the linking variables.

Then, again, Social Participation in Mexico is unrelated to Institutional Support (except for credit which is slightly related to both). In

contrast, in Peru two variables from the Participation set are, it seems, also affected by the Institutions factor: member control and participation. This reflects,apparently, the "autogestión" drive.

Some explanations of these differences were suggested in the preceding sections, and are discussed in much greater detail in the literature (see references under D).

IV. Pre-Conditions of Peasant Group Performance

From the factor analysis of the preceding section the conclusion emerged that the behavior and performance of peasant groups, could not be described in a one-dimensional scale. Rather, the 19 socio-economic indicators formed three distinct factors, common to both Mexico and Peru, that indicated that the development of peasant groups is a multi-dimensional process.

However, the above analysis did not tell us anything about the causal direction or interrelationship of these factors and their component variables. Moreover, the variables themselves were assigned to the different factors based only on their correlations, without reference to the functions they are likely to fulfill in the process.

Some variables are clearly "results", or performance indicators: observed increases in output, income and employment reflect achievements in the economic sphere,whereas member control and participation measure progress made towards the objective generally labelled social participation. Furthermore, factor analysis indicated that the two were, on the whole, distinct and unrelated. But under what conditions were peasant groups observed to have made greater progress in these two directions? In what

combinations did these factors appear, when these conditions were present?

Empirical studies of group farming have emphasized different preconditions of success. Some have stressed the economic elements: capital formation, technological change; others the institutional backing: technical assistance, training courses; still others the social disposition: internal harmony, leadership, honesty; and some have claimed that without political involvement progress is impossible. Factor analysis has disclosed that several of these "cause variables" formed part of the "result factors" (i.e., they have been observed to vary together), like technological change in the Economic Performance factor. It would then be reasonable to conclude that the data are consistent with the hypothesis that the former caused the latter (the causal link comes from our economic reasoning, not from the factor analysis). But other "cause variables" clustered into separate factors (like Institutional Support); how are these related to the other components of the process? Some clue was given by the bi-factor variables, but this was overshadowed by the orthogonality constraint imposed on the factors.

More specifically, the question we now face is the following: which, if any, of the precondition indicators have been associated with which, if any, of the performance indicators, when all variables are considered jointly? If performance could be measured along a single scale, we would use a multiple regression model, with performance as dependent variable and the diverse precondition indicators as independent variables. But since it was shown that performance itself is multidimensional, we have more than one dependent variable, calling for the technique of canonical correlation.

1. Canonical Correlation - outline of the method

> "Canonical correlation analysis can be looked on as a generalization of multiple correlation. In a multiple-correlation problem, we have a set of m variables x_i and one variable y; the objective is to find a linear compound of x-variables that has maximum correlation with y. In canonical correlation, there is more than one y-variable, and the objective is to find a linear compound of the x-varibales that has maximum correlation with a linear compound of the y-variables. The most suitable class of examples that comes to mind are those where the x-variables are from a different domain than the y-variables. For instance, the x-variables could be background variables referring to biographic data about psychiatric patients, and the y-variables descriptive variables about the patient's current behavior. The problem would be to find whether there is some combination of background variables (a background "pattern") that has a high correlation with a combination of y-variables (a behavior pattern)." (Van de Geer, p. 156-7)

In our case we have three performance indicators (Y_1, Y_2, Y_3) and seven pre-condition indicators (X_4, X_5,...,X_{10}; specified below), and we wish to examine how these two sets of variables are interrelated. The choice and composition of these ten indicators is based on the "construct" derived from the factor analysis of the preceding section.

We specify an overall performance measure, P_1, as a linear function of the three Y's; and an overall pre-condition measure, C_1, as a linear function of the seven X's. P_1 and C_1 are called canonical variates, and are defined as follows:

$$P_1 = b_1^1 Y_1 + b_2^1 Y_2 + b_3^1 Y_3$$

$$C_1 = b_4^1 X_4 + b_5^1 X_5 + \ldots + b_{10}^1 X_{10}$$

The first step of the analysis consists in deriving the 10 b^1 parameters such that r_{P_1, C_1} is maximized.[17] The value of this maximum r is

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[17] Like in the preceding section we omit the description of how these parameters are calculated.

called canonical correlation, and will be marked R_1.

The next step consists in deriving a second set of b coefficients:

$$P_2 = b_1^2 Y_1 + b_2^2 Y_2 + b_3^2 Y_3$$

$$C_2 = b_4^2 X_4 + b_5^2 X_5 + \ldots + b_{10}^2 X_{10}$$

such that r_{P_2, C_2} is maximized, subject to the condition that the second set of functions is orthogonal to the first, i.e., that P_2 is unrelated to P_1 (and to C_1) and that C_2 is unrelated to C_1 (and to P_1).

More than two such sets are possible.

> The number of possible pairs of linear combinations is equal to the number of dependent or independent variables, whichever is smaller. Each pair of canonical variates, P_i and C_i is maximally correlated, subject to the restriction that each canonical variate be orthogonal to all other canonical variates on its side of the equation... Successive R_i (canonical correlations) are of decreasing magnitude, and statistical tests are available, to reveal how many of the functions allow statistical interpretation. (Cooley, p. 36-7)

Turning now to our sample data, we have specified the canonical correlation model in two steps. First, we reduced the 19 original variables into 10 composite variables, on the basis of the preceding factor analysis, so as to identify what looked as the principal indicators of both preconditions and performance.

Second, three of these 10 indicators were assigned to the canonical variate "Performance", and the remaining seven to the canonical variate "Conditions". Performance is thus made up of the following three composite variables:

Composite variable		the simple average of the following scores
Y_1 .	Economic achievements:	output, employment, income
Y_2 .	Social achievements:	housing, access to education
Y_3 .	Social participation:	member control, member participation

Similarly, we measure "Conditions" in terms of seven composite variables, each represented by the simple average of the scores obtained on one or several of the following variables:

X_4 .	Technology:	technological change
X_5 .	Economic resources:	access to credit
X_6 .	Institutional support:	technical and administrative assistance, official support, managerial personnel, training of members.
X_7 .	Leadership:	leaders' capacity
X_8 .	Honesty:	honesty of leaders and functionaries
X_9 .	Social Harmony:	member admission, internal harmony
X_{10}.	Political Affiliation:	affiliation with peasant unions

We have thus reduced the 19 original variables into 10 composite variables, 7 of which make up the set of Conditions variables that are to explain the Performance set, composed of the remaining 3 composite variables.

2. First level of association

The first two canonical correlation coefficients are statistically significant. The results must hence be interpreted at two levels of association between the dependent and independent variables, as can be seen in Table 6 and Figure 3.

The first canonical correlation (R_1) equals .773, and is significant at the 1% level. It implies that the conditions (C_1 as a whole) account for 60% ($.773^2 = .60$) of the Performance (P_1 as a whole) whereas factors not measured by C are responsible for the rest.

In other words, 60% of the variance in P_1 is associated with observed variations in C_1, and the remaining 40% are due to "error", or variance in P_1 not attributable to C_1. Part of this error will be "recuperated" at the second level of association, as pointed out in section 3 below.

Since both P and C are derived in standardized form, it will also be true that

$$P_1 = .77C_1$$

That is, a one point increase in the C score will cause P to rise by 0.77 score points. The exact composition of P_1 and C_1 is set out in the following paragraphs.

a. The Performance Set

Performance, in turn, is related to its three component variables (Economic Achievements, Social Achievements and Social Participation) as depicted in the following standardized linear function:

$$P_1 = .55\ EA + .45\ SP + .42\ SA$$

The canonical coefficients (.55, .45, ...) are analogous to β coef-

ficients in multiple regression: the "partial" variation of EA by one standard deviation was associated with a .55 s.d. change in P_1. In other words: a rise in one s.d. of the score on EA, while SP and SA remain constant, will cause a rise in P_1 of .55 s.d.

The three coefficients are statistically significant[18/] at the 1% level. This proves our hypothesis that group performance can (and should) be measured in a three dimensional space, along three different axes, rather than along an uni-dimensional score. In other words, group A could have made well in terms of EA, scored low in SP and SA, and still obtain a total P score equal to group B with low EA but high SP, or equal to group C with slightly more than average on all three. Policy implications will obviously differ in each of these cases.

This does not mean to say that the three performance indicators are completely unrelated, but such an association was found in only one among the three pairs, as can be seen from the following correlations:

	Economic Achievements	Social Achievements	Social Participation
Economic Achievements	1.00	.55	.17
Social Achievements		1.00	-.05
Social Participation			1.00

18/ We are unaware of a direct test for the significance of canonical coefficients, and used the following proxy: regressing C_1 (as derived from X_4 thru X_{10}) on Y_1, Y_2 and Y_3, we applied standard multiple regression tests to the three Y coefficients. Similarly, we regressed P_1 (as derived from Y_1 through Y_3) on X_4, X_5, ...X_{10}, and again "borrowed" the results. Obviously, the two multiple regression coefficients thus obtained are equal to R_1, the canonical correlation coefficient.

Only Economic and Social Achievements are significantly correlated (30% of the variance in one is associated with variations in the other), whereas none of these two is related to Social Participation. This confirms, from a different angle, the conclusions reached with Factor Analysis above.

The three standardized canonical coefficients are of similar magnitude. This bears out the interesting fact that the contribution each of the three factors makes to Performance is not very different: peasant groups that differed from the mean by one standard deviation in terms of EA or SA or SP, scored about half a standard deviation higher in their overall P_1 rating. EA did carry a somewhat higher weight, followed by SP and then by SA. This indicates that the primary indicator of Performance is EA, followed rather closely by SP and SA.

Canonical coefficients are sometimes easier to interpret in "raw form", which would be analogous to the b coefficients in multiple regression. The corresponding values are:

$$P_1 = .48\ EA + .25\ SP + .32\ SA$$

When expressed in this form, the coefficients measure the "marginal product" of each performance indicator in terms of the overall performance score. Thus, if two peasant groups A and B have identical SA and SP scores, but A has an EA score one point higher than B, it will show an overall P score .48 higher. Similarly, a one-point advantage in SA (only) will produce a .25 rise in P. The difference as compared with the previous coefficient is that β measures score differentials in terms of standard deviations whereas b measures them in terms of original raw scores.

b. The Conditions Set

The preconditions or "causes" of the Performance of the 54 peasant

groups are specified in terms of seven indicators (each of which, in turn is defined in terms of some of the original 19 variables): Technology, Leadership, Honesty, Resources, Institutional Support, Political Affiliation and Social Harmony. These are related to the "overall conditions indicator" (or canonical variate C_1) as follows (cf. Table 6):

$C_1 = .46T + .25L - .12H + .11R - .09I + .05P + .03S$ (raw scores)

$C_1 + .71T + .48L - .21H + .17R - .13I + .11P + .05S$ (standardized scores)

The variables are listed in decreasing order of their β coefficients, which, in a sense, reflects their importance as explanatory elements of C_1. Only the first two coefficients are statistically significant (both at the 1% level), and the third comes close to the 10% level (but does not pass it).

By far the most important indicator is Technology; those groups that exceeded the mean T by one standard deviation, obtained a C_1 score 0.71 s.d. higher (and C_1 in turn, determined 60% of the Performance score) Progressing one raw-score (say from 3 to 4) in their technology, meant advancing 0.46 points in their C score.

The second variable is leadership. Groups with leaders one s.d. "more capable" than the rest (in terms of their score rating), showed Conditions close to one half a s.d. higher, in spite of the fact that with respect to the six remaining C indicators they were not better off. Measured in raw scores the marginal product of L, in terms of C_1, is 0.25, about half as high as that of T, which reached 0.46. (Since the absolute scaling of the raw scores is arbitrary, perhaps a better yardstick of comparison is that of β in terms of s.d., where L's marginal product reached 70% that of T).

The non-significance of the remaining five indicators implies that they have not been observed to affect the Conditions significantly, either

way, (i.e., statistically their coefficient was not shown to be different from zero). Does this mean that they are unrelated to the performance of the peasant groups? Since performance was defined in such broad terms, including economic and social dimensions, this would be a surprising result for most of the C factors. We must therefore examine this point more carefully.

An insignificant coefficient can reflect either the lack of association with the dependent variable, or a high correlation with other variables which in turn relate to the dependent variable.

The correlation among the eight variables (including the hypothetical variate C_1) is given in the following table, where variables are listed in declining order of their β's in C_1:

	Con	Tech	Lead	Hon	Res	Ins	Pol	Har
Conditions 1	1.00	.89	.69	.25	.50	.48	.37	.40
Technology		1.00	.39	.31	.36	.48	.34	.24
Leadership			1.00	.45	.33	.42	.02	.49
Honesty				1.00	.22	.17	-.05	.31
Resources					1.00	.37	.01	.15
Inst. Support						1.00	.18	.31
Pol. Affiliation							1.00	.18
Soc. Harmony								1.00

$$r_c\ (99\%) = .33$$

Next to T and L, the two variables with the highest correlation (about .50, which is very significant) with C_1, are Institutional Support and Resources (credit). Evidently they contribute very substantially to the Conditions that make for Performance. The reason why they did not come out with significant coefficients in the C function lies in their high cor-

relation with T. Technology thus "represents" the entire T-I-R package, and the last two variables can "explain" no significant part of the variance in C_1 that T has not already accounted for.

Political Affiliation and Social Harmony seem of lesser importance, and whatever association they do show with C is apparently due to their correlation with T and L, respectively, and not to a direct effect on C.

The role of honesty is of particular interest. Its direct correlation with C_1 is low, but it is strongly associated with leadership, in a positive way. However, when included in the multiple C function, it appears with a slight negative coefficient (that is close to the 10% level of significance). This would imply that in some cases, at least, there was a trade off in term of Honesty, for the progress registered in the Conditions and hence in the Performance of the peasant groups. The impact of Honesty on Performance is born out more clearly in the second set of canonical equations, as will be shown below.

In any event, if these three indicators (Honesty, Harmony and Political Affiliation) are considered development goals in themselves, the fact that they are of very low weight in the C_1 function indicates that at least they do not carry a price tag in terms of the Performance potential of the peasant groups, as here defined. If the Honesty coefficient were considered significant, it would mean that a 0.12 rise in the C_1 score was associated with a 1 point decline in the H score: this would be the price paid for progress, in terms of honesty.

A general note is in order here. Canonical correlation does not discover causal relationships. The specification of some indicators as "cause" and others as "effect" is determined by the researcher prior to the analysis, based on his hypotheses concerning the state of nature. The statistical analysis offered here can only serve to test these presumed relationships,

and give them an approximate quantitative expression.

3. Second Level of Association

As mentioned above, more than one pair of C-P combinations can be fitted to the data. In the present case, the first canonical correlations were found to be significant (see Table 6), hence the relationship between preconditions and performance must be interpreted in two dimensions.

The structure of the second Performance function differs from the first. Whereas P_1 put major weight on Economic Achievements, P_2 is oriented towards Social Participation as the primary objective in the Performance score.

$P_2 = .34\ SP - .20\ EA - .13\ SA$ in raw scores

$P_2 = .90\ SP - .34\ EA - .25\ SA$ in standardized form

Only the first coefficient is statistically significant (at a 1% level), the other two not proving to be significantly different from zero. Thus, Performance at this second level of association is made up of only one indicator - Social Participation-whereas neither Economic nor Social Achievements seem to affect it. Since SP is completely unrelated to either EA or SA (r = .17 and -.05 respectively), there is no indirect effect of either of them on P_2 as well.

The second Conditions function is also oriented in a different way than C_1, with primary weights on Honesty and Technology:

$C_2 = .26\ H - .28\ T + .20\ I + .12\ L - .03\ P + .03\ S - .02\ R$ (raw scores)

$C_2 = .68\ H - .65\ T + .41\ I + .35\ L - .10\ P + .09\ S - .06\ R$ (standardized)

Only the first two coefficients are significant (at a 5% level). Honesty has a strong positive effect on the Conditions at his level, but Technology has the opposite (!) effect of the same magnitude. The Conditions

that make for Performance in this sense (i.e., with Social Participation as a primary objective) are determined by the availability of honest leaders and functionaries. However, wherever technological changes were registered -and these came associated with Institutional Support, Credit, Leadership (capable, not necessarily honest) and Political Affiliation, as shown above - this apparently detracted from the same conditions. In other words, a rise in H without any change in T increased C_2, whereas a rise in T without any change in H decreased C_2 (by about the same amount); and C_2 affected P_2 since $P_2 = .51\ C_2$. A considerable tradeoff is thus involved between T and C_2 (and hence between T and P_2), which was offset whenever the gain in H compensated the progress achieved in T.

This complements the information obtained from the first set of equations (P_1 and C_1), where H entered the C_1 function with a negative (though hardly significant) coefficient. The picture is clearer now, if one considers the different structure and nature of P_1 and P_2. We shall elaborate on this in the following graphical summary.

4. Graphical Summary

The results of the canonical correlation analysis are presented in the path diagram reproduced in figure 3. The seven Conditions indicators are drawn on the left-hand side, the three Performance indicators, on the right. Each set of indicators is tied together through correlations among them, depicted by double pointed arrows (only correlations significant at the 1% level are considered). Variables were drawn in such a way that, as far as possible, arrows do not cross each other. The formation of the variables, in this case, depicts a "neat" construct, where relationships

are very clear-cut and easily interpretable.

Performance was found to exist in two different dimensions; the first is depicted in the upper part of the diagram, the second in the lower part. Performance in one sense (P_1) is made up of all three indicators, dominated by Economic Achievements (EA), but with significant representation of Social Participation (SP) and Social Achievements (SA) as well. The values on the corresponding arrows are canonical coefficients (β in Table 6).

Performance in a second sense (P_2) was also found, based on one indicator only: Social Participation. The two Performance measures are completely unrelated (i.e., the correlation between P_1 and P_2 equals zero), so that groups that score high on one do not usually score high on the other. It is in this sense that we consider P_1 to lie in a different dimension than P_2.

Vis-a-vis each P measure there is a corresponding Conditions measure (C) that determines it. Thus, P_1 is stipulated as a function of C_1, and P_2 as a function of C_2. The number on each arrow connecting these two indicates the canonical correlation coefficient (R_1, or R_2) which can also be interpreted as the regression coefficient of P on C (b or β).

Each C measure, in turn, is determined by some explanatory indicators, as shown by the arrows. Only significant coefficients (at 5%) are listed: Technology (T) and Leadership (L) for C_1, Technology and Honesty (H) for C_2. Again, the Conditions that make for P_1 are unrelated to the Conditions that make for P_2, and C_2 does not affect P_1 (these correlations also equal zero).[19/]

19/ The above is analogous to Factor Analysis in the following sense: the two P's can be interpreted as an orthogonal factor solution for the three variables, and the two C's as an orthogonal factor solution for the seven variables. The two factor solutions are interrelated by the fact that factors were derived so as to maximize the correlations between each corresponding set of factors (Van de Geer, p. 162). This analogy might help in the interpretation of the path diagram in figure 3.

Performance is evaluated in two dimensions (i.e., as two unrelated factors), in terms of three socio-economic indicators. When conceived as consisting primarily of economic achievements, but also including social considerations (P_1), it depends on a composite set of conditions made up of seven socio-economic indicators. This set is represented by a factor C_1, that is primarily affected by the variables T and L; Performance, in this sense, depends directly on these two "strategic" variables. Indirectly, C_1 also depends on the other variables, as indicated by their intercorrelations with the two "strategic" variables. Thus, T is unoperative without institutional backing and credit, but what the diagram indicates is that these two without T have had no observable effect on C_1 (and hence on P_1).

But Performance was also assigned a second interpretation, independent of the first (i.e., a second factor, orthogonal to the first, was derived from the same three indicators). In this second interpretation, P_2 stands for Social Participation only, and is neither directly nor indirectly affected by the other two indicators (since none of them is correlated with SP). This is very similar to the results obtained from the Factor Analysis in section III above.

Performance, in this second sense, is determined by a second canonical variate (or synthetic factor) C_2, which in turn is made up of the same seven conditions indicators, but in a very different way from C_1. Different in two ways.

First, it is composed of different variables (significantly). Honesty now appears with a significant and sizeable coefficient: it determines the conditions that make for better Performance, when Performance is given this

meaning.[20/]

Second, although the T variable appears significantly in both dimensions, it does so with opposite signs: it contributes positively to C_1 (hence to P_1), but negatively to C_2 (hence to P_2). In other words, Technology fulfils opposite functions as a pre-condition for the performance of peasant groups in its two connotations. This, perhaps, is the most interesting and meaningful contribution of this statistical model.

When performance is interpreted primarily in terms of Economic Achievements, T affects it positively. However, when performance is interpreted primarily in terms of Social Participation, T will detract from it - after its positive effect on P_1 has been accounted for, and as long as Honesty (H) remains unchanged. There is thus a tradeoff between T as it affects P_1, and T as it affects P_2 - if H does not change.

The last phrase offers the clue. H becomes crucial to social participation in group action as soon as T starts to rise. On the other hand, while T remains stagnant, SP can be achieved with relatively low strain on H - but then P_1 will not rise. This was observed in the Factor Analysis of Peru (of section III above), where we denominated this process the Rupture of Traditional Frameworks. It was also observed in the case of Mexico: the more collective ejidos progressed economically (due to credit and technological innovations), the more the door was opened to corruption and dishonesty on part of the same leaders and functionaries who originated the change. Since peasant groups are

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20/ It will be recalled that Honesty also appeared in C_1, but did not pass the 10% level of significance, therefore it is not listed here. Nonetheless, the fact that it appeared there with a negative sign, corroborates from a different angle the conclusion derived from its position in C_2, regarding the role H fulfills in the performance process of peasant groups.

very sensitive and vulnerable to this point (as shown by the fact that P_2 emerged as it did), many of them collapsed in spite of their economic achievements.[21/]

In short, development of peasant groups is a multi-dimensional process; the same socio-economic variables interact in different and sometimes opposite ways in these various dimensions. What is good for P_1 may be bad for P_2, and trade-offs are the rule, rather than the exception. The end result cannot be measured as one weighted average of a multiple object function, but rather as a delicate equilibrium of opposing forces that span different dimensions.

This corroborates the general pattern derived from the Factor Analysis but with some additional valuable information regarding the quantitative interrelationships among the factors that constitute the preconditions and results of the development process.

21/ On this particular point see the author's El Ejido Colectivo pp, 472 ff.

V. Conclusions and Further Analysis

Recent land reform programs in Mexico and Peru included the promotion of group farming among reform beneficiaries. Production cooperatives were established and credit, technical assistance and public support in general were channelled through them. It is the purpose of the present paper to analyze empirically the operation and performance of these peasant associations, as observed over the last five years.

The analysis is based on the evaluation of a sample of 54 case studies elaborated in the course of a broader study of land reform in these two countries. A set of 19 socio-economic, institutional and political indicators was specified, and scores ranging from 1 through 5 were assigned to each. Multivariate analysis techniques, specifically factor analysis and canonical correlation,were used to examine the interrelationships among these variables in order to arrive at some logical constructs of these diverse indicators, test some generally accepted hypotheses concerning their interdependence, suggest possible causal links among them and locate strategic policy variables.

Factor analysis disclosed that the development process of the 54 peasant groups, as designated by the 19 variables examined, is essentially composed of three main factors: Socio-Economic Performance, Social Participation, and Institutional Support.

The general factor pattern was similar in both countries, although the relative weights of these three factors (in terms of total variance explained by each) and their composition varied somewhat, reflecting the different land reform types and paths described in the literature. The most meaningful differences depicted by this analysis are pointed out below.

Socio-economic Performance depicts changes in output, employment and income, generated by technological change, based on access to credit and professional managerial services, with peasants living in acceptable social conditions. In short, it reflects Performance in the best development sense. In addition, Economic Performance in Mexico depends heavily on technical and administrative assistance provided by some public agency, unlike Peru where local leaders and managers hired by and responsible to the group have a much stronger impact. In Peru, increases in income were not part of Economic Performance but of Institutional Support, since they derived from minimum wage legislation more than from production achievements on the farm.

Social Participation includes member control of and participation in group activities, leaders' capacity, honesty of leaders and functionaries and internal harmony.

Social Participation in Mexico is unrrelated to any of the economic indicators, unlike Peru where technological change and progress in output were also related to the purely sociological ingredients of group participation. This, in turn, reflects the greater involvement of Peruvian group leaders in the production sphere of the groups' life, mainly through the surveillance of the local manager.

Institutional Support is made up of a minimum of three variables in both countries: technical and administrative assistance and public support in general. In Mexico, furthermore, it also comprises managerial personnel, credit and technological change, all of which form part of the institutional package delivered by the reform agency to its clientele. Unlike Peru, where these services depend, to a much larger extent than in Mexico, on the group's

(or its manager's) own initiative.

Institutional Support in Peru also comprises member participation in group activities, reflecting the stress put by local reform agencies on the promotion of "auto-gestion"

These three factors emerged as basically unrelated to each other, implying that the operation and performance of group farming must be measured and evaluated in three independent dimensions. Contrary to general belief the three do not constitute one package, with all elements in it growing or declining together; rather, high scores on say Economic Performance have not been generally observed to be associated with high scores on Social Participation or Institutional Support.

The lack of correlation between Economic Performance and Social Participation is even more manifest within each country. This refutes the hypothesis postulated for many decades by doctrinaires about the inseparable "twin objectives" of rural cooperatives.

Performance of peasant groups is thus a multidimensional process, progressing along various routes at different speeds, often in opposite directions. How can success or failure, along these different paths, be explained in terms of economic, social and political preconditions?

Canonical correlation disclosed that, when all indicators are considered jointly, performance "in general" must be interpreted in at least two dimensions. In the first, major emphasis is given to economic achievements, but social conditions and group participation also carry a significant weight. At this level, two pre-condition indicators (out of seven considered) appear to be significant: technological change and capacity of local leadership. Of the remaining five indicators, two (access to credit and institutional support)

are also strongly correlated with the pre-conditions of success, but their net contribution (after technology and leadership are accounted for) is statistically insignificant.

We can therefore consider technology and leadership as the two strategic policy variables for achieving progress in group performance, when performance is given this first interpretation.

At a second level of interpretation, performance is made up of only one indicator: social participation. Rerformance in this sense is determined by two pre-condition indicators: it is affected positively by honesty of leadership and functionaries, and negatively by technological change. There is a significant trade-off between honesty and technology at this level, reflecting the double role played by technology in the entire process. When performance is interpreted primarily in terms of economic achievements, technology affects it positively. However, when performance is interpreted in terms of social participation, technological innovation (because of its stimulating effect on economic progress) will put a heavy strain on the social textures of the group's behavior, unless honesty rises sufficiently to offset this new challenge.

The history of collective ejidos in Mexico, over the last three decades, offers many illustrations of this process. As collective groups progressed economically the door was opened to corruption of leaders and functionaries -the same leadership that was crucial in bringing about he economic change in the first place.

The conclusion would therefore be that if performance in this second sense is cherished, the list of strategic policy variab.es must be augmented

by one: honesty. Moreover, this last variable is strongly associated with the first two: the stronger the impact of technological innovation, the greater must be the countervailing power of honesty, in order to keep leadership in proper balance of capacity, motivation, popularity and integrity.

In short, the development of peasant groups is a multi-dimensional process; the same socio-economic variables interact in different and sometimes opposite ways in these various dimensions. What is good for performance in one sense may be bad for performance in another sense, and trade-offs are the rule rather than the exception. The end result cannot be measured as some weighted average of a multiple object function, but rather as a delicate equilibrium of opposing forces that span different dimensions.

Further analysis is planned to proceed in several directions.[22/] First, an attempt will be made to detect different patterns of behavior and performance of peasant groups operating under different land reform types and property/management systems.

Second, differences will be sought among geographical regions at various stages of over-all economic development, and of different socio-ethnical background.

Third, the effect of the size of peasant groups on the diverse performance indicators will be examined. The hypothesis to be tested and quantified is the existence of economic advantages versus social disadvantages of scale in group farming.

Fourth, the assumption of linearity of the various indicators-underlying the scoring of the basic variables and the ensuing multivariate analysis-will be tested, and if necessary modified.

22/ Work on this is now in progress at the Latin American Development Institute of Bar Ilan, on the basis of a larger sample of case studies now being concluded in Mexico. It is hoped to reach about 100 peasant groups throughout the entire country.

Table 1

General Characteristics of the Sample Data

(Mexico, Peru and Combined Sample)

Variables		Combined Sample (N = 54)		Mexico (N= 31)		Peru (N = 23)	
		Mean	S.D.	Mean	S.D.	Mean	S.D.
Economic Indicators							
1. T	Technological change	3.46	1.19	3.77	1.31	3.04	0.88
2. Q	Change in output	3.81 **	1.23	4.23	0.67	3.26	1.57
3. Y	Change in income	4.24	0.75	4.23	0.56	4.26	0.96
4. E	Change in employment	3.78 **	0.96	4.19	0.75	3.06	0.87
Institutional Backing							
5. C	Access to credit	3.70	1.24	3.58	1.18	3.87	1.32
6. TA	Technical assistance	3.31	1.45	3.48	1.63	3.09	1.08
7. AA	Administrative assistance	2.91	1.42	2.81	1.62	3.04	1.11
8. OS	Official support	3.13	1.32	3.13	1.52	3.13	1.01
9. Tr	Training of members	2.11 *	1.63	1.65	1.50	2.74	1.63
10. M	Managerial personnel	3.89	1.81	4.10	1.70	3.61	1.95
Social Conditions							
11. H	Housing standards	2.57 **	1.12	3.06	0.93	1.86	0.99
12. Ed	Access to education	2.96	1.20	3.13	0.88	2.74	1.51
Social Issues							
13. L	Leaders' capacity	3.85	1.43	3.81	1.49	3.91	1.38
14. MC	Member control	3.63	1.29	3.42	1.39	3.91	1.12
15. P	Member participation	3.46	1.60	3.26	1.75	3.74	1.36
16. MA	Member admission	3.68	1.75	3.58	1.73	3.82	1.82
17. Ha	Internal harmony	2.70	2.00	2.94	2.03	2.39	1.95
18. Ho	Honesty	4.43	1.35	4.42	1.36	4.43	1.38
Political Dimension							
19. U	Affiliation with peasant unions	3.48	1.94	3.90	1.78	2.91	2.04

**, *, Difference in means between countries significant at 1%, 5% respectfully.

Table 2

Factor Loadings* of Combined Sample

(19 Variables, 56 Cases)

Variables		Common Factors: Economic Performance	Social Participation	Institutional Support	Management	Training
Percentage of Variance		29%	15%	10%	7%	6%
Economic						
1. Technological change	T	.69				
2. Change in output	Q	.80				
3. Change in income	Y	.45		(.40)		
4. Change in employment	E	.79				(-.36)
Institutional						
5. Access to credit	C	.38				
6. Technical assistance	TA			.87		
7. Administrative assistance	AA			.81		
8. Official support	OS			.75		
9. Training of members						.65
10. Managerial personnel	M	(.43)			.84	
Social Conditions						
11. Housing standards	H	.63				
12. Access to education	Ed	.71				(.36)
Social Issues						
13. Leaders' capacity	L		.83			
14. Member control	MC		.62			
15. Member participation	P		.82			
16. Member admission	MA			-.32	-.32	
17. Internal harmony	Ha		.54			
18. Honesty	Ho		.64			(-.32)
Political						
19. Affiliation to peasant unions	U					

* Only loadings greater than .30 have been listed (Quartimax rotation).

Table 3

Factor Score Coefficients of Combined Sample
(19 Variables, 54 Cases)

Variables		Common Factors: Economic Performance	Social Participation	Institutional Support	Management	Training
Percentage of Variance		29%	15%	10%	7%	6%
R^2 *		.89	.87	.85	.71	.65
Economic						
1. Technological change	T	.13				
2. Change in output	Q	.35				
3. Change in income	Y	.02		.03		
4. Change in employment	E	.33				-.36
Institutional						
5. Access to credit		.00				
6. Technical assistance	TA			.59		
7. Administrative assistance	AA			.27		
8. Official support	OS			.23		
9. Training of members	Tr					.31
10. Managerial personnel	M	.14			1.25	
Social Conditions						
11. Housing standards	H	.08				
12. Access to education	Ed	.27				.40
Social Issues						
13. Leaders' capacity	L		.56			
14. Member control	MC		.06			
15. Member participation	P		.34			
16. Member admission	MA			.02	.13	
17. Internal harmony	Ha		.01			
18. Honesty	Ho		.18			-.29
Political						
19. Affiliation to peasant unions	U					

* Multiple regression of common factors on variables with loadings greater than .30 in Table 2.

Table 4

Composition of Common Factors

Combined sample	Mexico	Peru
54 cases	31 cases	23 cases
Economic Performance	Social Participation	Institutional Support
Economic achievements	Member control and	Techn. and admin. assistance
Technological change	participation	Official support
Credit	Leadership	(Change income)
Managerial personnel	(Harmony) and honesty	
Social conditions	(Credit and technol.)	
Social Participation	Institutional Support	Economic Performance
Member control and parti.	Managerial personnel	Output and (employment)
Leadership	Technic. & adm. assis.	Technological change
Harmony and honesty	Offic. support & cred.	Credit (management)
	Closed groups	Social conditions
Institutional Support	Economic Performance	Social Participation
Technical and admin.	Output & income	Member control & participation
assistance	Technol. change	Leadership
Official support	(techn. & admin. assis.)	Harmony & (honesty)
(change income)	Social conditions	(Output & technology)
Closed groups		
Management	Employment	Rupture of Tradition
Managerial personnel	Employment	Training & (education)
Closed groups	Lack of training	Lack of honesty
	(technol. change)	Affil. peasant unions
Training	Peasant Unions	Income and Employment
Training and (educ.)	Affil. peasant unions	Income and employment
(lack of honesty)	Official support	(Output)
(no change in employment	(technol. change)	Internal control
	Internal Harmony	Management
	Harmony	Managerial personnel
	Income	Closed groups
		(technol. change)

* The names under each factor title refer approximately to groups of variables with significant loadings. Names in parenthesis refer to variables with secondary loadings on this factor.

Factors are listed in descending order of the percentage of data variance explained by them. Hence, the different ordering in the three columns.

Source: Combined sample - Table 2. Mexico and Peru - separate factor analysis for each country, Quartimax rotation.

Table 5

Correlation Among Factors*, Mexico and Peru Compared

Combined	Econom. Perform.	Instit. Support	Social Particip.	Social Conditions	Management	Training
EP	1.00	.26	.24	.29	.21	-.02
IS		1.00	.28	.10	.34	.14
SP			1.00	-.06	.11	.08
SC				1.00	.26	-.09
M					1.00	.07
T						1.00

Mexico	Econom. Perform.	Instit. Support	Social Particip.	Employment	Internal Harmony	Peasant Unions
EP	1.00	.26	.08	.23	.08	.19
IS		1.00	.28	-.02	.21	.32
SP			1.00	.03	.33	.11
E				1.00	.04	.11
IM					1.00	.12
PU						1.00

Peru	Econom. Perform.	Instit. Support	Social Particip.	Employment	Management	Rupture Traditions
EP	1.00	-.02	.12	.22	.23	.06
IS		1.00	.14	.22	.17	-.07
SP			1.00	.31	.19	-.13
E				1.00	.28	.09
M					1.00	.19
RT						1.00

* Correlation among factors derived from oblique rotation of axes.

Table 6

Canonical Correlation Coefficients

(Combined Sample, 54 cases)

Canonical Correlation	Dependent Variables	b	β	w	Independent Variables	b	β	w
R_1 = .773**	Econ. Achievements **	.48	.55	.47	Technology **	.46	.71	.63
	Social Participation **	.25	.45	.24	Leadership **	.25	.48	.33
	Social Achievements **	.32	.42	.29	Honesty #	-.12	-.21	-.05
					Econ. Resources	.11	.17	.09
					Institutional Support	-.09	-.13	-.06
					Political Participation	.05	.11	.04
					Social Harmony	.03	.05	.02
R_2 = .513*	Social Participation **	.34	.90	.77	Honesty *	.26	.68	.50
	Economic Achievements	-.20	-.34	.11	Technology *	-.28	-.65	.09
	Social Achievements	-.13	-.25	.12	Institutional Support	.20	.41	.14
					Leadership	.12	.35	.21
					Political Participation	-.03	-.10	.02
					Social Harmony	.03	.09	.04
					Econ. Resources	-.02	-.06	.01

* Significant at 5% level ** significant at 1% level # significant at approx. 13% level

β are derived from Canonical Correlation Analysis, and represent standardized coefficients, b represent raw-score coefficients, and w weights, derived from regression of canonical variates on opposite-set variables.

Variables are listed in descending order of β coefficients.

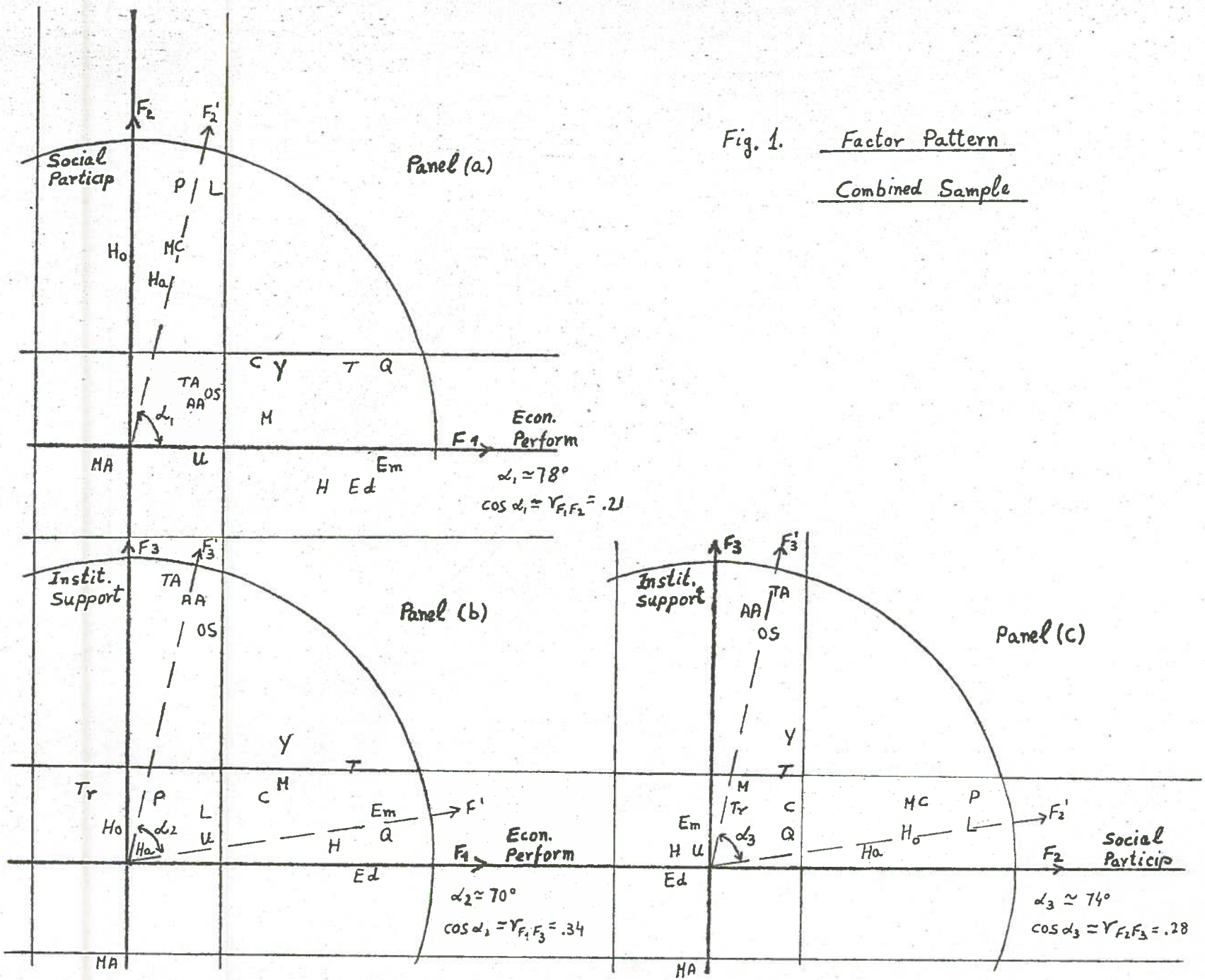

Fig. 1. Factor Pattern

Combined Sample

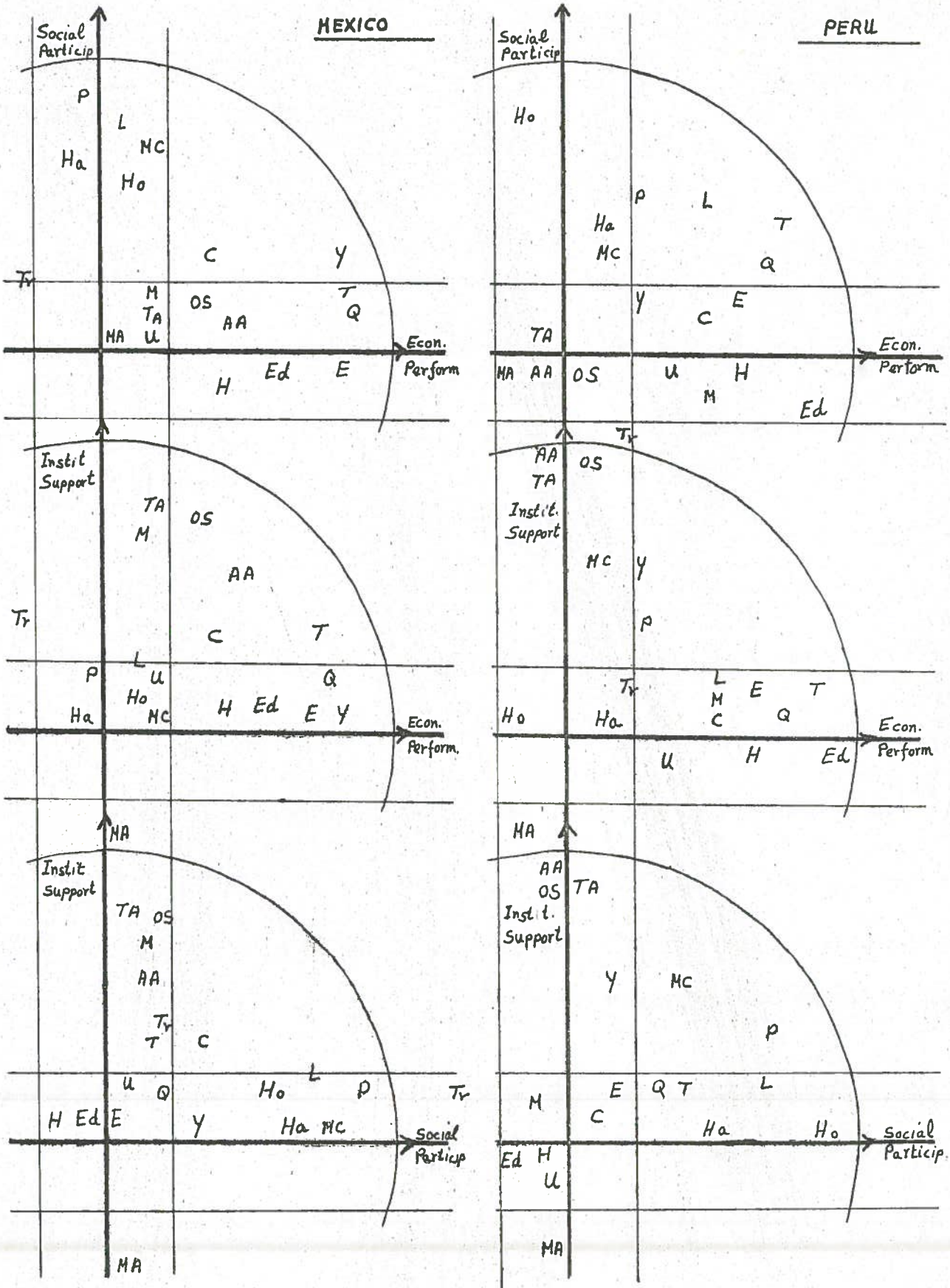

Fig. 2. Comparative Factor Pattern

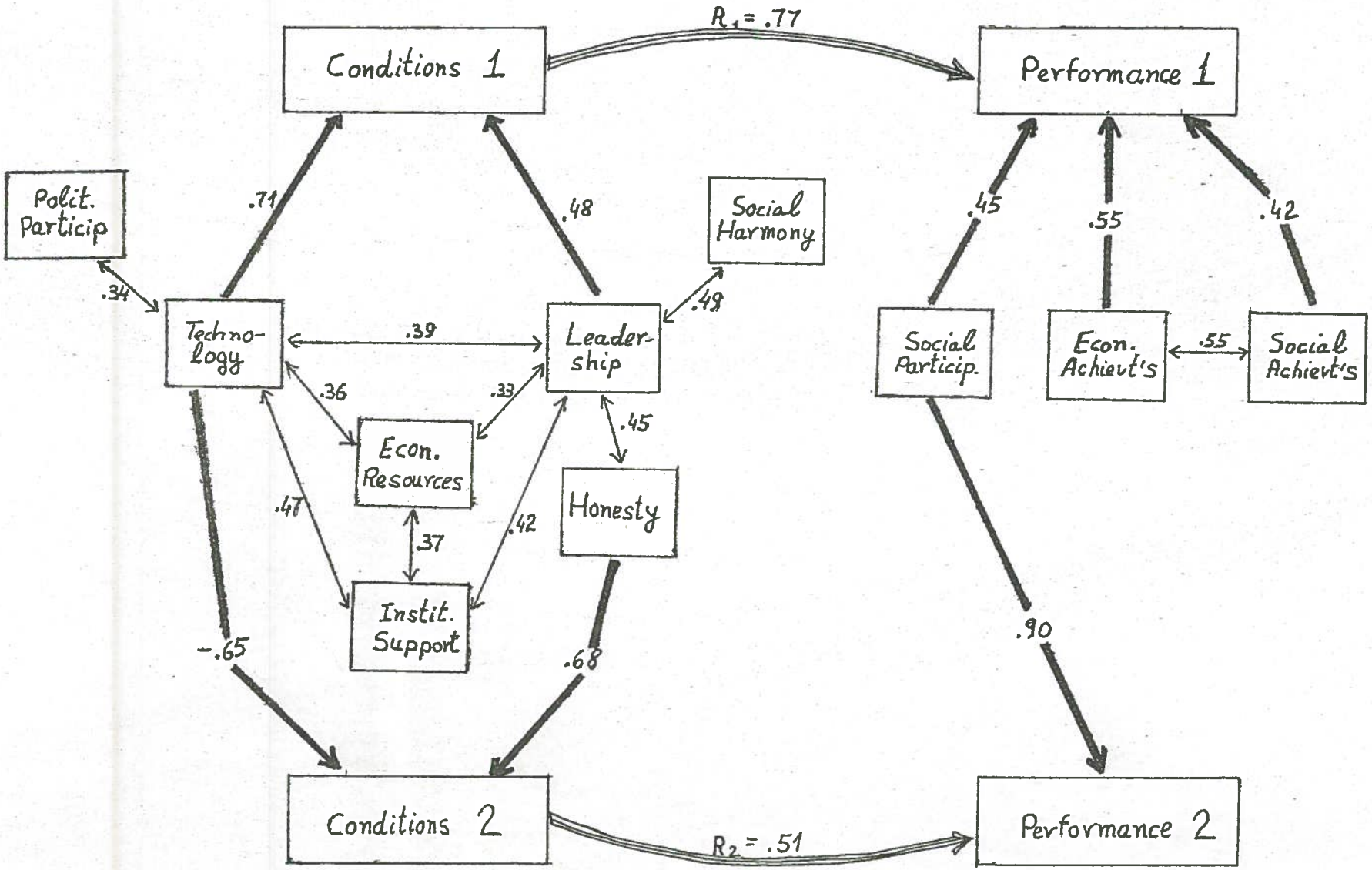

Fig. 3. Path Diagram of Canonical Correlation

$P(r > .33) = .01$

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