Framework for a National Wage Policy

TS Papola*

The Indian economy is characterised by a number of such features which render the formulation of a single or even a few mutually consistent objectives for wage policy difficult. The generally-low levels of wages warrant a policy for increase in the levels of real wages, but the overall low productivity, particularly in the low-wage paying sectors—agricultural and non-organised, non-agricultural sectors—limits the capacity of the economy, sectors and units to sustain a substantial increase in wages. Unemployment and under-employment on a large scale adds to this limitation. The need for capital formation for growth is also supposed to limit the scope for a policy of substantial and continuous raise in wages.

The inflationary situation posed a further dilemma to the wage policy. Steeply-rising prices warranted the necessity of increase in money wages so as to prevent erosion in the levels of living, particularly of the workers at the low-wages levels, but dangers of the wage increases adding fuel to the inflationary fire had also to be recognised. At the same time it was also not found advisable to adopt a strategy of wage restraint, for despite increases in money wages the wage levels in most parts of the economy were low in absolute terms, and although implications of rising wages for capital formation, employment and inflation were recognised, the contribution of the former to the latter was not considered to be dangerously significant.

The situation thus did not provide much scope for a clear-cut approach to the wage problem, the wage issues mostly got settled on an *ad-hoc* basis. Apparently, the philosophy of development pronounced in the official and semi-official documents did not favour the concept of market-determined wage rates, and wage structures. Various panels, plan documents and adjudication awards unequivocally affirmed that the wage determination cannot be left to the forces of demand and supply in an underdeveloped labour-surplus economy.[1] The fear that the wage rates

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1 For a discussion on this issue, see Papola TS, *Principles of Wage Determination : An Empirical Study*, Bombay 1970, Chapter II.

will be forced to starvation level if left to the market forces, then, was the major rationale for a wage policy and, therefore, ensuring a minimum level of wages to all employed became its primary objective. Many other considerations such as productivity growth, industrial peace, price stability, rationality of wage differentials, and price stability were frequently mentioned with changing emphasis from time to time and some *ad-hoc* measures were suggested to achieve them. But none of them became a part of the plan objectives and strategy; nor were they backed by any statutory measures. To ensure a minimum level of wages, however, a piece of legislation was enacted as early as 1948. The issue still remains one of the major concerns of public policy. Of late, it is considered a part of a comprehensive programme of ensuring minimum incomes to all.

It cannot be said that there has been an effective wage policy vigorously pursued for meeting the objective of ensuring minimum wage. That the objective has a statutory backing is virtually the only evidence of such a policy. It is, no doubt, a necessary, but, obviously not a sufficient condition to meet the objective. The following are the major problems which have come in the way of effective use of the legislation. *First* the Act is not automatic in its application; the 'appropriate' government has to decide from time to time about the activities where it is to be applied. *Second*, even in the selected activities, units can be granted exemptions. *Third*, the Act does not lay down the definite criteria for fixing the minimum wage and the *ad hoc* wage-fixing bodies have tended to give different weightage to the various factors. *Fourth*, while one would believe that the subsistence minimum which the minimum wage under this Act, in fact, is, would be dependent on an absolute standard of minimum needs, in practice, consideration like paying capacity of the employer have weighed significantly in its fixation. *Fifth*, the minimum money wage once fixed does not change with rising cost of living, except when the authority decides to revise it, which it not very frequent. Consequently, the use of this piece of legislation has not been very effective in meeting what has been implicitly the major objective of the Indian wage policy.

Wage Situation

The ineffectiveness of a *statutory measure* to meet a *simple and straight-*

forward objective of ensuring a minimun subsistence wage, in a way, emphasises the futility of attempting any comprehensive wages and incomes policy in an economy run largely on the basis of innumerable unorganised, small-scale, privately-owned units. That, to a certain extent, explains the absence of such a wage policy as a part of the Indian economic policy. The fact that the wage situation cannot be left alone even in a predominantly-private enterprise economy once central planning is accepted as the mode of managing the economy, cannot be ignored. Over the last two decades, wages have not featured as a part of the planning objectives, targets or instruments, and as such despite the overemphasised notion of 'excessive intervention in the labour market', the wage trends and wage situation in India have behaved more or less as in an unregulated labour market.[2] The overall labour supply situation has prevented real wages from rising despite a substantial increase in productivity. Wage differentials by occupations and industries have widened, and the bases for wage relativities between activities and sectors continue to be irrational and inequitable. The labour markets have not been able to generate sufficient quantities of required skills due sometimes to the wage rigidities and conventional wage hierarchies, but primarily on account of the lack of effective policy on wages, manpower information and training[3].

The wage situation as it obtains in the Indian economy can be summarised in the following :

1. A large number of workers, particularly in the agricultural and the unorganised non-agricultural sectors earn a wage hardly sufficient to subsist with an average family of three dependents. There are neither forces at work nor any institutional mechanism to ensure rise in their money wages commensurate with the rise in cost of living.

2. The money wages, however, have been rising particularly in the organised factory sector where a worker's earnings would yield a per capita income (for a family of four) around one and half times the national average.

2. For a discussion on this proposition see, L, J. Handy and T. S. Papola, 'Wage Policy and Industrial Relations in India', *Economic Journal*, March 1974.

3. For detailed discussion on the working of the labour markets, see T.S. Papola and K.K.Subramanian, *Wage Structure and Labour Mobility in a Local Labour Market*, Bombay, 1975.

3. The real wages are on an average only marginally above the 1951 level, although labour productivity, (value added per worker) has increased at least by 50 percent over this period in this sector.

4. There are a few large units, particularly the subsidiaries of the multinationals which pay wages and salaries at a level which the economy can ill afford at its present level of development and lead to distortions in wages and salary structure and manpower allocation within the industry as well as between the private and public sectors.

5. As a result of (1) and (2) above, the wage disparities between the organised and unorganised sectors have increased, and as the entry to organised sector is highly restricted, the unorganised sector provides the reservoir and residuum of labour supply. The situation, by depressing the wages in the unorganised. sector, leads to a further increase in disparities.

6. Wage relativities between jobs and occupations continue to be governed by traditions and customs to a very large extent, thus being devoid both of rationality and equity.

7. The basis for increase in wages are not uniformly agreed in the organised sector of industries and services; however, cost of living has been the major factor in the wage increases during the last three decades. There have been some wage revisions by Boards, Commissions, Collective agreements etc., but the major increase in wage packet has taken the form of cost-of-living based dearness allowance. The system has neither satisfied the workers nor the employers. The workers do receive some compensation for the increase in cost of living, but that does not on an average enable them to maintain their real earning : for, only the maximum–100 percent–neutralisation would maintain real wages, but that is granted only in rare cases. From the viewpoint of their sharing the gains of productivity, the system of wage adjustment provides no mechanism and, in general, the real wages have lagged behind increase in labour productivity. The employers on the other hand, find that the increase in wages that they have to pay does not provide any inducement for better performance.

The system of wage adjustment has also led to certain other distortions in the wage structure. It is prevalent mostly in the organised sector, and

the degree to which neutralistion of cost of living index is provided is generally higher in large, already-high-wage-paying organisations. Thus it has led to an increase in wage disparities, even in the case of similar occupations, between organised and unorganised sector on the one hand, and between large and small units on the other. Within an organisation, however, the neutralisation is higher at lower wage levels than at higher wage level. The arrangement is desirable to the extent irrational disparities get reduced with its operation. It is, however, found in certain cases that the variable D.A. which is based solely on cost of living constituting the major element in the wage packet, there is a tendency towards virtual elimination of even the differentials based on skills, thus dampening inducement for the acquisition and enhancement of skills.

Reformulation of Wage Policy : Objectives

The features of the Indian wage situation mentioned above suggest that the wage levels and wage structures leave much to be desired both from the viewpoint of income distribution and efficiency-inducing aspects of wage payments. That the wage movements and wage relativities should be regulated and planned in accordance with the Plan objectives has been frequently emphasised, but due, first, to the less significant place to which wage policy has been rendered in the planning process and, secondly, to the presumably-insurmountable problems of implementation, this aspect of planning and economic policy has received very little attention. Part of the problem lies also in the confusion regarding the role that a wage policy can play in the economy dominated by private enterprise, but managed on the basis of central planning.

An attempt is made here to clarify this issue by stating a set of basic objectives of wage policy in the given framework of the Indian economy and then formulating a scheme which can meet these objectives. Given the prevailing wage situation and the objectives of planning and economic policy in india, a wage policy has basically to work towards the following objectives:

(i) a guaranteed level of minimum wages sufficient to meet the subsistence needs of every worker and his family, irrespective of the location of his activity, job, sector and productivity;

(ii) improvement in the levels of living of the workers in accordance with the general rise in the real national output in the country;

(iii) a wage structure reflecting the differential based on skills, job contents and social importance, but no dispartities based on sectors, employers, and size of establishment.

(iv) a system of wage adjustments conducive to better performance and enhancement of productivity.

This set of objectives gives preponderance to the goal of a fair distribution of income over allocation. The implicit assumption is that a planned economy has other instruments such as manpower planning to ensure fulfillment of the manpower requirements of the plan. The wage policy would primarily ensure a minimum income to every worker and a fair share in the increase in national output. Wage differentials based on nature of job, skills, occupational hazards, strategic importance, etc.. would have to remain to avoid individual dissatisfaction even if adequate labour supply to difficult jobs can be ensured by some other method. Similarly, granting undifferentiated increases based on overall economic performance would certainly imply some element of cross subsidy, the workers in sectors with high productivity increases will have to share part of such increases with those in sectors with low productivity increases. An appropriate balance between the equity implicit in this procedure and greater efficiency-enhancing potential of a differentiated scheme of wage revisions based on differential rates of productivity increases will have to be worked out.

Components of Wage Structure

In order to evolve a wage pattern fulfilling the above objectives of a wage policy, the wage packet workers would consist of the following four components : (a) minimum wage considered essential for the fulfillment of a subsistence level for an average family; (b) an element of premium for skill, workload, hazard, responsibility and importance of the job, (for brevity let us call it 'skill premium). These two elements will make the wage structure in the base period. Over time, the wages will move on the basis of the following two components : (c) a productivity component based on the overall performance of the economy, industry, the unit and group of workers or individual worker; and (d) a cost of living component

for workers with earnings below what can be regarded as a need-based wage. Let us briefly explain the concept and rationale of each of these components.

The *minimum Wage* envisaged here is the absolute minimum based on physiological and social needs of an average working class family. The concept is, of course, specific to a certain extent to the level of economic and social development of a country, but once determined on a national level, its uniform application irrespective of industry and establishment is essential. If, however, the needs are found to differ significantly among the various regions, it may be desirable to fix the regional minima. The concept is identical with the one implied, though not stated and effectively implemented, in the Minimum Wages Act. Its rationale is obvious: the society cannot afford to engage people to work without providing them the necessary wherewithals to subsist and to maintain their efficiency. The principle is universal, but it is imperative for any society with a conscious policy aiming at improvement in living standards in general and at an egalitarian system, in particular. Therefore, considerations like productivity and paying capacity of an individual establishment are irrelevent for the fixation of the minimum wage.

The *skill premium* is the differential to compensate a worker for his skills and special attributes of his job. Application of this criteria to evolve a rational structure of wage differentials would have to be preceded by the evolution of a scheme of assigning values to jobs according to their requirements of skills, responsibility and other attributes. This process would involve not merely analysis of the contents of jobs but also applying judgements based on the accepted values of the society. The jobs can then be classified into a manageable number of grades each carrying a different skill premium. The 'premia' superimposed on the 'minimum', would constitute the wage structure in the base year.

The *productivity component* would be the major, and, in many cases, the sole mode of wage increases. *The basic idea here is not that a worker should be paid according to his contribution, but that the worker should get a fair share out of the increase in overall efficiency.* Therefore, the usual argument that the productivity, understood to mean the specific contribution of a factor, is not measurable, and therefore, cannot be made a basis for wage increases, is irrelevant in this scheme. The measure

of productivity that is required here is relative: *change* rather than *magnitude* is to be measured, and since one is interested in overall efficiency, output per worker, or value added per worker would serve the purpose. The producitvity change, understood in this sense, is measurable for the economy, industry, establishment and, in most cases, for a worker or a group of workers. Since both equity and inducement for the improvement in performance are to be considered, a composite index of productivity is preferable over the index at any one level. If equity is the major consideration, greater weight may be given to the efficiency of the economy and industry, and if incentive for improving per formance is given more imprortance, then worker's/group's and unit's productivity gets higher weightage. In a national wage policy, the weights have to be determined at the level of the economy. It may be mentioned here that by making wage increases in a unit partly dependent on productivity increases in industry, not only is a measure of equality introduced in the wage structure, but the units with low performance are motivated to introduce productivity-enhancing conditions as well.

This mechanism of wage adjustment over time is expected to lead to a rise in real wages of the workers. As a matter of fact, if productivity change is measured in real terms, then the money wage increases would be determined at a level which ensures a proportionate increase in real wages. So long as the productivity increase in an establishment is given a significant weight, there may be units, particularly in the unorganised sector, which on account of peculiar circumstances in which they are placed, would be required to pay a relatively small wage increase to their workers. And most of the workers in these units may also be on a wage level hardly above the subsistence minimum, due to low levels of skills. In the event of a price rise of substantial magnitude, their real wages may decline. For them, therefore, a *cost of living component* would have to be built into the scheme, which will neutralise, to a certain, extent the increase in cost of living. The component may be made applicable to wage levels only up to what can be considered a need-based minimum, providing not for bare subistence but some measure of comfort, recreation and social needs.

The Scheme in Operation : An Illustration

The proposed scheme can be explained with the help of a hypothetical illustration. The illustration gives wages for the initial period for the various

categories of workers, but so far as the wage increases are concerned, the magnitude would refer to an individual worker or a group of workers depending on whether the individul or group productivity is considered. The illustration assumes the following :

(i) All jobs are classifiable into eight distinct groups, each including categories fairly homogeneous or comparable to each other. Obviously, in practice, there will have to be many more grades.

(ii) The fulfillment of the physiologically and sociologically determined minimum needs requires Rs.300 per month for an average worker to subsist with his dependents—say, two adult equivalents—at the prices obtaining at the time of wage fixation.

(iii) Productivity indices over the period (of, say, one year) are : 110 for the economy as a whole, 120 for the industry concerned, 120 for the establishment and 110 for the individual worker/group of workers.

(iv) Each of the four indices are given equal weight, thus yielding an overall productivity index of 115.

(v) The consumer price index moved up from 100 in the base year to 110; and the neutralisation envisaged is 50 per cent.

(vi) Cost of living componet is not applicable beyond a total wage of Rs. 500 per month, which is considered to be the need-based minimum wage.

Wage Fixation and Revisions under the Proposed Scheme : An Illustration

(Figures in Rs. per month)

Grades	*Unskilled*	*Semi-skilled*	*Skilled*	*Highly skilled*	*Supervisory*	*Managerial* I	II	III
	1	2	3	4	5	6	7	8
Wage Components								
1. Minimum wage	300	300	300	300	300	300	300	300
2. Skill premium	—	50	100	200	300	500	700	900
Initial wage at the time of fixation.	300	350	400	500	600	800	1000	1200
3. Productivity component (at index 115)	45.00	52.50	60.00	75.00	90.00	120.00	150.00	180.00
4. Cost of living component (at CPI=120)	15.00	17.50	20.00	—	—	—	—	—
Total wage during the next period	360.00	420.00	480.00	575.00	690.00	920.00	1150.00	1380.00

Advantages and Limitations of the Scheme

The framework of a policy illustrated in the proposed scheme meets the basic objectives stated earlier. It ensures a minimum level of earning, share in productivity gains over time and rational bases for wage relativities. Subsistence and 'skills' provide the basis for wage fixation, while a productivity-wage link-up provides the mechanism for wage increases. A fusion of the considerations of equity and efficiency has been attempted. The main advantages of such a framework lie in its following features :

First, it would be possible with the help of the proposed framework to include wages as an element in the process of economic planning. Given the output and employment targets, and the implicit productivity projections, the wage movements can be predicted and effectively regulated. It would also be possible to consider the achievement of the planned wage levels as one of the criteria for evaluating performance.

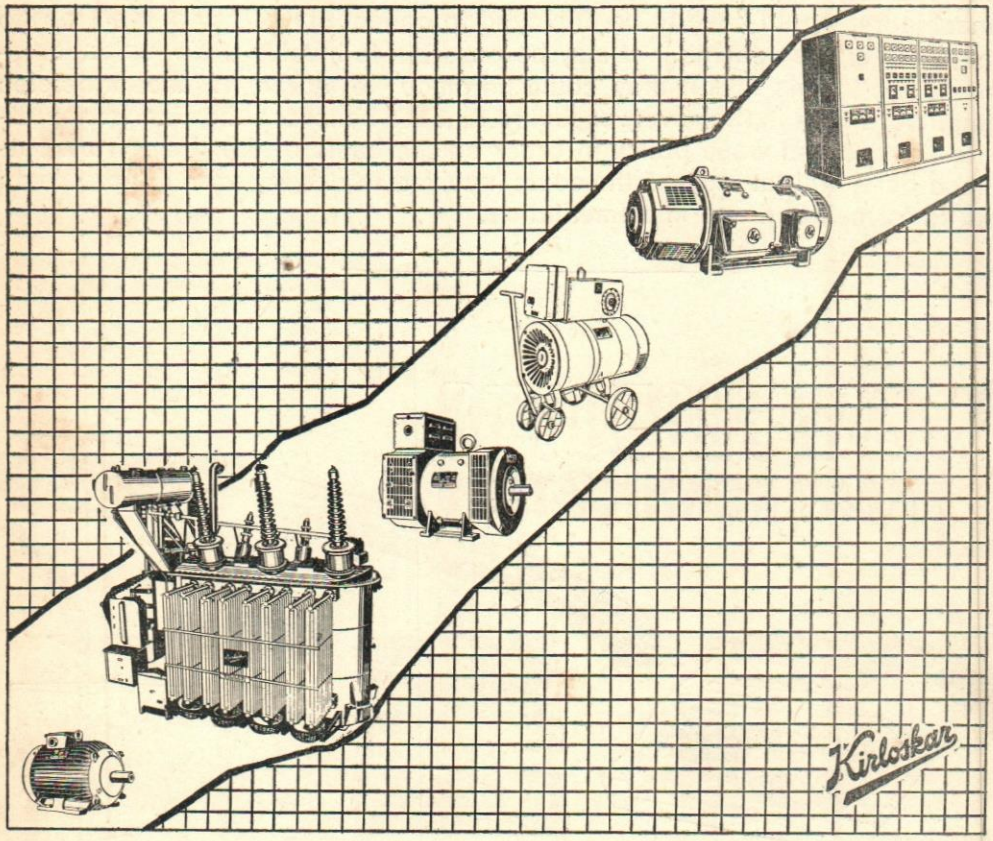
Second, the framework is capable of application to all categories of workers and, therefore, provides the basis for a national wage policy. The problem of non-measurability of productivity of workers in certain 'unproductive' sectors (e.g., government service, university, etc.) can be tackled by giving entire weightage to the national productivity in their case. As a matter of fact, the principle applies to workers in all sectors: if worker's or group's productivity is not measurable, the corresponding weightage gets transferred to the establishment index (in our illustration the weightage of establishment productivity becomes 50% in such cases.)

Third, the inducement mechanism is built into the scheme without necessitating the measurement of specific productivity or contribution, which has always been held as the bottleneck in the way of evolving a productivity-wage link-up. The problem no longer exists with the adoption of 'income' rather than 'price' concept of wages; and that has been the basic philosophy behind this scheme.

Some major problems relating to the implementation of the scheme may be mentioned here. First, the realisation of a measure of price stability is a prerequisite for the successful functioning of this scheme. Second, since it provides a major break from the existing arrangments, the scheme

would have to compromise initially, to a certain extent, in order to fix the existing wage pattern into the new scheme. Third, a large official machinery would have to be deployed to collect statistics as well as to administer the scheme. It may be possible to involve trade union organisations in this task if they could be made to agree to the principles implicit in it. It is, however, expected that the benefits following from putting the national wage policy in order on the basis of the framework outlined here, will far exceed the costs involved in dealing with the problems of its formulation and implementation.

NEW HEIGHTS REACHED



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Linking Bonus to Productivity ?

V. K. Goel*

The promulgation of the Payment of Bonus (Amendment) Ordinance on 25th September, 1975 and its ratification by the two houses of the Indian Parliament on 11th February 1976 has been an important landmark in the history of payment of bonus in Indian Industry. If the payment of Bonus Act, 1965 had taken away the concept of "ex-gratia" from the earlier practices of paying bonus, the Bonus Ordinance, 1975 has invalidated the concept of "deferred wage" which had been the underlying philosophy of payment of bonus under the Bonus Act, 1965.

One of the most distinguishable features of the newly amended Bonus Act, 1976 is that it has made bonus, for the first time, a means of sharing the gains of industry either measured in terms of profits or increased production or productivity. While changing the long title of principal Act, 1965, the 1976 Act stipulates the following : "An Act to provide for the payment of bonus to persons employed in certain establishments on the basis of profits or on the basis of production or productivity....."

From Ex-Gratia to Profit/Productivity Sharing

The concept of bonus as an annual payment made to industrial employees has undergone a substantial change ever since its inception in cotton textile industry in India during the years of the first World War. In its earliest form, bonus was regarded as a gratuitous payment by an employer to his employees. At least upto mid-forties, workers' claim to bonus was not considered as a legal right but was awarded on principles of justice, equity and good conscience. It was essentially an ex-gratia payment even if it was paid under the terms of a bilateral agreement between union and management. For example, the Bonus Dispute Committee appointed by the Government of Bombay in 1924 came to the conclusion that the mill workers had not established any enforceable

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The views expressed are those of the author and not of the Council.

claim—customary, legal or equitable—to an annual payment of bonus which could be upheld in a court of law.

It was during and after the World War II that bonus, instead of being regarded as ex-gratia payment, started getting recognition as an "Industrial Claim". In the dispute between the General Motors (India) Ltd., and the Workmen adjudicated under the Defence of India Rules in 1942, the judgement read :

"It is almost universally accepted principle now that the profits are made possible by the contribution that both capital and labour make in any particular industry and (I think) it is also conceded that labour has a right to share in increased profits that are made in any particular period."

This change in the concept of bonus became further evident when a bonus case was brought, for the first time, to the Industrial Court,Bombay, in 1946. The Court observed :

"The Millowners" Association's contention that bonus is ex-gratia payment is true from the standpoint of civil law which can only enforce the terms of a contract between the parties, but in the domain of industrial relations between employers and workers the rights and duties of the parties are not governed merely by a civil law but by collective bargaining in the settlement of disputes arising out of demands made by one on another for more earnings, better conditions of work and increased production. The justification for such demands as "industrial matter" arises especially when wages fall short of the living wage standard and the industry makes huge profits part of which are due to the contribution which the workers make in increasing production. The demand for a bonus is, therefore, an industrial claim when either or both these conditions are satisfied."

It also observed :

"It is to be remembered that" 'adequate wages and dearness allowance', if any, for increased cost of living are a first charge on the industry, but the workers may reasonably ask for a bonus when there are enhanced profits, when dividends are paid out after providing for taxation and depreciation, especially when their wages are below the living wage standard."

Again in 1948, the Bombay High Court laid down that payment of bonus could be demanded by the workmen as of right, that is to say, as a payment which should be made by the employer as extra remuneration for work done by the employees under a contract, expressed or implied.

In the same year, the Labour Appellate Tribunal, while evolving the "Full Bench Formula", observed :

"Labour as well as the working capital employed in the industry both contribute to the profit made and both are, therefore, entitled to claim a legitimate return out of the profit, and such legitimate return, so far as labour is concerned, must be based on the living wage standard. It is however, to be remembered that a claim to bonus might be admissible even if the living wage standard were completely attained. It may, therefore, be stated that so long as the living wage standard has not been attained, the bonus partakes primarily of the character of the satisfaction often partial and temporary of the deficiency in the legitimate income of the average worker in an industry, and that once such income has been attained it would also partake of the character of profits sharing. Owing to this dual character of bonus it would be a mistake to regard a demand for bonus as a demand for profit-sharing pure and simple."

It is significant to note from these decisions that bonus was not only considered a device for sharing the prosperity of the industry, but also a means to fill the gap between the existing and the living wage. As such, it assumed a dual character of profit-sharing on the one hand, and deferred wage, on the other. The Bonus Commission which was appointed by the Government of India in 1961, in its report submitted in 1964, while maintaining that "Bonus has also the advantage that in the case of low-paid workers such sharing in prosperity augments their earnings and so helps to bridge the gap between the actual wage and the need based wage", did not accept the concept of deferred wage. It observed :

In our view, the concept that bonus is designed to fill the gap betweer the actual wage and the living wage is beset with difficulties. It is tru that Article 43 of our Constitution lays down as one of the Directive Pri ciples of State Policy that "The state shall endeavour to secure, suitable legislation or economic organisation or in any other way, to workers, agricultural, industrial or otherwise, work, a living wage, cc tions of work ensuring a decent standard of life and full enjoyme

can either be paid on the basis of profits or on the basis of production or productivity. It will be worthwhile to examine in brief the relative merits and demerits of each system.

Production-Based Bonus

The question of linking bonus to production had been discussed both by the Profit Sharing Committee appointed by Government of India in 1948 and the Bonus Commission in 1961. The conclusions of these two bodies and some of the evidences given by the representatives of employers and trade unions before them are still valid and, therefore, summarised below:

The Profit Sharing Committee was of the view that it was impossible to devise a system in which labour's share of profits could be determined on a sliding scale varying with production. It is worthwhile quoting here the observations of the Committee.

"For one thing, profits made by Industry depend on many factors besides labour, and to that extent, do not bear any measurable relation to what labour does or does not do. An undertaking in which labour has performed its full part might fail to make any profits because of other reasons while large profits might be made in spite of irregularities or slackness of labour. Conditions of production vary from industry to industry and from undertaking to undertaking within each industry. The productivity of labour is dependent, among other things, on the nature of the equipment and the efficiency of organisation and supervision. Then, again the measurement of total production in terms of a common unit is a very difficult task. Even the final products of an industry or undertaking are not always uniform and easily measurable. To prescribe a norm of annual production is even more difficult. Further, the basic conditions in any one year may be quite different from the conditions on which the norm has been determined. The production equipment might have increased or diminished or improved or deteriorated in the mean time. The size and composition of the labour force might similarly have changed. There may be involuntary interruptions for which no one is responsible. To compare actual production in any given year with the norm would, therefore, be extremely unscientific and unsatisfactory. To compare total production in any industry would be an even more unsatisfactory basis, as the number of working units in the

Industry might itself vary from year to year."

Similar views were also expressed by a number of Employers.' Associations while giving their evidences before the National Commission on Labour. On the question of linking bonus with production, trade unions were also opposed to the proposal. For instance, the Indian National Trade Union Congress had submitted:

"If the annual bonus is made dependent upon the total production, taking some earlier year as the base year, it would mean that for every increase in production over the base year's production, there should be an increase in bonus even though any increase in production need not always mean increase in profits, much less corresponding increase in profits. It may be more. It may be less. We are aware that in spite of the workers putting in their best efforts and increasing production, they may not get a square deal by way of bonus since profits, which are the results of various other factors operating simultaneously, may not be proportionately higher. For these reasons we would not like annual bonus to be linked with production. Any incentive for increasing productivity can be provided by a well-planned scheme of production allowance and or piece rate wages given to the workers on the basis of their individual performance.

In view of the objections to the proposal of linking bonus with production by large sections of employers as well as almost all the unions, the Bonus Commission found itself unable to recommend such a linkage.

Bonus *Vs.* Incentive

At this stage, it may also be pertinent to make a distinction between 'annual bonus' and 'incentives'. At the outset, it must be said that an annual bonus either paid on the basis of profits or on the basis of production/productivity is not a direct means for increasing production or productivity. It is essentially a means of sharing the prosperity either measured in terms of productivity or in terms of profits. On the other hand, an incentive plan properly devised does help in boosting up the production and productivity, as it is based on the principle of "payment by results." It may be an individual incentive or a group incentive but the underlined principle remains the same.

A further important distinction between an annual bonus and an incentive scheme is that while bonus is paid irrespective of the contribution of an individual or a group of individuals towards higher productivity, incentive is paid directly in relation to the contribution of an individual or a group of individuals according to their contribution towards higher productivity.

From the accounting point of view also there is a difference between an annual bonus and and incentive scheme. While payments made under an incentive scheme is an element of cost structure or in other words, forms an essential ingredient of the wage structure, the payments made under the annual bonus do not enter into cost or the wage structure.

Productivity-Based Bonus

It should be clear from the foregoing discussion that annual bonus is neither an incentive scheme nor it is "deferred payment by result". It is essentially a means of sharing the prosperity of an enterprise between its two most important constituents namely, labour and capital. As has already been stated, the underlying philosophy of bonus is based on the principle of "social partnership between labour and capital", whereby labour has as much right as capital to share the prosperity of an enterprise. This being so, the question of "sources of profit" become irrelevant in the distribution of profits to labour.

The concept of linking bonus to productivity assumes that profit is an exclusive function of productivity. But in reality and particularly in Indian economy, this may not be true. One may cite a score of examples from Indian industry where there is no appreciable gains in productivity and yet profits are swelling due to price manipulation s. Conversely,there are industries which have registered quite a high rate of productivity growth and still their profits have either remained stagnant or even declined because of unfavourable prices for their products in national and international markets. In both the situations, linking bonus to productivity would be detrimental to both labour and capital as well as to the economy as a whole.

To further illustrate this point, it would be worthwhile to look into the logic of two submissions, made by the Tata Engineering and Locomotive Co. Ltd. and Shri B. C. Mukherjee, the Managing Director of the

Fertiliser Corporation of India Ltd. before the National Commission on Labour :

"Since the principle that the remuneration of labour should be related to productivity has been almost universally accepted, it has been suggested that the present system of bonus payment should be replaced by a bonus based on productivity. It is submitted that such a proposal is not feasible. A productivity bonus by its very nature is not entirely paid for by the employing unit, but is at least partly earned by the increased efforts and efficiency of the workmen. To suggest that the workmen should give up their existing right to participate in the profits of the undertaktng in which they are employed without receiving any benefit in exchange except the opportunity partly through their own efforts to earn higher remuneration is not realistic or practical. Productivity bonuses of all kinds are highly desirable but they cannot be suggested as a substitute for profit sharing bonus..."

...Tata Engg. Locomotive Co. Ltd.

"I do not think that it would be logical to link profit-sharing bonus with production, for profits and production are not necessarily interdependent. There can conceivably be large profits despite relative inefficiency and low production; per contra there may be no profits at all, despite maximum efficiency and full production up to rated capacity. Profit-sharing bonus should not thus be confused with a reward for efficiency and good output. There is, of course, a case for the latter but it has no relationship with profits or a profit sharing bonus. The payment of a profit sharing bonus may act, at least in some measure, as an incentive to workmen's efficiency, particularly if it varies from year to year, depending on a concern's net financial results; and it may also give them some sense of partnership in the industry in which they are engaged. I would, however, regard these as incidental gains, and not as basic reasons for the grant of a profit-sharing bonus. To the extent that the payment of a profit-sharing bonus accelerates efficiency and thereby increases the surplus available for distribution, the consequence is welcome; but it would be confusing to lose sight of the fact that the one and only reason for granting a profit-sharing bonus is that there is a profit and workers engaged in the concerned industry can legitimately expect a fair share of it.

...Shri B. C. Mukherjee

This is not to say that there is no need for an all-out effort for improving productivity. Ever-rising levels of productivity is *sine qua non* for economic development. What is, however, to be understood is the fact that bonus is neither the means to achieve this end nor productivity index can serve the basis for distribution of bonus and dividends between labour and capital respectively.

Profit-Based Bonus

The payment of annual bonus based on profits is the simplest and most prevalent form of profit sharing in India. The mechanics of computing the distributable surplus and the share of labour and capital have already been defined and determined by the law ever since the principal Bonus Act came into force in 1965. Bonus Ordinance, though, provides the alternative of linking bonus with production/productivity : it lays down only the procedure for computing distributable surplus and the maximum share of labour in the profits of an enterprise.

In the case of bonus based on production or productivity, the Ordinance does not lay down any procedure and leaves the matter to the bilateral agreement between the employer and the employees. Section 31A of the Ordinance reads as follows :

"Notwithstanding anything contained in this Act, where an agreement or a settlement has been entered into by the employees with their employer before the commencement of the Payment of Bonus (Amendment) Ordinance, 1975 or ,where the employees enter into any agreement or settlement with their employer after such commencement for payment of an annual bonus linked with production or productivity in lieu of bonus based on profits payable under this Act, then, such employees shall be entitled to receive bonus due to them under such agreement or settlement, as the case may be :

Provided that such employees shall not be entitled to be paid such bonus in excess of twenty percent of the salary or wage earned by them during the relevant accounting year."

It is often argued that in a profit-based bonus, there is no element of incentive to higher productivity. The Bonus Commission itself admitted the non-incentive character of the Bonus, when it maintained :

"Our view is that the profit bonus system has little direct incentive effect. Bonus is usually paid to all workmen at the same rate in terms of monthly basic wages or in some cases in terms of consolidated wages. The efficient as also the inefficient worker gets bonus at the same rate." As was observed by the Tripartite Profit Sharing Committee 1950 which recommended experiments in Profit Sharing :

"The efficient worker who has the misfortune to be employed in an undertaking which makes no profit must remain content with his ordinary wages; while an inefficient worker who has the good fortune to work in a profit-making concern will, nevertheless, share in the prosperity of that concern."

"An annual but uncertain bonus, varying from year to year and paid long after the close of the financial year, can hardly act as an incentive to greater effort. Incentives, to be effective, have to be given soon after the effort which it is sought to reward. Besides, the best incentives are those applied to results achieved by individuals or small groups of workmen; the incentive becomes weaker when applied to large groups; and when the factory is treated as a unit, the incentive is too weak to have any influence on the quantity or quality of work turned out by the individual worker. Profit bonus is in reality a very different thing from incentive bonus, for incentives to efficiency operate only under properly conceived production bonus schemes which establish a direct relationship between better productive efficiency and higher earnings."

This, however, raises some fundamental conceptual issues relating to the very objective of profit sharing; the first and foremost being the question as to whether bonus is a form of profit sharing or a means to increase productivity and sharing the gains of increased productivity. Obviously,for the reasons explained above, an annual bonus either based on profits or on production or on productivity cannot perform the function of an incentive scheme. If higher productivity is the aim, then, one has to look for some other system rather than statutory annual bonus irrespective of its basis for computation.

Incentive schemes and, more recently, productivity agreements, for example, are the two most important devices of increasing productivity and simultaneously sharing it gain.

A Case for Productivity Agreement

It must be said, therefore, that for higher productivity, it is neither possible nor desirable and, above all, not enough to change the basis of computation of annual bonus from profits to production or productivity. It calls for a radical change in performance-reward relationship. The technique of productivity bargaining together with its result—the productivity agreement—provides an opportunity for facilitating such a change. A productivity agreement is an agreement "in which workers agree to make a change or a number of changes in working practice, that will lead in itself—leaving out any compensating pay increases—to more economical working; and in return the employer agrees to a higher level of pay or other benefits." The technique is based on the problem solving approach and the agreement produces a change in work organisation, method, productivity and pay, the outcome of which is greater efficiency. It is this total approach which can really pave the way for higher productivity.

Conclusions

(i) The payment of annual bonus is not a form of sharing the gains of increased productivity. It is essentially a form of profit sharing, recognising the workers' right to share the prosperity of the enterprise. As such, sources of profits accruing to a unit are irrelevant so long there is a statutory recognition of this right.

(ii) The payment of annual bonus is non-incentive in nature since there hardly exists any direct performance-reward relationship. Further, higher productivity does not necessarily mean better financial results. In many industries the financial results are influenced by circumstances such as the position or market, course of trade shift in consumer tastes and performances, change in fiscal policy, national or international price behaviour and so on. Accordingly, a unit with higher productivity record may still suffer a loss and *vice-versa*. As such it may not be logical to link bonus with production or productivity.

(iii) Within the existing framework of Bonus Ordinance, the only meaningful basis for payment of annual bonus seems to be the profit.

(iv) For increasing productivity and sharing its gains, the need for well-

designed incentive schemes or a comprehensive productivity agreement can hardly be overemphasised. Productivity bargaining resulting into productivity agreements should become the cornerstone on which the new edifice of industrial relations and wage policy should be raised.

(v) For this to happen, an appropriate methodology for measurement of productivity at the firm level is an indispensable condition.

Corporate Dividend Practices and Policies

N. L. Dhameja

The object of this paper is to analyse the dividend policies and practices relating to equity shares. The dividend policies of companies are studied to answer the questions like : Whether the companies have a dividend policy ? What is the dividend rate declared by management to shareholders ? Is the 'reported cash dividend' true dividend for the sharehoiders ? Whether the companies have a stable dividend rate ? What is the relationship between dividend and profit ? How are the changes in profit reflected in dividend changes ?

The study is based on data for 158 listed non-government public limited manufacturing companies for the period 1961-72. The companies so included are from various industries, of different sizes and different growth rates.

The study is divided into five sections. Section 1 analyses the dividend practice and policies and identifies the dividend practices among companies. Section 2 examines the dividend practices to study the dividend behaviour. Section 3 determines the relationship between dividend and profit. Section 4 presents the regression estimates of dividends on profits, and the conclusions are given in the last section.

Dividend Policies

Dividend practices can be studied to enquire whether the companies have any dividend pclicy. Broadly there are three types of principles underlying dividend policy as followed by the Board of Directors (BOD):

(a) to allocate profits between dividends and reserves and have a certain dividend payout ratio ;

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The author wishes to express his deep gratitude to Prof. S. C. Kuchhal and Dr. C. Rangarajan for guidance at various stages of work. The author is also thankful to Dr G.S. Gupta for comments on earlier draft of the study.

(b) to follow a stable dividend rate, i.e., to give a certain fixed percentage on capital—book value or market value—as dividends to share-holders. The stable dividend return on book value is a certain amount of cash dividend per share irrespective of market value or of other investment opportunities, while stable dividend on market value basis refers to dividend yield and relates to market price of shares. A number of companies pay a stable rate of dividend on their book value of capital to the share-holders for a number of years and this policy is called 'institutionalising' a company.

(c) to retain certain amount of profit for growth requirements and dividend may be declared considering the need for funds and the policy of external finance.

To consider the implications of these principles, the first principle focusses on current year's profit and does not consider the return to investor; the second principle lays emphasis on return to investor and requires the use not only of current-year profits but also of earlier years' profits. These two principles consider dividend as a primary decision. The third principle lays emphasis on growth and dividend in this case is considered subservient ('irrelevant') to other financial policies which are not analysed in this study.

These principles as applied singly or collectively are based on the objectives followed by BDD.

Dividend Payout Ratios

The distribution of companies according to dividend earning ratio are given in Table 1. The ratios for the companies covered for individual years or for sub-periods indicate that over the period there is no major shift in the dividend payout ratio. However, average payout ratio increased from 55 percent to 62 percent over the period of study. Table 1 shows that about 40 percent companies paid 50 to 75 percent of profits as dividend, 35 percent distributed more than three-fourths of their profits, while only one-fourth distributed less than 50 percent of their profits as dividends.

Annual payout ratios for individual companies are subject to wide variations ranging from zero in one year and more than unity and negative in

other, indicating low propensity to save. But these ratios are to be interpreted with caution as net profit, a random variable, is subject to heavy fluctuations which may not influence the numerator—the dividend.

Table 1 : Relative Frequency Distribution of Companies According to Payout Ratio Intervals for Various Years

Dividend Payment Ratio Intervals in percentages	*Number of Companies (Percentage to total)*								
	1961	*1962*	*1963*	*1964*	*1971*	*1972*	*1961 to 66*	*1967 to 72*	*1961 to 72*
1. Zero Dividend	8.6	8.1	8.2	5.6	7.5	10.7	0.6	1.8	0.6
2. upto 25	3.7	9.4	6.3	7.5	8.2	9.4	8.2	4.4	3.7
3. 25—50	34.5	21.2	29.1	28.0	35.6	29.4	25.3	28.4	22.3
4. 50—75	34.0	33.0	31.3	33.5	30.6	24.0	34.3	34.5	40.0
5. 75 —100	14.9	15.8	17.0	13.5	11.3	10.1	13.9	11.3	15.1
6. More than 100	3.1	10.0	6.3	7.5	5.0	12.0	17.7	19.6	18.3
7. **	1.2	2.5	1.8	4.4	1.8	4.4	—	—	—

** Dividend but less or very low profits.

Dividend Yield

For an investor, it is the yieid or rate of return which is most important. While deciding about his portfolio, he considers the returns on all securities. It is the dividend yield which is more meaningful than the cash dividend. It is because the face value of shares differs from the corresponding market value and this difference creates wide divergence between dividend rate and dividend yield. To look to dividend rate as a rate of return on investment is erroneous as the shares may be acquired at market price.[1]

Table 2 gives the relative distribution of companies for various dividend yield inetrvals. In large proportion of cases, yield is zero as there may be no dividend or market price may not be available. The distribution is less skewed as compared to that of dividend rate, as more than 50 per-

1. Gupta L. C. : *Bonus Shares, A Study of the Dividend and Prices Effects of Bonus Shares Issue*, Macmillan, India (1973), p. 28.

cent of the cases lie in the interval of 5-10 percent yield. It can be seen from Table 2 that there is an improvement in dividend yield in 1970 and 1971 as the proportion of cases having high yield has increased. Though the medium for all the years except 1971 and 1972 lies in the 5.0 to 7.5 percent class interval, the next higher class is equally important. In 1971 and 1972 the medium was placed in 7.5–10.0 percent interval.

This distribution for dividend yield shows that the return on equity shares mostly lies between 5-10 percent, but it is not a good indicator for our study. BDD which decide the dividend declaration, do not have any control over dividend yield which is mostly affected by market price of shares—an external factor.

Table 2 : Relative Frequency Distribution of Companies According to Dividend Yield in Various Years

Dividend Yield Intervals in Percentages	*Distribution of Companies (Percentages to Total)*								
	1961	*1962*	*1963*	*1964*	*1971*	*1972*	*1961-66 (Aver.)*	*1967-68 (Aver.)*	*1961-72 (Aver.)*
Zero	16.4	14.5	13.2	9.4	8.8	12.0	0.6	1.8	0.6
Upto 2.5	1.8	3.1	1.8	0.6	—	—	1.8	1.8	0.6
2.5–5.0	22.1	20.2	20.8	7.5	3.7	6.3	18.9	13.9	13.2
5.0–7-5	34.8	36.6	31.8	32.9	31.0	26.5	41.1	37.9	46.2
7.5–10.0	20.6	20.6	25.7	35.9	36.7	33.7	32.0	33.5	32.9
10.0–12.5	3.7	5.0	4.4	12.0	11.7	13.9	5.0	9.9	6.5
12.5–15.0	—	0.6	2.5	2.5	4.4	5.6	—	0.6	—
Above 15.0	0.6	—	0.6	1.2	3.7	1.6	0.6	0.6	—

Market price of a security is an arbitrary figure subject to speculation in the stock exchange. Further, market price varies from day to day, while yield is calculated by dividing the dividend rate for the year by the average of high and low market prices during the year. Since the denominator of yield being subject to limitations of averages, speculation, and other external factors not within the control of the management, therefore, dividend yield cannot be regarded as an efficient indicator of dividend declaration for the purpose of our study.

Dividend Rate-Unadjusted

The frequency distribution of companies having various different rates of dividends unadjusted for bonus and right issue (DPS_1) and adjusted[2] for bonus and right issue (DPS_2) are given in Table 3. It indicates that while the proportion of companies having adjusted dividend rate between 10-20 percent has increased over the period, unadjusted dividend rate has not improved over the period. This is because the proportion of companies having high unadjusted dividend rate above 20 percent has reduced. In 1961, 20 percent of companies had(DPS_1)more than 20 percent, while the similar proportions for 1964, 1970, 1971 and 1972 were about 6, 6, 5.7 and 6 percent respectively.

For the sub-periods 1961-66 and 1967-72, the proportion of companies having DPS_1 more than 20 percent declined from 13.9 percent to 7.6 percent–the proportion of companies having DPS_1 between 10-20 percent remained almost same, i.e., about 55 percent. However, mean, median and mode lie in the interval of 10-15 percent for all the years. The mean DPS_1 has reduced from 13.6 percent in 1961 to 13 percent in 1972, because the companies having high unadjusted dividend rate declined over the period while companies having unadjusted dividend rate below 20 percent increased over the period.

The studies on finances of medium and large joint stock companies by Reserve Bank of India (RBI) give the distribution of companies in various dividend rate intervals and the average dividend rate for the total industry (the dividend rate here is the unadjusted dividend rate). The frequency distribution of companies in percentages according to dividend

2. Dividend per share, is the dividend declared by management on the shares outstanding at that point of time. Some of these shares might have been acquired as bonus shares without involving additional investment and some as right issue. Since investment in shares is a long term investment, the rate of dividend be calculated by dividing the dividend received by original investment plus additions to investment. For example, investment of rupees one hundred in equity shares five years ago might have doubled by means of bonus shares in the ratio of 1 : 1 and now the shareholder may be holding two shares of rupees one hundred each, with the original investment of rupees 100 only. If the company is declaring dividend of rupees 10 per share, the rate of dividend is not 10 per cent but 20 percent (dividend received divided by original investment, of Rs. 20/100=20 percent). So the reported dividend per share must be adjusted for the additional shares issued—either as bonus shares or as right shares. Bonus shares are obtained without any additional investment while right shares are obtained by making some investment. Hence the adjustment to reported divided (DPS_1) is done for :
   (i) the additional shares obtained, and
   (ii) the additional amount invested because of right issue.

Table 3 : Relative Frequency Distribution of Dividend Rate DPS_1 and

Dividend Rate	*1961*		*1962*		*1963*		*1964*	
	DPS_1	DPS_2	DPS_1	DPS_2	DPS_1	DPS_2	DPS_1	DPS_2
Intervals in %								
1. Zero	7.6	7.6	6.1	6.1	7.6	7.5	5.1	5.0
2. Upto 5%	2.6	2.3	3.5	3.1	3.8	3.7	2.6	2.5
3. 5—10	23.0	22.5	24.0	23.7	24.7	22.1	25.9	23.4
4. 10—15	29.0	27.5	35.8	33.9	32.3	29.7	28.5	25.3
5. 15—20	17.0	18.0	15.6	14.7	17.7	17.5	22.1	20.8
6. 20– 30	14.0	13.4	12.0	11.8	11.4	14.5	12.0	17.4
7. 30 – 40	5.5	7.0	1.5	4.7	0.6	2.5	1.9	2.5
8. Above 40%	1.3	1.2	1.5	2.0	1.9	2.5	1.9	3.1
Mean	13.8	14.0	13.3	14.6	14.2	15.3	15.3	16.4
Median Class	10-15	10-15	10-15	10-15	10-15	10-15	10-15	10-15
Mode Class	10-15	10-15	10-15	10-15	10-15	10-15	10-15	10-15

Adjusted Dividend Rate (DPS_2)

1970		*1971*		*1972*		*1961-66 Average*		*1967-72 Average*		*1961-72 Average*	
DPS_1	DPS_2	DPS_1	DPS_2	DPS_1	DPS_2	DPS_1	DPS_2	DPS_1	DPS_2	DPS_1	DPS_2
5.0	5.0	6.3	6.3	6.1	6.1	0.6	0.6	1.3	1.2	0	0
3.2	2.5	1.9	1.2	3.3	1.2	8.9	8.8	8.2	8.2	5.1	5.0
27.8	11.3	24.0	7.5	16.7	7.9	22.8	19.6	25.9	8.8	25.3	18.9
43.7	23.4	44.9	26.5	42.2	21.8	30.4	27.8	44.3	29.1	41.8	28.4
13.9	24.6	17.2	22.6	24.4	18.4	23.4	19.6	12.7	22.5	19.0	21.8
3.2	17.5	3.2	18.3	5 5	21.8	10.2	18.0	5.1	17.0	5.7	17.8
1.3	8.2	1.9	7.5	1.5	13.0	2.5	2.5	1.9	6.3	2.5	3.1
1.9	7.5	0.6	10.1	0.3	9.8	1.2	3.1	0.6	6.9	0.6	5.0
12.9	21.5	13.0	22.3	13.0	24.0	13.9	15.5	12.1	18.3	13%	17%
10-15	15-20	10-15	15-20	10-15	15-20	10-15	10-15	10-15	15-20	10-15	10-15
10-15	10-15	10-15	10-15	10-15	10-15	10-15	10-15	10-15	10-15	10-15	10-15

rate and the average dividend rate for total industry for various years is presented in Table 4.

The above table also shows that for the whole period the proportion of companies having zero dividend has increased. For the years 1964 to 1969 the companies having dividend rate (unadjusted) below 20 percent has increased while percentage of companies having dividend rate above 20 percent has reduced. During 1970-72, there was an increase in the percentage of companies having high dividend rate (above 10 percent). The equity dividend as percentage of equity capital shows declining rate up to 1969 and increasing rate thereafter. RBI study of 1333 Joint Stock Companies for 1961-65 shows that "the amount of dividend distributed to shareholders increased but this was predominantly on account of the dividend distributed on a larger paid-up capital base rather than the stepping-up of the dividend rate".

Adjusted Dividend Rate (DPS_a)

As stated earlier, table 3 gives the distribution of companies according to dividend rate adjusted for bonus and right issue for various years.

Table 4 : Distribution of Companies in Percentages According to Dividend Payment on Equity Capital

Dividend rate in percent	*Relative Frequency Distribution of Companies*								
	1964	*1965*	*1966*	*1967*	*1968*	*1969*	*1970*	*1971*	*1972*
0	29.6	34.5	37.9	42.8	43.4	41.9	40.1	43.7	42.0
Upto 5	5.4	5.5	4.2	4.7	4.8	3.9	3.4	2.7	1.9
5—10	25.1	25.4	19.5	19.8	19.4	19.4	17.6	13.8	14.8
10—20	32.0	27.6	29.9	27.5	27.2	29.4	33.3	33.2	34.0
20—30	5.9	5.2	6.6	4.4	3.5	4.1	4.3	6.6	7.3
Over 30	2.0	1.9	1.9	1.2	1.3	1.3	1.3		
Average dividend rate for total industry	11.3	11.04	9.6	9.1	8.9	9.7	10.6	11.4	12.1

Source : Finances of Large and Medium Joint Stock Companies : Reserve Bank of India Bulletin (various issues).

It shows that the proportion of companies having DPS_2 below 10 percent reduced from 26 percent in 1961 to 13.6 percent in 1970. to 8.7 percent in 1971, to 8.3 percent in 1972. On the contrary, the proportion of companies having high dividend rate above 20 percent doubled over the period. DPS_2 for the sub-periods 1961-66 and 1967-72 shows that the distribution has become negatively skewed, i.e. the lower tail has become louder than the upper tail. It is mainly due to the smaller number of companies in the lowest size class and larger number of cases in the highest size class during 1967-72.

Though the mode lies in 10-15 percent interval for all the years, the median class interval has increased from 10-15 percent in 1951 to 15-20 percent in 1972. The mean adjusted dividend rate has an increasing trend and has increased from 14 percent in 1962 to 24 percent in 1972. The above analysis shows that the reported dividend rate (DPS_1) does not have increasing trend but has almost reduced over the period, while adjusted dividend rate (DPS_2) has increased over the period. Mean DPS_1 and DPS_2 for the period 1961-72 were 13 percent and 18 percent respectively.

This implies that 'reported' dividend rate is biased downwards as compared to the 'true dividends' when adjusted for bonus and right issue. If one is to study the rate of dividend received over a period as a return on long-term investment, one should study the adjusted dividend rate.[3]

This upward movement in the distribution of companies by DPS_2 interval as compared to that of DPS_1 requires a critical examination of the extent of displacement. Table 5 shows the effect of distributing companies by DPS_2 for the years 1963, 1970, 1971 and for three average periods. This table shows the displacement caused to companies according to various DPS_1 intervals by various steps. Second column indicates the companies in the various DPS_1 intervals and column nine shows the companies in the various DPS_2 interval. The movement of companies from DPS_1 to DPS_2 is shown by columns 3, 4, 5, 6, 7, and 8.

3. This is on the assumption that an investor will invest in equities if he has surplus funds after providing for his immediate cash needs by holding iiquid assets—cash and near-cash assets like fixed deposits. This assumption is in accordance with Keynes' 'three-fold motives of holding liquid assets, i. e., the transaction motive, the precautionary motive, and the speculative motive.

Table 5 : Effects of Alternative Dividend Rates Criteria (DPS_1 and DPS_2) on Companies Distribution

DPS_1 & DPS_2 Interval	No. of cases distribution by DPS_1	Remaining in same class	If distributed by DPS_2										Total regarded by DPS_2
			One step		Two steps		Three steps		Four steps		Five steps		
			up	dn	up	dn	up	dn	up	dn	up	dn	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1963													
1. Zero	12	12											12
2. upto 5%	6	6											6
3. 5—10%	39	34	3		2								35
4. 10—15%	51	44	3	1	3								47
5. 15—20%	28	22	6										27
6. 20—30%	18	14	3		1								23
7. 30—40%	1	1											4
8. above 40%	3	5											4
Total	158	136	15	1	6								158
1970													
1. Zero	8	8											8
2. upto 5%	5	4	1										4
3. 5—10%	44	16	10		10		4		2		2		18
4. 10—15%	69	27	23	1	14		2		2				37
5. 15—20%	22	6	8		5		3						39
6. 20—30%	5	1	3		1								27
7. 30—40%	2	1	1										13
8. above 40%	3	3											
Total	158	56	46	1	30		9		4		2		146
1972													
1. Zero	10	10											10
2. upto 5%	3	2	1										2
3. 5—10%	38	11	13		7		6		1				12
4. 10—15%	71	28	21		14		3		5				43
5. 15—20%	27	7	8	1	7		4						35
6. 20—30%	5	1	1		3								29
7. 30—40%	3		3										12
8. above 40%	1	1											16
Total	158	60	47	1	31		13		6				159

Table 5 (contd.)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
1961—66 Average													
1. Zero	1	1											1
2. upto 5%	14	14											14
3. 5—10%	36	30	6										31
4. 10—15%	48	38	7	1	2								44
5. 15—20%	37	24	12				1						31
6. 20—30%	16	14	2										28
7. 30—40%	4	2	2										4
8. above 40%	2	2											5
Total	158	125	29	1	2		1						158
1967—72 Average													
1. Zero	2	2											2
2. upto 5%	13	13											13
3. 5—10%	41	14	17		7		3						14
4. 10—50%	70	29	24		12		2		3				46
5. 15—20%	20	4	8		5		3						35
6. 20—30%	8	4	2		2								27
7. 30—40%	3	1	2										10
8. above 40%	1	1											11
Total	158	68	53		26		8		3				158
1961—72 Average													
1. Zero													0
2. upto 5%	8	8											8
3. 5—10%	40	30	10										30
4. 10—15%	66	35	22		7		1		1				45
5. 15—20%	30	12	15		3								34
6. 20—30%	9	6	1		2								28
7. 30—40%	4		4										5
8. above 40%	1	1											8
Total	158	92	52		12		1		1				158

In 1963, out of 158 companies studied, 136 (86 percent) remained in the same class interval by DPS_2 and only 18 companies (14 percent) moved towards upward size classes, particularly to the neighbouring class. On the other hand in 1970 and 1971, only about 35 percent of the companies remained in the same-size class and the remaining 65 percent companies moved to the higher class interval towards DPS_2. The displacement mainly upward, so resulted, was in various steps. About 30 percent of the companies were placed one step upward, 20 percent in two steps upwards, while about 12 percent in four and more steps upwards.

The displacement, upward movement to adjusted dividend rate, was mainly for the companies having dividend rates (DPS_1) between 5—20 percent. This indicates that bonus shares were issued by such companies and the adjusted dividend rate (DPS_2) was higher than reported dividend rate (DPS_1) or the bonus and the right issue were made on favourable terms to shareholders of such companies. For instance, Kirloskar Brothers Ltd. reduced its dividend rate on equity shares from 12 percent in 1963 to 10 percent in 1966 but issued a bonus shares "to bring about a better relationship between paid-up capital and the capital actually employed in business". Mr. S. L. Kirloskar, Chairman of the company said in the 46th Annual General Meeting :

> "This year the Directors have decided to issue bonus shares, and this way it has become inevitable to fix a rate of dividend that takes into account this growth by way of bonus issue. I, therefore, feel that even though the rate of dividend is reduced, the shareholders are the gainers in the long run".

Though the above analysis shows that the companies, in general, moved to the next step upwards when they were classified according to DPS_2, the examination of the data more closely shows that only in fifteen companies, the issue of right shares reduced the adjusted dividend rate (DPS_2), and in the remaining companies the issue of right and bonus shares increased the return to shareholders. In these fifteen companies the reduction in adjusted dividend rate (DPS_2) was mainly in the early years of the study, i.e , during 1963-67 and the reduction, except in one case, was marginal and such cases remained in the same DPS_1 size interval. Only in one chemical company right shares were issued at a premium and the dividend rate (DPS_1) was not high enough to adjust for the additional investment because of premium on right issue. This is

the reason that on comparing DPS_1 and DPS_2 in Table 5, it is observed that one company is displaced downwards by one step.

Another study on bonus shares by Dr. L. C. Gupta, corroborates our results that the benefits of bonus shares are mainly to investors of shares having dividend rates between 5 to 20 percent. He stated that higher bonus ratios were found more often among companies paying high dividend rates, and lower ratios more often among companies paying low dividend rates; and the higher the pre-bonus dividend rate, the lesser is the probability that the rate will be maintained after the bonus issue.[4]

Bonus shares at higher levels of dividend rate, according to Dr. Gupta, are frequently intended purely as a split up operation without any immediate increase in dividend. This, he concludes from his results shown in his Appendix Table A-9, indicating larger proportion of cases having reduction in the magnitude of dividend on declaration of bonus at higher levels of ex-dividend rates.[5] But our analysis shows that issue of bonus shares increases the dividend received and is a benefit to the investors.

Dividend Policies Followed and Dividend Behaviour

it is observed that many companies try to find a policy of stabilising dividend over time. Lintner[6] observed that the elements of intertia and conservatism lead managements to have stable dividend policies. Darling[7] has also pointed out that the goal of top management leads to stablilisation of dividend rate. There is said to be a fairly stable relationship between income, retention and dividend declaration.[8]

In Table 6, the companies are classified in four categories : (a) companies paying no dividend, (b) companies reducing their dividend, (c) companies increasing their dividend, and (d) companies keeping

4. Gupta L. C. : *Ibid*, p. 39
5. Gupta L. C. : *Ibid*, p. 27
6. Lintner, John : 'Distribution of income of corporations among dividends, retained earnings and taxes'—*American Economic Review : Paper and Proceedings*, Vol. XLVI, May, 1956, p. 97—113.
7. Darling, Pal : 'The Influence of Expectation and Liquidity on Dividend Policy, *Journal of Political Economy*, Vol LXV, No. 3, June 1957 p. 209—224.
8. Dobrovolosky S. P. : *Corporate Income Retention 1915—1943*, New York, National Bureau of Economic Research (1951), ch. 1.

dividend constant. These categories are in relation to dividend of that company in the previous year.

Table 6 : Frequency Distribution of Companies According to Adjusted Dividend Rate (DPS_2) Changes by Year

Company Group	*Number of Companies*											
	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	Total
1. Zero Dividend	11	8	6	3	7	20	15	7	7	10	16	110
2. Reduction in Dividend	53	29	13	29	28	31	21	15	11	18	15	263
3. Stable Dividend	58	57	76	81	70	60	62	57	55	74	67	717
4. Incrase in Dividend	32	60	61	44	53	57	60	79	85	56	59	636
Total	154	154	156	157	158	158	158	158	158	158	157	1226

In only about 6 percent cases, the dividend was skipped, while in 94 percent cases dividend was declared. Maintaining more or less a stable dividend rate was a common practice and next in importance was the practice to increase dividend rate In about 41 percent cases, dividend rate was maintained at the previous year's level, in 38 percent cases the dividend rate was increased and only in 15 percent cases the dividend rate was reduced. In the above analysis, the dividend rate is in relation to the previous year. In order to study the regularity of dividend by a company, we scrutinise the data more closely to ascertain the companies skipping dividend in the subsequent years of our study.

Distribution of Companies Skipping Dividend (DPS_2) in next 11 Years (i.e. during 1961—72)

Table Companies	*Years*											
	Nil	1	2	3	4	5	6	7	8	9	10	11
158	100	23	13	11	5	2	3	—	—	—	1	—

Of the companies covered, two thirds distributed dividend for all the years. Only 14 percent of companies skipped dividend once, 18 percent cases skipped dividend for 2 to 4 years and only in 5 percent cases dividend was skipped for more than five years. To examine the dividend behaviour in detail, we test the hypothesis that Board of Directors (BOD) deliberately avoid dividend cuts to the extent possible and attempt to provide over time an increasing, or at least a non-decreasing, record of each dividend payments.

In order to test this hypothesis, we find out the trend of changes in dividend rate (DPS_2). Percentage change in DPS_2 ($\triangle$ DPS_2) is defined as

$$\triangle DPS_2 = \frac{DPS_2\ (t) - DPS_2\ (t\text{-}1)}{DPS_2\ (t\text{-}1)}$$

The frequency distributions of companies at various class intervals of $\triangle$ DPS_2 are drawn in Table 7.

Another way to study the dividend behaviour is to assign some specific value to dividend changes and examine the sequence of such assigned values over time. For example, dividend cut may be assigned the value unity (or 1), dividend increase be assigned the value '2' irrespective of size of increase and 'S' for dividend remaining constant. To avoid any ambiguity, zero dividend is assigned the value zero. Thus, wherever dividend has been reduced to zero, or zero dividend is continued, these are assigned the values zero and not '1' or 'S'. For example, sequence as (SS, 1222, 1110) means that for two years dividend rate remained same, then it was reduced for next one year and then increased for three years followed by dividend out for three years, leading to skipping dividend in the last year.

Empirical Results

Table 7 presents the distribution of $\triangle$ DPS_2 by interval for each year during the period 1962 to 1972. The class intervals for DPS_2 are shown in the first column. Numbers in the columns under the year t (where t = 1962... ...1972) reveal the number of firms whose $\triangle$ DPS_2 fall in the particular class intervals. Total at the bottom of each column shows the number of companies covered for each year. The total number of firm year observations for the entire study were 1726.

Table 7 : Frequency Distribution of Companies by Adjusted Dividends (DPS_2)

DPS_2 change Interval in percentage	Number of					
	1962	1963	1964	1965	1966	1967
Zero dividend	11	8	6	3	7	20
Less than —75				1		
—75 to —50	2	2	4	1	3	6
—50 to --25	16	8	4	12	11	13
—25 to 0	35	19	9	15	14	12
*	58*†	57*†	76*†	81*†	70*†	60*†
0 to 25	16	36	31	33	33	24
25 to 50	2	13	19	4	10	13
50 to 75	2	—	3	1	3	4
75 to 100	3	2	—	1	—	1
Above 100	2	2	1	—	4	1
**	7	7	7	5	3	4
Total	154	154	156	157	158	158

* Dividend remained constant

** Dividend increased but negative or zero values involved.

*† Interval containing median value for the year.

Changes by Year and Interval

Companies						
1968	1969	1970	1971	1972	Total	Cumulative Total
15	7	7	10	16	110	110
	1				2	112
2	2	1	1	2	22	134
10	7	3	4	7	95	229
9	5	7	13	6	14	373
62*†	57*†	55*†	74*†	67*†	717*†	1090*†
28	38	43	37	43	362	1452
9	17	28	8	6	129	1581
7	3	2	5	4	34	1615
—	6	3	1	4	21	1636
3	4	6	4	1	28	1664
13	11	3	1	1	62	1726
158	158	158	158	158	1726	

This table shows that in large number of cases (41 percent), dividend rate remained constant. Next in importance (21 percent) were instances of small increases in dividend rates of less than 25 percent. Instances having decrease in dividend by less than 25 percent accounted for 9 percent, while in 7 percent dividend increased between 25 to 50 percent. The median observation for each year and for the whole period falls in the interval of dividend of no change.

This shows that the practice of dividend rate with no change or small change is found in about 78 percent of the cases. Out of the cases having small changes in dividend rate, the cases of reduction in dividend rates are very small. Further, only in about 7 percent cases the decrease in dividend rate was more than 25 percent.

The main limitation of the above analysis of dividend changes is that each firm-year observation is treated independently of all other observations. For that, another method of assigning specific values, asexplained above, to dividend changes is followed and the results are discussed.

Dividend records of each firm were examined and the following things were observed :

1. Longest consecutive stream of decreasing dividend
2. Longest consecutive stream of increasing dividend
3. Longest consecutive stream of nondecreasing dividend

i. e., the longest stream where dividend were either increased or held constant.

These observations about each firm are shown in Figure 1, 2, and 3 respectively.

Figure 1 shows that 21 firms (13 percent) never reduced their dividend rate during the period of study. Most common policy was to cut dividend rate once as it accounted for about 55 percent of total cases. About 20 percent firms cut their dividends twice. So if the dividend policy is defined as increasing stream hypothesis where firms cut their dividends only once, it shows that 68 percent of firms follow this policy; or, if the increasing stream hypothesis is defined to cover firms decreasing their dividend only for two years or less, then this policy is followed in 88 percent of firms studied. Only six firms cut dividend for four or more years.

Figure 2 shows the firms having longest stream of increasing dividend, It shows that the firms do not have the policy of increasing dividend for a long stream of years. Only 43 firms increased the dividend for a continuous period of 3 years, while the number of firms having increase in dividend for two years and the one year were 58 and 47, respectively.

Only small number of firms (4) could increase their dividend for 5 to 7 years.

Since large number of firms did not follow increasing dividend policy, a study of the largest number of years for which the dividend was kept non-decreasing is pertinent. Figure 3 gives such cases having dividends constant or increasing. In 21 companies, dividend was either kept stable or was increased throughout the study period, and in 128 companies dividend was kept non-decreasing for at least four years. The mode, the most common number lies at 4 years where 29 firms did not decrease their dividend rate. The median lies in the 6-year class.

Thus, our analysis shows that the directors do not follow a policy of increassing dividend rate for a long stream of years, but they follow a policy of non-decreasing dividend for a longer span and avoid any decreases in dividend.

Dividend Influenced by Earnings

Dividend is paid out of profit and profit is taken as the starting point for declaration of the dividend. The dividend is said to communicate information to investors about firm's profitability, so the question to be examined is: Is there any relationship between dividend and profits ?

Table 8 gives the joint distribution for adjusted dividend rate change ($\triangle DPS_2$) and adjusted earning rate change ($\triangle EPS_2$) for all the years together. The elements along the main diagonal represent cases having constant dividend payout ratio. Only 18 percent of the elements lie on the main diagonal, but many elements fall adjacent to the main diagonal.

The three most populated cells adjacent to the main diagonal are 172 elements where DPS_2 are maintained at the last year level but EPS_2 are reduced by less than 25 percent, 134 elements where DPS_2 are maintained but EPS_2 are increased by less than 25 percent and 101 cases having increase in DPS_2 and EPS_2 by less than 25 percent.

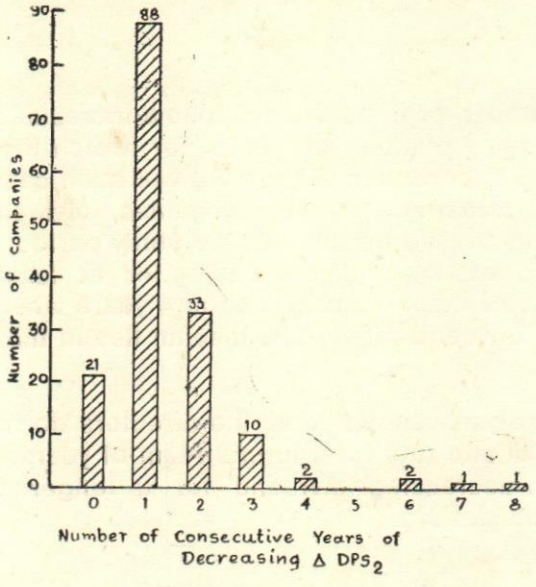


FIG .1

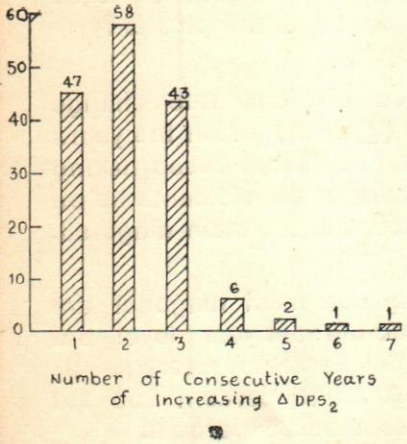


FIG. .2

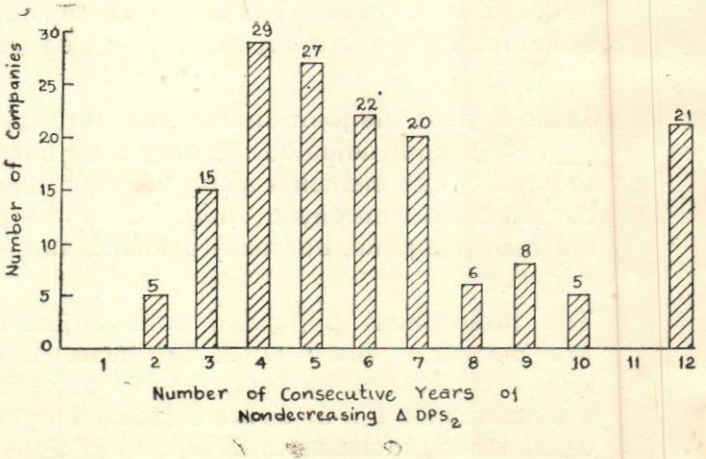
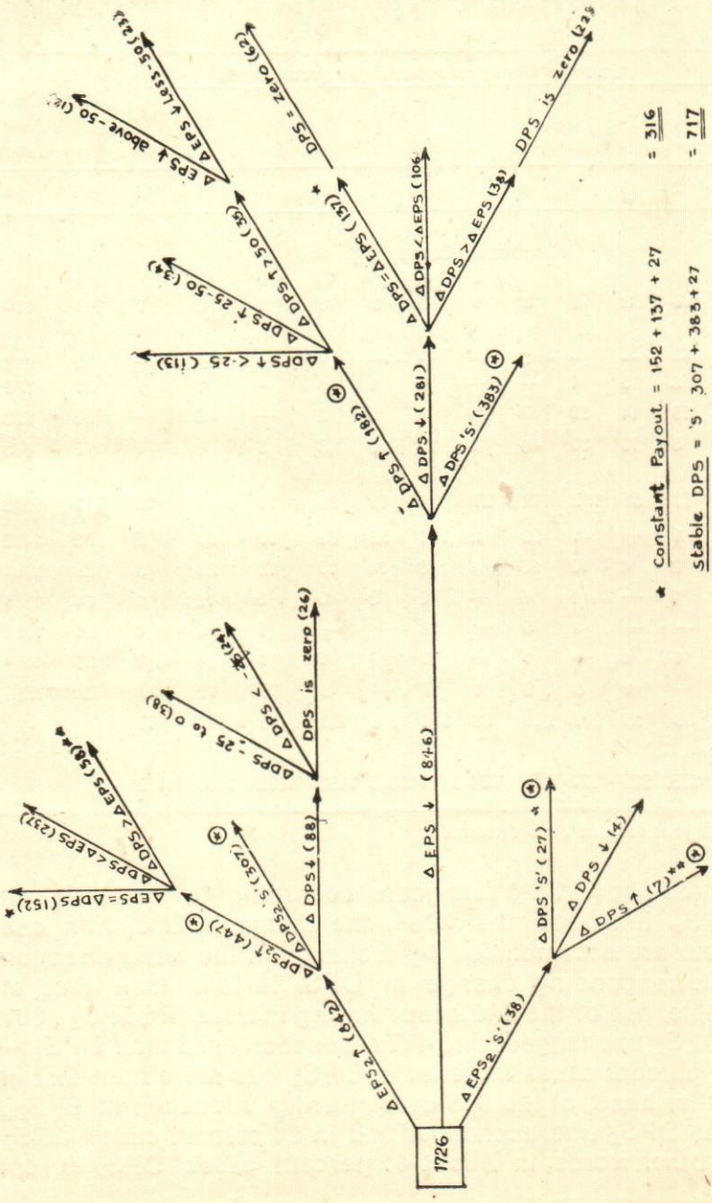


FIG. 3



* Constant Payout = 152 + 137 + 27 = 316

Stable DPS = 's' 307 + 383 + 27 = 717

Disgaving i.e. Δ DPS > Δ EPS (being positive)
when Δ EPS is 's' 7
when Δ EPS ↓ 182 + 383 + 18 = 581
when Δ EPS ↑ = 58 = 646

Ⓐ Non Decreasing DPS
Δ EPS 's' = 7 + 27 = 34
Δ EPS ↑ = 447 + 307 = 751
Δ EPS ↓ = 383 + 182 = 565 = 1350

FIG 4 PRESENTATION OF INCREASE (↑), DECREASE (↓), CONSTANT (S), ADJUSTED DIVIDEND RATE (DPS), FOR 1726 FIRM YEARS FOR THE PERIOD 1962-72 HAVING CHANGES IN ADJUSTED EARNING RATE (EPS)

not in the same direction as that of EPS_2 (two-third of these cases not having change in DPS_2 similar to that of EPS_2 were those having decrease in EPS_2 and increase in DPS_2 —the increase in DPS_2 was less than 25 percent).

Quantification of Dividend Practices

In this section, regression analysis is used to analyse dividend practices among companies. Lintner and Darling dividend equations as given below are estimated from cross-section data of 157 companies for each of the years 1963-72.

$$D_t = \alpha + \beta P_t + \gamma D_{t-1} \quad \text{Lintner Model}$$

$$D_t = \alpha + \beta P_t + \delta P_{t+1} \quad \text{Darling Model}$$

Where, D_t = dividend for the t_{th} year

P_t = Profit for the current year

β, γ and δ are parameters to be estimated

α = is the intercept term.

The estimates of these equations are presented in Table 9 and 10. Table 9 presents the estimates for adjusted dividend rate equation while Table 10 presents the estimates for unadjusted dividend rate equation. On analysing these estimates one observes the following points :

(a) The degree of explanation $\bar{R}^2$ is high in table 9 as compared to that of Table 10 with the exception of the initial years. The co-efficient of determination are significant at 1 percent level and it indicates that adjusted dividend rate is well explained by adjusted current year profit and lagged adjusted dividend.

Table 8 : Frequency Comparison of Earning and Dividend per Share Changes by Intervals

Dividend Changes intervals in Percentages	*Earning Changes Intervals in Percentages*												*Total Cum. Frequency*	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Number of Cases													
1. Zero Dividends	62	10	3	6	3	0	7	2	3	1	6	7	110	110
2. Less than —75	—	—	—	—	2	—	—	—	—	—	—	—	2	112
3. —75 to —50	6	3	5	1	—	—	2	1	1	—	1	1	21	133
4. —50 to —25	4	15	14	30	13	1	8	5	2	—	3	—	95	228
5. —25 to 0	7	5	13	39	40	3	15	10	3	5	4	1	145	373
6. Maintained as per year	31	17	51	112	172	27	134	60	29	17	49	18	717	1090
7. 0 to 25	11	1	—	41	60	2	101	52	39	10	37	8	362	1452
8. 25 to 50	3	2	4	10	15	4	8	14	15	12	29	3	129	1581
9. 50 to 75	1	1	—	1	5	—	2	3	5	3	12	1	14	1615
10. 75 to 100	—	—	—	4	5	—	2	—	—	1	5	4	21	1636
11. Above 100	1	1	4	—	1	—	7	1	1	1	4	7	28	1664
12. **	4	—	1	3	3	1	7	—	3	2	11	27	62	1726
13. Total	130	55	95	247	319	38	303	148	101	52	161	77		
14. Cumulative Total	130	185	280	527	856	884	1187	1335	1436	1488	1449	1726		

Table 9 : Estimates of Adjusted Dividend Rate Equations

$$DPS_2 = \alpha + \beta EPS_2 + \gamma DPS_{2\text{-}1}$$
$$DPS_2 = \alpha + \beta EPS_2 + \delta EPS_{2\text{-}1}$$

Year	α	β	γ	δ	$\bar{R}^2$
1963	1.77	.074*	.768*		.9033
1964	1 61	.05*	.86*		.9359
1965	1.05	.006	.914*		.8794
1966	.232	.136*	.737*		.874
1967	.526	.064*	.775*		.808
1968	1.69	.1002*	.745*		.9035
1969	1.75	.093*	.787*		.861
1970	1.86	.122*	,76*		.852
1971	.873	.015*	.96*		.911
1972	-1.24	.063*	.9996*		.9026
1963-72	.75	.047*	.902*		.864
1963	7.66	.278*		—.024*	.62
1964	7.95	.107*		.168*	.641
1965	9.26	– .007		.225*	.438
1966	6.87	.218*		.083*	.613
1967	6.58	.105*		.167*	.607
1968	7.95	,169*		.102*	.752
1969	7.43	,154*		.156*	.676
1970	4.73	.255*		.132*	.802
1971	7.28	.019**		.313*	.749

Table 10: Estimates of Dividend Rate (Unadjusted) Equations

$$DPS_1 = \alpha + \beta EPS_1 + \gamma DPS_{-1}$$
$$DPS_1 = \alpha + \beta EPS_1 + \delta EPS_{-1}$$

Year	α	β	γ	δ	$\bar{R}^2$
1963	1.6	.067*	.788*		.897
1964	1.65	.06*	.84*		.9288
1965	.371	.035*	.894*		.8908
1966	1.8	.15*	.496*		.698
1967	.579	.112*	.63*		.838
1968	4.58	.112*	.357*		.576
1969	4.47	.111*	.429*		.485
1970	3.03	.162*	.464		.555
1971	3.53	.07*	.587*		.725
1972	.724	.065*	.819		.788
1963-72	2.27	.094*	.634*		.76
1963					
1964	6.86	.159*		.38*	.65
1965	6.97	.024*		.255*	.519
1966	5.82	.236*		.842**	.396
1967	4.91	.205*		.0074*	.688
1968	7.2	.116*		.062*	.422
1969	7.65	.148*		.028**	.358
1970	5.93	.173*		.088*	.493
1971	6.58	.092*		.156*	.552
1972	8.09	.104*		.092*	.359
1963-72	6.98	.156*		.084*	.493

(c) The regression coefficient of current year profit measures short-term propensity to pay. These coefficients for adjusted dividend rate, as dependent variable in Table 9, are of appropriate sign in all regressions but one, and are significant at 1 percent level in all the cases except two. These coefficients in Table 10 according to Darling equation (with lagged profit as explanatory variable) are more than that of Lintner's equation—the highest value in these cases being 0.29 and 0.14 respectively. The long-term marginal propensity to pay, as calculated from Lintner's equation is about 30 percent, but it has increased after 1969, implying a policy to pay more during the later years.

(d) The intercept term is generally positive except once in 1972 and it shows that the companies studied have greater reluctance to reduce than to increase dividend.

The above points corroborate our earlier findings that adjusted dividend rate rather than unadjusted dividend rate is better explained by current year profit and lagged dividend, and the companies generally follow a stable dividend policy by attaching a great emphasis to lagged dividend and conservatively adjust dividend for the change in profit.

Conclusions

The dividend practices vary from company to company. The dividend policy as followed by companies can be best described as eclectic as it can be put to use according to the convenience of the interested parties.

The companies are not observed to have dividend yield or dividend payout ratio as a dividend policy. However, the dividend payout ratio for all the companies under study has increased from 55 percent to 62 percent over the period of study. The reported dividend rate per share has declined over the period from 13.8 percent to 13 percent while the adjusted dividend rate (hereafter called dividend rate) has an upward trend from 14 to 24 percent over the same period. The discrepency between reported dividend rate and adjusted dividend rate indicates the intention of the management to undertake the dividend rate and to avoid giving an impression of profiteering which a high dividend rate seems to convey[9].

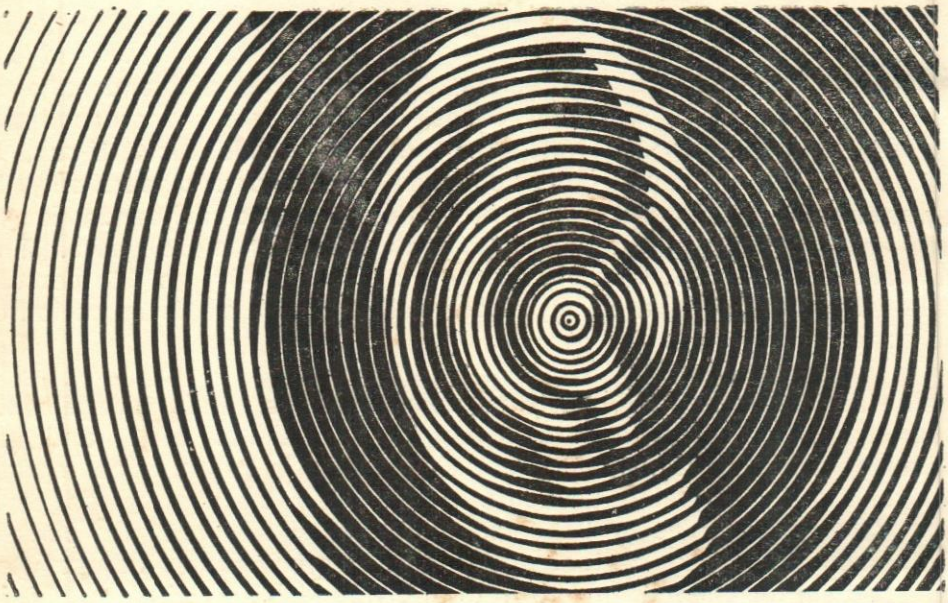
9. Gupta, S. C.: *Ibid.*

The general practice is to declare dividend. The dividend rate is generally kept stable, in some cases dividend rate is increased and in a very few cases dividend rates are cut. The dividend cut, if any, is very small and is done for a consecutive one or two years only. In aggregate, two-thirds of companies studied, declared dividends for 12 years and only 5 percent skipped dividend for five or more years. The firms are found to follow non-decreasing dividend policy as 88 percent of the firms followed a policy to cut dividend for a maximum period of two consecutive years.

The dividends are generally related with earnings, and managements generally try to avoid dividend cuts with the decrease in profit and are conservative to adjust dividends for an increase in profit. The regression results for adjusted dividend rates indicate that last year's dividend rate is used as a benchmark for the determination of current year's dividend and the current year's profits are used to adjust with conservatism for change in the rate of dividend. Tata Electric Locomotive Company Ltd. (TELCO) is a good example to show that dividends are related with profits and Directors avoid dividend cuts, if possible. TELCO had a fall in its profit during the year 1967-68. Chairman, Mr. J.R.D. Tata said at the Annual General Meeting of the Company:

"In order to avoid causing hardship to the shareholders and in the belief that the profitability of the company will be re-established in the current and subsequent years as the new facilities become increasingly productive, the Directors have recommended the maintenance of the dividend on ordinary share... I am sure that shareholders will appreciate this action on the part of the Directors, but I trust they will realise that the next and subsequent dividends on ordinary shares will depend on profit."

This study shows the dividend practices of companies, but does not analyse how far dividends vary in companies of different categories like size, control, industry or growth. Further, the study is restricted to dividend practices and influence of earnings on dividend, and does not attempt to analyse the influence of other factors on dividend. *



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Environment and Small Industries

S. Venkatesh*

In recent years, considerable progress has been achieved in India in the establishment of small scale industries. It is increasingly recognised that, in the Indian context, this sector has an important role to play with its potential for providing larger employment opportunities, for removal of poverty and for reduction of regional imbalances. From a total of 1,20,000 registered units in 1966, the sector has grown to a size of 4,08,000 by 1973. The table below indicates the progress in this field during 1966-73.

	1966	1970	1973
No. of registered units (in thousands)	120	238	408
Employment (in lakhs)	29.3	33 4	45
Fixed Investment (Rs. millions)	5,480	6,300	8,150
Production (in Rs. millions)	29,540	41,250	62,000

Source : Handbook of Statistics 1973, Small industries, Government of India and Annual Report 1974-75.

Units with an investment not exceeding Rs. 10 lakhs in plant and machinery irrespective of the number of persons employed are classified as small scale units. In the case of small enterprises which are ancillaries to specialised large scale industries, this limit is Rs. 15 lakhs. The number of small scale units given above refers only to those which have been registered with the Departments of Industries of the government. Since an entrepreneur is entitled to various types of assistance from government only in case his unit is registered, the growth in registered units, particularly, in recent years, would represent the growth in small scale industry in general.

The industrial structure, consisting of both factory and the non-factory establishments is characterised by the predominance of small industrial

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units. According to a survey[1] covering only factory establishments, small scale units accounted in 1967 for 92 percent of the total number of factories. They provided employment to 46 percent of total factory labour. Further, with a fixed capital share of 11 percent, the sector was responsible for 33 percent of total factory production. In the export sector also, the performance of small industries has steadily improved. In 1973-74, the exports from this sector were of the value of Rs. 4,000 million or 16 percent of total exports. In addition, a small scale factory has the advantage of requiring, on an average, much less fixed capital per worker than a large scale factory.

An Industrial Estates Programme has been started to encourage and support the establishment, expansion and modernisation of small scale industries through the provision of factory accommodation and common service facilities. This programme has been making steady progress. While there were only 181 completed estates in 1964, this number had gone up to 499 by 1973. Of these, 444 were actually functioning, accommodating 9497 small scale units. These units produce goods worth Rs. 2850 million.

To the extent possible, these industrial activities are dispersed in rural and backward areas. Out of the 499 estates completed, 214 were in urban areas with a population of over 50,000, 144 in semi-urban areas with a population between 5,000 and 5,0000 and 141 estates in rural areas with population below 5,000.

Coverage

Small scale industries manufacture a wide range of articles—from cosmetics to complicated electronic gadgets. An assortment of industrial and automible components, scientific instruments, pharmaceutical preparations, processed food and fruit products and large variety of other items come within the purview of Small Scale Industries. A broad distribution of these small units, in the registered factory sector, industry-wise would be as under :

Agro-based	33% (approx.)
Leather & Leather based	1.5%—2%

1. Annual Survey of Industries, Central Statistical Organisation , 1967

Paper and Paper based	9%
Rubber and Plastic based	1.5—2%
Chemicals and Chemical based	5%
Mineral based including glass and ceramics	8.5 to 9%
Metal based and others	40%

Source : Handbook of Statistics, 1973

In the field of electronics and electrical industries, the production programme in small industries sector covers even sophisticated electronics items relating to manufacture of instruments and instrumentation, testing and measuring equipment, ECG machines, televisions, tape-recorders, etc. In 1974 alone, 48,000 television sets and 1.4 million low-cost radio-receivers were produced by the small sector.

Regarding electrical industries, the range of production includes sophisticated items like transformers (upto 132 KV), air-brake switches, domestic electrical appliances, etc. In the field of leather and leather goods, the bulk of the units (as much as about 90 percent) are in the small scale sector. Programmes continue to step up their production still further.

The metal based industries also cover a very wide range of production, like manufacture of electrical machinery, railroad equipment, components of ships and aircrafts, professional and scientific measuring and controlling instruments, watches etc.

National Policy Towards Small Scale Industries

The objective of the programme for the development of different small industries in the country's fifth plan is :

(a) To generate maximum opportunities for employment, particularly self-employment;

(b) To facilitate fuller utilisation of the skills and equipment of the persons engaged in these industries;

(c) Progressively improve the production techniques; and

(d) Promote these industries in semi-urban and rural areas including backward areas.

A number of large scale undertakings in the public and private sectors have been persuaded to farm out several of their requirements to small scale ancillary units. There is no compulsion in this regard.

The main thrust of the small industries assistance programme is to help these units reach maximum levels of efficiency. This would be attempted through an integrated assistance programme, including management counselling and training, increased availability of credit, better technical services and facilities and assistance in domestic marketing and exports. Selected items of production are reserved exclusively for the small scale sector. At present, 177 items are thus earmarked. The small scale industries are also assisted by way of due weightage in the allotment of scarce raw materials, subsidy on capital investment of new units, rebates in taxes, etc.

It is also the policy of the government to give a positive emphasis to the promotion of those small industries in rural and backward areas. The natural reluctance of entrepreneurs to go to rural areas is proposed to be overcome by way of adequate incentives and other facilities.

By means of these measures, it is proposed to set up additional 1.6 lakh new units in the current Fifth Plan period (1974-79), thus generating additional employment of the order of 1.6 million. A substantial financial provision is made in the National Plan for this purpose.

Pollution Control Measures

Except in a few localised pockets with a relatively high degree of industrialisation, the effect of environmental pollution is yet to be felt in other ares. As a consequence, the significance of possible environmental degradation due to industries is only gradually being appreciated. Even among large industries, it is in the case of a few establishments only that remedial measures are initiated to control pollution. As far as small scale industries are concerned, even the appreciation of the problem is not encouraging.

Adequate legislative provision exists in India to prevent and control water pollution. A legislation entitled "The water (Prevention & Control of Pollution) Act" has been recently enacted, which is equally applicable to both large and small scale industries in cases of pollution. The Act vests the enforcement authority with adequate powers to deal with cases of water pollution.

Environmental preservation could be satisfactorily ensured only with the active participation of the public at large. As such, besides resorting to the provisions of the legislation, concerted attempts are being made to build up a general awareness of the problem of pollution.

Governmental Measures

As a developing country, we are conscious of the advantage of being alerted in advance against the potential environmental pollution due to industries. The need to take timely action in this regard is fully appreciated. This is one of the areas where prevention is better, and much less costly, than cure. The approach of our country to this problem was very clearly brought out when our Prime Minister addressed the U. N. Conference on Human Environment at Stockholm (Sweden) in 1972 and observed:

"Modern man must re-establish an unbroken link with nature and with life.....and the higher standard of living must be achieved without alienating people from their heritage and without despoiling nature of its beauty, freshness and purity so essential to our lives."

At this stage, it has to be stressed that our environmental problems are, in a way, different in nature and scope compared to those faced by some other societies. To quote our Prime Minister again, "The environmental problems of developing countries are not the side effects of excessive industrialisation but reflect the inadequacy of development..... To us, development is one of the primary means of improving the environment for living, of providing food, water, sanitation and shelter." Protection and enhancement of the quality of the environment cuts through the boundaries of traditional disciplines and, as such, environmental problems can only be resolved by a process of integrated planning which takes full account of our imperative needs, possible side effects and long-term consequences of development actions.

Keeping these factors in view, we have set up a high-power National Committee on Environmental Planning and Coordination (NCEPC) to identify, investigate and propose solutions for the problems of improving the human environment in the context of the growth and distribution of population and economic development. For accomplishing these goals, the NCEPC is to review, formulate and promote environmentally sound policies and programmes covering development projects, physical planning, legislation, administrative procedures, education, public information and research.

The National Committee functions primarily through its two sub-committees, viz., (a) Indian National Man and the Biosphere programme (MAB), and (b) Environment Research Committee (ERC). These sub-committees identify the specific fields which need research proposal and also evaluate such research projects.

The lack of availability of information and data in the field of environment is recognised and it is, therefore, proposed to build up an Environment Information System. In each constituent state in our country, a separate Environment Committee is being set up to keep a close watch over the environmental aspects *vis-a-vis* the development programmes.

Under the Central Water (Prevention & Control of Pollution) Act, a Central Board is constituted and similar boards are functioning in the different states of the country to prevent water pollution.

In respect of new industrial enterprises, adequate precautionary measures are contemplated to prevent possible future environmental pollution. The licensing of these activities will be considered only if the project reports do include in detail the pollution control measures and make adequate provision for the same.

Institutional Arrangements for Assistance, Supervision and Information

The Small Industries Development Organisation (SIDO) set up at National level serves as the apex body which besides formulating general policies for the development of small industries coordinates all the assistance programmes operated by various government and non-government

institutions. Its assistance programme includes supply of information on prospects of industries which could be taken up in small scale sector, drawing up schemes for the manufacture of various items, technical consultancy services, common facilities, extension services, training in management and technical trades, economic information service, assistance in modernisation and technological development and guidance in the procurement of machinery, etc. In its policy matter, it is guided by the advice of a high-powered board (Small Scale Industries Board).

SIDO has a number of field formations called Small Industries Service Institutes. These are 17 in number, with 54 attached extension branches spread over different states. These form the base organisations which are in direct day-to-day contact with the industry and the entrepreneur. They form the main link between research organisations and the small industries and serve as the channel for flow of government assistance, supervision and other technical information.

The role of providing plant and machinery to small industrialists on hire-purchase basis is fulfilled by the National Small Industries Corporation (NSIC). Through its prototype development and training centres, the NSIC provides training to the technical and managerial staff at various levels.

On technology side, commercial exploitation of the production processes developed by various laboratories and research institutions is licensed to different entrepreneurs through the National Research Developmental Corporation (NRDC). Research in environmental sciences is conducted by a few institutions, especially the Indian Institutes of Technology.

Organisations like National Productivity Council have been extending all assistance in training the small industry entrepreneurs in the concepts and techniques of productivity. Consultancy services in techno-managerial fields have been made available to small scale industry units at concessional rates of fee. National Productivity Council has also set up special cells for productivity services for small scale industries.

Problem Areas of Pollution Control

As mentioned earlier, this aspect of pollution control is yet to be adequately appreciated by the small entrepreneurs. One of the primary causes

is their sense of complacence that their role in causing this pollution is negligible by the very nature and magnitude of their activities. It is also due to the fact that environmental science is a comparatively new field and, there is no general awareness of the problem, more so among small industrialists. Yet another consideration would be the unhealthy example set by some of the larger industries. When the larger units themselves are slow in checking pollution, the small undertakings would understandably take courage to defer their own action in this direction.

The chief consideration, however, is that any investment on pollution control would push up the production costs and, especially when all industries do not simultaneously take up such pollution control, the price differential will clearly work to the disadvantage of a few conscientious entrepreneurs.

Some findings of a recent Industrial Pollution Survey conducted by the Associate Chamber of Commerce and Industry, New Delhi, throw interesting light on the attitude of the Industrialists to the question of pollution control. About 75 percent of the respondents to the questionnaire were unaware of the contents and implications of Water Pollution Act and the standards prescribed for liquid effluents. Only 33 percent of the respondents were prepared to consider voluntary measures to improve the quality of their gaseous emissions. A still smaller number (10 per cent) are ready to imporve the quality of their solid effluents. Surprisingly, a few firms (some of whom are under enlightened management) have given a negative response to even such measures as good house-keeping and preventive maintenance, presumably on the ground that they are causing no pollution.

The problems of pollution control, in general, and among small industries in particular, are due to a number of factors—economic, technological and social.

(*a*) *Economic factors :* Small industries, irrespective of their location—in urban, semi-urban or rural areas—come within the administrative jurisdiction of certain civic bodies. These may be big corporations, municipalities or small village panchayats. Everyone of these civic bodies has its obligatory functions, such as, water supply, communications, disposal of solid waste, sanitation, education, etc. However, the extent to

which these authorities could perform their tasks is determined by their resources which are often inadequate. The smaller the civic body, the bigger is the problem. This is reflected even in the mode of collection, transportation and disposal of refuse from settlements and industries. Incineration or composting is more an exception.

If any industry comes forward to take up any pollution control measures, it gets no incentive by way of tax relief, etc. On the other hand, it stands to lose by way of increased cost of production which amounts to penalising that unit.

The industries themselves do not always have adequate resources for undertaking such pollution control measures. It would be necessary for Government to consider giving adequate incentive by way of subsidy or other concessions on such investment.

(*b*) *Technological factors :* There is scope for considerable Research & Development work to develop suitable devices to measure and monitor pollution. It would similarly be necessary to evolve suitable treatment processes for the effluents, which should be within reasonable reach of the small entrepreneurs. Energy crisis has resulted in the need for investigation in processes for energy recovery from wastes. Innovative techniques in recycling etc. are to be studied carefully before recommending them for adoption on a large scale.

Generally speaking, there should be greater liaison between research institutions and small industry. Expert advice of professional bodies like R & D Institutions, Productivity Councils, etc. should be available to Industry, *inter alia* in the fields of:

(i) Choice of better equipment

(ii) Choice of better technology

(iii) Good house-keeping

(iv) Recycling of wastes

(v) Preventive maintenance

(iv) Treatment of wastage (solid, liquid and gaseous) and monitoring devices.

(*c*) *Social factors :* Keeping the environment clean requires not only the solution of technological problems but also the public acceptance,

cooperation and active participation. As every individual is, in a sense, responsible for affecting the environment, he should also be disciplined to keep it clean. Appropriate changes in attitude are to be brought about by suitable educational measures, propaganda and enlisting the services of voluntary organisations.

(*d*) *Other Problems—Settlements :* Very rarely, if ever, the progress in the field of satisfactory settlements has kept pace with the growth of industry in any area. For instance, at the Okhla Industrial Estate in Delhi, out of a labour force of 8000, hardly 20 per cent of the workers are provided accommodation. The rest of them naturally have to come from the neighbourhood or have to live with others under unsatisfactory conditions. Other attendant problems of sanitation, transportation, education, marketing, etc. which are a part of settlements are also thus thrown up.

Remedial Measures

(1) As revealed by a survey, many industrialists—more so, the small entrepreneurs—are just not aware of the problems of environmental pollution and of the legislation in this regard. A strong general awareness of this problem has to be immediately built up.

It is equally important that the authorities in charge of industrial development should also be committed to the need for evironmental preservation.

(2) Even among those industrialists who are aware of the problem, the reason for their not initiating any pollution control measures is mostly because of economic considerations. This is all the more applicable in the case of existing industries. Government should, therefore, seriously consider giving adequate financial assistance towards the initial outlay on such measures.

(3) In respect of new industries, outlay on pollution control measures should form part of the project cost. Concerned authorities should strictly ensure this before according approval for the project. A mere assertion from industries that this aspect is kept in view would not always suffice.

(4) When a new industry is so approved, adequate follow-up action is essential to ensure that the pollution control measures are actually carried out.

(5) Legislative provisions for the prevention of pollution should be strictly enforced. For effective control, it would be desirable to have a comprehensive legislation/authority covering all aspects of pollution.

(6) The industry observing such pollution control measures should be suitably rewarded by way of tax relief, etc.

(7) With a view to keeping down the cost, areas of possible cooperative effort especially among the small industries in the field of pollution control should be identified and tried.

(8) Active participation of R & D institutions should be enlisted to evolve suitable monitoring devices, pollution control measures. Similarly, intensified research on recycling of wastes is immediately necessary, along with close liaison between such R & D organisations and industry.

(9) Satisfactory environmental preservation is ultimately possible only through the whole-hearted cooperation of all concerned. Voluntary organisations and educational institutions have a prominent role to play in this direction.

(10) A strong "Environmental Information System" should be built up covering the up-to-date "State of Environment" in general in the country, identifying, among other things, the problem areas, expertise and research facilities available in the area of environmental preservation, both within and outside the country, together with the latest research findings in the field.

There is no conflict between "development" and "environment". The problems of environmental pollution experienced in highly industrialised societies should put the developing countries, who are still in the process of industrialisation, on their guard. Any investment in this direction is worthwhile. Besides building up a general awareness of the problem, the authorities in charge should totally identify themselves with the need for such environmental preservation.

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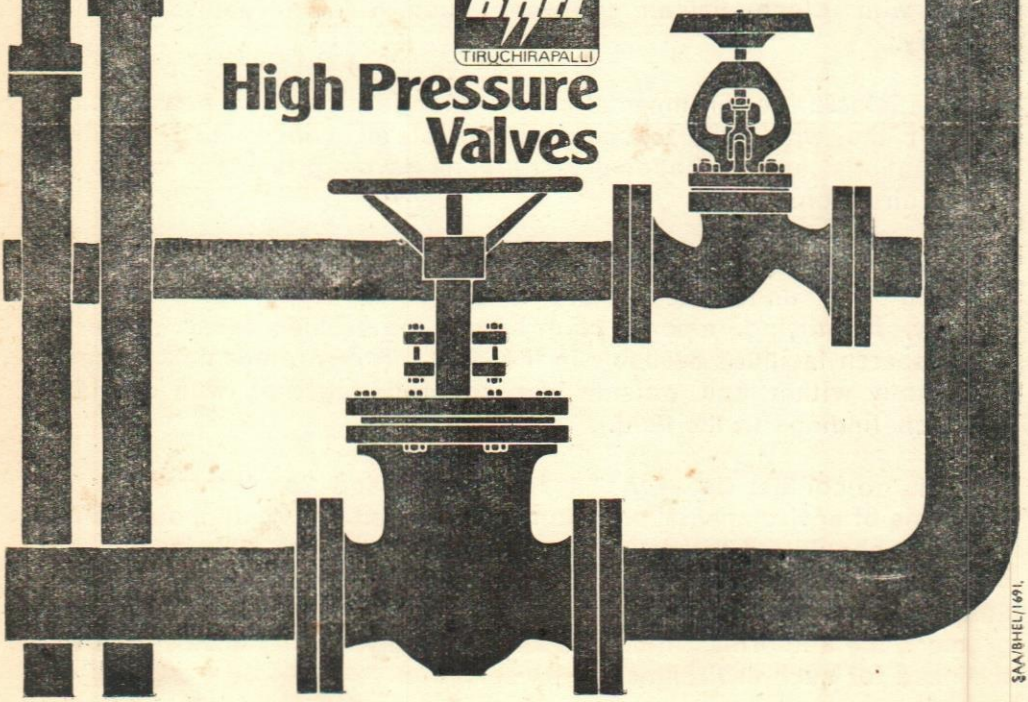

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Productivity Trends in Small-Scale Firms : Managerial Implications

S. Acharya T.V.S. Ramamohan Rao*

Productivity concepts and policies aimed at its improvement are not new to the small scale entrepreneur. He is continuously reminded that a sustained level of productivity is necessary for the long-run viability of the unit. In one of our recent studies, Rao and Acharya (1975), an attempt has been made to give a concrete expression to the basic dimension of long-run viability that is at stake. It was observed that almost all small firms depend on internal funds for financing both fixed and current assets. The dependence may decrease somewhat with size but is not eliminated altogether. Secondly, the smaller units do not have any control on market price, with the result that any increase in profits can come about only by increasing productivity. We have empirically demonstrated that maintaining a survival level of production is itself contingent upon keeping the productivity high.

Cross-sectional studies on small units, conducted from time to time, suggest that on an average, the productivity of small firms is rather low— N.C.A.E.R.. (1973); Rao and Prassad, (1975); Singh (1970).[1] A variety of reasons have been indicated, chief among which are the lack of technical know-how and financial difficulties. The remedial measures offered by the government agencies, therefore, tend to concentrate on providing these facilities in order to ameliorate the problem.

We are, however, of the opinion that the more basic malady is the lack of systematic managerial decision processes within the firm. In both, Rao and Acharya (1975) and Acharya and Rao, (1975),we have provided evidence for this hypothesis with respect to production and profit planning. [2,3] This study is also based on the assumption that low producti-

* ....

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Thanks are due to R. R. Barthwal and R. K. Sampath. The usual caveat applies, however.

1. Even Singh (1970), though he examined the internal organisational structure, falls into the trap of suggesting government agency intervention as the answer to the malady.
2. We have also shown in Rao and Acharya (1975a) that productivity, in its turn, is already a cornerstone in the determination of wages in small firms along with the ability to pay.
3. Thompson and Mills (1973) argued the same point from a different perspective. They feel

vity is basically caused by the absence of managerial efficiency. Perhaps correcting these, rather than continuous assistance from outside, will preferably be a long-run solution.

The present paper attempts to identify the determinants of productivity. Our analysis indicates that technical features such as capital intensity, economies of scale in production, and market risks, such as the unexpected shortages of raw materials, have significant effects on productivity. But apart from this, it appears that capital and materials management play a pivotal role in causing the productivity to be what it is.

Theoretical Framework

In principle, the most appropriate measure of productivity is the total factor productivity. However, in a cross-section analysis of the kind we have from the survey data, the measurement of cost of capital was not possible due to inadequacy of data. Therefore, the value added per worker as a measure of productivity was used.

Intuitively, it is quite clear that labour productivity depends upon technical and managerial factors within the control of management as well as factors outside their purview—such as attitudes of labour, interruption in production caused by unforeseen factors, etc. We are, primarily, interested in the effect of discretionary managerial behaviour on labour productivity. First the technical factors are considered. Higher capital intensity, as the classical argument suggests, embodies better efficiency because of a greater extent of automation and better workforce management. This feature has been empirically demonstrated for large scale industries in India. One of the many studies on this aspect is Mukherjee (1975).

In rather extensive studies, Dadi (1973) has shown that the skill composition of labour makes a substantial contribution to labour productivity at the industry level. The same should also hold at the firm level. For the skill composition it becomes increasingly important when handling various machinery in an optimal manner is called for. The measurement of this variable is, however, somewhat ambiguous. Skilled

that being engrossed in day-to-day problems of production, finance etc., the small entrepreneur is unable to provide the most efficient internal managerial organisation.

labour can be classified into technical, non-technical, semi-skilled and so on and the theoretical specification does not indicate which of these should be included. We, therefore, used the ratio of wages paid to skilled technical and non-technical workers to total wage bill as a measure of skill composition. Data for any other break-up was not available.

Maheshwari (1967) also argues that the low level of production in small units denies them the privileges of division of labour. It may, therefore, be expected that as the size of output increases, economies of scale will become significant in defining productivity. Low capacity utilisation, whatever may be the cause, tends to imply a loss in productivity. In an interesting study Rakesh Kumar (1975) provides the case of a firm where productivity increased 7·5 times as a consequence of better capacity utilisation. We measure the index of capacity utilisation by the ratio of fixed assets to total production. The other important factor is the management of raw materials. It has been repeatedly pointed out that wastages in handling of machines and processing lapses resulted in wastage of utilities and excessive inventory, hampering productivity.[4] We have adopted the ratio of cost of raw materials and utilities to total production as a measure of the efficiency in the use of materials. The other dimension of materials management which also impinges on productivity is the risk factor. Most industrial enterprises, especially in the small scale, have been subject to uncertainties of raw material availability, their prices and so on. As in our previous studies, we use the ratio of average variable cost of the current period to that of the previous period as a measure of risk.

Data

Recently, Prasad and Rao (1975) collected primary data from firms producing light engineering goods in Uttar Pradesh for an analysis of their employment potential. The sample exhibited vast differences in technology, structure of inventory, working capital, etc. It was observed that there are three distinct-size classes based on the stock of plant and machinery of the firms. We, accordingly, disaggregated the data into three samples:

4. The latest example of this is Singh and Lakshminarayan (1975).

Sample 1 : Plant and machinery under Rs. 50 thousand.
Sample 2 : Plant and machinery between Rs. 75 thousand & Rs. 2 Lakhs.
Sample 3 : Plant and machinery between Rs. 2 lakhs & Rs. 7·5 lakhs.
Some comparative figures are presented below:

S. No.	Feature	Unit	1	2	3
1.	Number of firms		23	23	15
2.	Capital Intensity	Rs. thousand/worker	2.75	5.75	12 09
3.	AVC_t	Rs / Rs. production	0.64	0.67	0.69
4.	I_t / S_t	Rs./Rs. sales	0.06	0.12	0.10
5.	WC_t / TFA_t	Rs./Rs.	0.68	1.91	0.89
6.	AVC_t / AVC_{t-1}		1.03	1.08	0.98
7.	M_t / Pt	Rs./Rs. production	0.42	0.54	0.59
8.	TFA_t / P_t		0.72	0.55	0.50
9.	$(W_1 + W2)/W$		0.10	0.12	0.08
10.	Prodt.	Rs. thousand/worker	6.29	8.96	12.48

Explanation of symbols used:—
AVC_t =average variable cost; I_t =inventory, S_t = sales; WC_t —working capital; TFA_t = total fixed assets; M_t = materials consumed (raw materials +utilities) W_1 +W2=wages paid to skilled technical and non-technical workers; W =wages paid to all workers, and $Prod_t$ =value added per worker.

It may be noted that there are pronounced differences in productivity, capital intensity, capacity utilisation and efficiency in the use of capacity and materials. These findings are not new with us. In an earlier study on small scale units by NCAER (1973), It was found that labour productivity varies between three thousand rupees and twenty-five thousand rupees.

Empirical Findings

To begin with, consider the results for each of the samples separately. We only present the best regression available.

$$\textit{Sample 1 :}\quad Prod_t = 1.73 + 0.28\,P_t - 2.30\frac{TFA_t}{P_t} + 0.76\frac{TFA_t}{L_t} - 8.34\frac{M_t}{P_t}$$

(6.13) (1.70) (4.59) (2.37)

$\bar{R}^2 = 0.80$ (Numbers in brackets are 't' values)

It is evident from this equation that the size or level of production, capacity utilisation, capital intensity and materials management are the significant determinants of labour productivity. For firms in this sample, economies of scale are significant.

$$\textit{Sample 2 :}\quad Prod_t = 24.62 - 9.59\frac{TFA_t}{P_t} + 0.43\frac{TFA_t}{L_t} - 15.19\frac{M_t}{P_t}$$

(5.35) (3.52) (5.43)

$$+ 341.47\frac{(W_1 + W_2)_t}{W_t} - 9.62\frac{AVC_t}{AVC_{t-1}} \quad \bar{R}^2 = 0.89$$

(2.83) (3.10)

One of the important observations is that the size of these firms is such that the economies of scale are insignificant. Hence, the P_t variable does not appear in this equation any longer. Secondly, the skill composition has bccome an important determinant of productivity, indicating that the degree of sophistication in production is already visible. Thirdly, it appears that firms in sample 2 have grown large enough to experience market risks but at the same time they have not grown sufficiently to have an adequate strategic flexibility.[5] They are as yet quite small to have sufficient internal coordination to absorb the risks.

$$\textit{Sample 3 :}\quad Prod_t = 39.29 - 34.71\frac{TFA_t}{P_t} + 0.47\frac{TFA_t}{L_t} - 42.12\frac{M_t}{P_t}$$

(3.58) (3.33) (3.14)

5. We found this feature of firms in sample 2 even in our earlier studies with this data.

$$+894.50\frac{(W_1 + W_2)_t}{W_t}, \bar{R}^2 = 0.59$$

(2.00)

Note that the only important difference between samples 2 and 3 is that firms in sample 3 have grown large enough to cushion risks associated with acquisition of raw materials, finances, etc. One of the main reasons for this may be the fact that the cost structure tends to be more flexible as firm-size increases. See Basu (1971). On the whole, the following observations are pertinent :

1. Each of the determinants of productivity tends to have a greater marginal influence on it as size of the firm increases. This is reflected in the size of the coefficients of all the variables increasing as we move from sample 1 to sample 3.

2. The smallest firms do experience economies of scale but they have very little or no technological sophistication. An increase in size tends to make the skill composition of paramount importance in determining labour productivity.

3. All three samples indicate that a better utilisation of capital can improve productivity, though to varying degrees perhaps because of the limit set by capital intensity.

4. The increase in the coefficient of Mt/Pt with sample size, in addition to its negative sign throughout, points to the fact that materials management is not improving even with an increase in size of firms.

Conclusion

As stated at the outset, our basic finding is that management of plant and machinery and materials management will have to be improved significantly if we wish to improve the productivity of small firms. Policies should be aimed at improving the raw materials markets and this is especially critical in the case of smaller firms. Far greater dividends are expected from shifting the emphasis to internal managerial structure rather than spend money on providing further technical assistance to the small scale entrepreneur.

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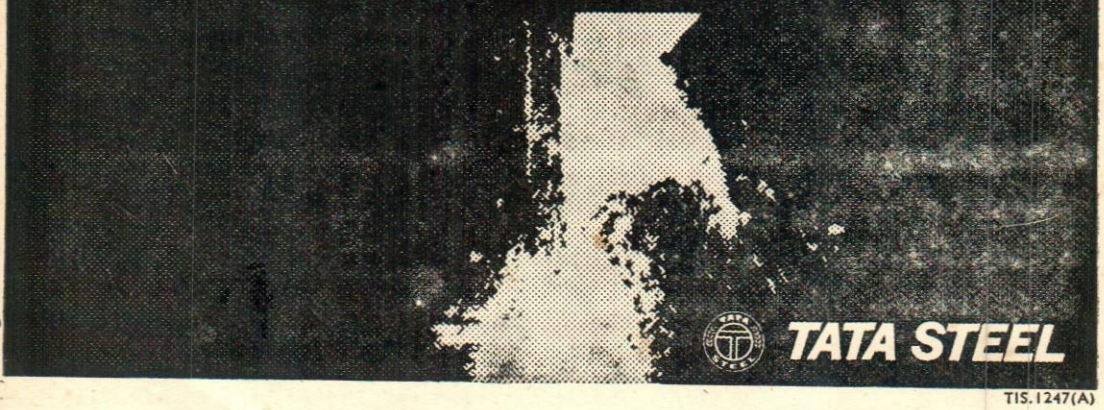

TATA STEEL

TIS.1247(A)

Decomposition of Change in Agricultural Production : A Review

Chandresh K. Srivastava*

Narula—Vidyasagar approach[1] for determining the contribution of area and yield changes to change in production being one of the latest and regarded as an improvement over previous studies needs a fresh look. According to the authors, their methodology is more 'efficacious' than the conventional[2] and Minhas—Vaidyanathan[3] methods, as it removes the 'non-complementarity' in contributions in the conventional models and weight bias in the Minhas—Vaidyanathan model. Since the former study based its analysis mainly on the latter, the approach of the present study will be to critically examine the Narula—Vidyasagar approach in the light of Minhas—Vaidyanathan and conventional models along with the other studies notably—the Economic Survey of Indian Agriculture[4] and the study conducted by Ramamurthy[5].

Review of Past Studies

The conventional model tries to explain the percent change in production of a particular crop between two points of time only through change in area and yield rates, though the authors were aware that the sum of the changes in area and yield was not equal to the change in production.

* The author is a lecturer in Shyamlal College, University of Delhi.

He is thankful to Dr. J. N. Sinha of the Institute of Economic Growth and Shri Prem Lal for the useful discussions he had with them.

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The authors could not establish the equality between the change in production and the factors of change in production.[6]

The Minhas—Vaidyanathan approach tried to measure the changes in the value of crop production for all the forecast crops and also the

6. *Conventional Method*

	Base Year	*'t'th Year*
(i) Area (Hectares)	$=A_o$	$A_t = A_o + \triangle A_o$
(ii) Yield per hectare in tonnes	$=Y_o$	$Y_t = Y_o + \triangle Y_o$
(iii) Production (Tonnes)	$=A_oY_o=P_o$	$A_t\ Y_t = (A_o+\triangle A_o)(Y_o+\triangle Y_o)=P_t$

(iv) Percent change in production in the 't'th year over base year

$$A_t\ Y_t - A_oY_o = 100\ \frac{(P_o+\triangle P_o)-P_o}{P_o}$$

(v) Percentage change in area in 't'th year over the base year $=100(A_t-A_o)+A_o=[100(A_o+\triangle A_o)-A_o]/A_o$

(vi) Percentage change in yield in 't'th year over the base year $=100(Y_t-Y_o)+Y_o=[100(Y_o+\triangle Y_o)-Y_o]/Y_o$

$100\ (P_t - P_o) / P_o$ was interpreted through $100(A_t - A_o) / A_o$ and $100(Y_t - Y_o) / Y_o$

But $100(P_t - P_o) / P_o$ was greater than $\frac{100(A_o+\triangle A_o-A_o)}{A_o} + \frac{100(Y_o+\triangle Y_o-Y_o)}{Y_o}$

After taking the left hand side : $100(\triangle P/P_o)\ 100(\triangle A_oY_o+A_o\triangle Y_o)/A_oY_o$ .....(A)

$$=[(A_o+\triangle A_o)(Y_o+\triangle Y_o)-A_oY_o]=\frac{100(\triangle A_oY_o+A_o\triangle Y_o+\triangle Y_oA_o)}{A_oY_o}>A$$

shares of factors of decomposition.[7] The study brought to light the effect of crop pattern on the changes in production. Also, constant price weights were used to add up the production of heterogeneous crops.

There was yet another method adopted by the Agricultural Ministry in their ESIA, 1966-67 study, and by Ramamurthy too. Here, change in the production of a single crop was decomposed into change due to area,

7. *Minhas—Vaidyanathan Method* :

	Base Year	*Current Year*
(i) Area of the 'i' th crop	A_{io}	A_{it}
(ii) Area of all crops	A_o	A_t
(iii) Yield of 'i' th crop	Y_{io}	Y_{it}
(iv) Cropping pattern of 'i' th crop	C_{io}	C_{it}
(v) Price of crop (constant weight)	W_i	W_i
(vi) Value of production of all crops	$A_o \sum_{i=1}^{n} W_i Y_{io} C_{io} = V_o$	$A_t \sum_{i=1}^{n} W_i Y_{it} C_{it} = V_t$

(vii) Change in the value of production of all crops

$$= V_t - V_o = A_t \Sigma W_i Y_{it} C_{it} - A_o \Sigma W_i Y_{io} C_{io}$$

$$= (A_t - A_o) \Sigma W_i C_{io} Y_{io}$$

$$+ A_t \Sigma W_i C_{io} (Y_{it} - Y_{io})$$

$$+ A_t \Sigma W_i Y_{io} (C_{it} - C_{io})$$

$$+ A_t \Sigma W_i (Y_{it} - Y_{io}) (C_{it} - C_{io})$$

yield and the interaction of change in area and yield respectively.[8] Since this methodology was used for a single crop and the change in production was considered between two successive years, crop pattern was not considered here. Ramamurthy deals simultaneously with four-factor and three-factor decomposition of change in crop production and establishes the equality between change in production and the related factors. He also explains how the shares of the factors of decomposition undergo changes depending on the number of factors of decomposition. For example, the contribution of area will be different in the two sets of decomposition viz., (i) area, yieln and the interaction of area and yield; and (ii) area, yield, cropping pattern and the interaction of yield and cropping pattern.

Narula—Vidyasagar Model

Following Minhas—Vaidyanathan decomposition of change in the value of crop production, Narula—Vidyasagar also studied the change in the production of a single crop only viz., wheat in IADP districts of Ludhiana, Aligarh, Shahabad and Jammu for the period 1966-67 to 1970-71. The

8. ESIA (1966-67) and Ramamurthy's methodology :

$P_o = A_o Y_o$; $P_t = A_t\ Y_t = (A_o + \triangle A_o)\ (Y_o + \triangle Y_o)$

Change in production of a crop in the 't'th year over the base year

$$= \frac{100(P_t - P_o)}{P_o} = \frac{100\ [(A_o + \triangle A_o)\ (Y_o + \triangle Y_o) - A_o Y_o]}{A_o Y_o}$$

$$= \frac{100(A_o Y_o + \triangle A_o Y_o + A_o \triangle Y_o + \triangle A_o \triangle Y_o - A_o Y_o)}{A_o Y_o}$$

$$= 100(\triangle A_o Y_o + \triangle Y_o A_o + \triangle A_o \triangle Y_o)/A_o Y_o \qquad \text{--(B)}$$

After multiplication and division, the terms of 'B' are the shares of area, yield and the interaction of area and yield in the change in crop production. It may be noted here that the interaction term $\triangle A_o\ \triangle Y_o$: (i) will be zero if either of the changes is zero (ii) its magnitude will be high if the changes in them are high or change in either of them is high.

Further, Ramamurthy's study shows the weakness of the traditional method and logically apportions the change in production to area, yield and interaction of area and yield.

Table 1 : Contribution of Area, Yield and Their Inte
(on Variable Base M

Districts		LUDHIANA				ALIGARH		
Year	Change in Production over the previous year	Change in production due to			Change in Production over the previous year	Change in Production due to		
		Area	Yield	Interaction of Area and Yield		Area	Yield	Interaction of Area and Yield
	$\frac{(P_t-P_o)100}{P_o}$	$\frac{(A_t-A_o)100}{A_o}$	$\frac{(Y_t-Y_o)100}{Y_o}$	$\frac{(A_t-A_o)(Y_t-Y_o)100}{A_o Y_o}$	$\frac{(P_t-P_o)100}{P_o}$	$\frac{(A_t-A_o)100}{A_o}$	$\frac{(Y_t-Y_o)100}{Y_o}$	$\frac{(A_t-A_o)(Y_t-Y_o)100}{A_o Y_o}$
1967-68	1065.02	1260.63	(—) 14.38	(—) 181.23	753.64	1091.88	(—) 28.38	(—) 309.86
1968-69	64.86	88.09	(—) 12.35	(—) 10.88	41.60	53.16	(—) 7.55	(—) 4.01
1969-70	2.36	15.73	(—) 11.55	(—) 1.82	31.52	15.59	13.78	2.15
1970-71	7.62	1.79	5.73	0.10	34.19	16.47	14.35	2.37

Table 2 : Contribution of Area, Yield and Their Inte
(on Fixed Base

1967-68	1065.02	1260.63	(—) 14.38	(—) 181.25	753.64	1091.88	(—) 28.38	(—) 309.86
1968-69	1820.80	2459.26	(—) 24.95	(—) 613.51	1108.76	1725.47	(—) 33.78	(—) 582.93
1969-70	1866.33	2861.95	(—) 33.62	(—) 962.00	1489.71	2010.10	(—) 24.66	(—) 495.73
1970-71	2016.30	2915.09	(—) 29.81	(—) 868.98	2017.17	2357.58	(—) 13.85	(—) 326.56

raction to Change in Production
ethod)

	SHAHABAD				JAMMU		
Change in Production over the previous year	*Change in production due to*			*Change in Production over the previous year*	*Change in production due to*		
	Area	*Yield*	*Interaction of Area and Yield*		*Area*	*Yield*	*Interaction of Area and Yield*
$\frac{(P_t-P_o)100}{P_o}$	$\frac{(A_t-A_o)100}{A_o}$	$\frac{(Y_t-Y_o)100}{Y_o}$	$\frac{(A_t-A_o)(Y_t-Y_o)100}{A_o Y_o}$	$\frac{(P_t-P_o)100}{P_o A_o}$	$\frac{(A_t-A_o)100}{A_o}$	$\frac{(Y_t-Y_o)100}{Y_o}$	$\frac{(A_t-A_o)(Y_t-Y_o)100}{A_o Y_o}$
696.87	631.63	8.92	56.32	—	—	—	—
27.10	14.99	10 53	1.58	14.99	12.17	2.51	0.31
4.50	15.43	(—) 9.52	(—) 1.41	( ) 20.52	(—) 4.28	(—) 17.16	0 93
12.64	0.32	12.28	0.04	165.42	103.89	30.18	31.35

raction to Change in Production
Method)

Base : 1966-67

696.87	631.63	8.92	56.32	—	—	—	—
922.78	741.30	20.38	151.09	14.99	12.17	2.51	0.31
957.72	871.12	8.92	77.68	(—) 8.83	7.36	(—) 15.08	(—) 1.11
1091.28	874.12	22.29	194.87	141.99	118.89	10.55	12.55

change in production has been decomposed into contributions of area and yield only. Though they were able to establish the mathematical equality for a single crop case, yet their approach to have yielded erroneous results.

The Narula—Vidyasagar study[9] deduces the following for a change in the production of a single crop, from Minhas--Vaidyanathan's study:

$$P_t - P_o = (Y_t - Y_o)\ A_t + (A_t - A_o)\ Y_o$$

Where change in yield receives the weight of current year area and change in area receives the weight of base year yield.

The term $(Y_t - Y_o)A_t$ is not the effect of change in yield alone, area remaining constant, to call it a yield effect. The term measures the effecet of change in yield over the area containing the change in itsslf. The term $(A_t - A_o)\ Y_o$ can rightly be termed as an area effect. As the sum of $(Y_t - Y_o)\ A_t$ and $(A_t - A_o)\ Y_o$ is equal to $(P_t - P_o)$ in the model, Narula and Vidyasagar's concern was that in the Minhas—Vaidyanathan model damage is being done in suppressing the importance of yield increases in favour of acreage expansion. But it is clear that Minhas and Vaidyanathan do not plead that gains in production are more due to acreage expansion than the spurt in yield and that they do not give any preferential treatment to change in area.

We shall now critically examine the methods used in the Narula—Vidyasagar model. We substitute the values $(P_o + \triangle P_o)$ for P_t, $(Y_o + \triangle Y_o)$ for Y_t and $(A_o + \triangle A_o)$ for A_t. The Minhas—Vidyanathan model as used by Narula and Vidyasagar, then takes the following form :

$$[(P_o + \triangle P_o) - P_o] = [(Y_o + \triangle Y_o) - Y_o]\ (A_o + \triangle A_o) + [(A_o + \triangle A_o) - A_o]\ (Y_o)$$

$$\therefore \triangle P = \triangle Y_o A_o + \triangle Y_o \triangle A_o + \triangle A_o Y_o$$

Rearranging them as $\triangle A_o Y_o + \triangle Y_o A_o + \triangle A_o \triangle Y_o$

9. The study uses average yield ($\bar{Y}$) and not yield per acre (Y). Such mean values have not been used for area. The justification for using such mean values has not been given in the study. Yield figures are, no doubt, obtained on a sample basis, while area figures by complete enumeration method, but use of *average yields* is not clear. For our purpose such averages have been avoided.

these indicate (i) share of area, (ii) share of yield and (iii) share of interaction of changes in area and yield in the change in production.

Even the alternative method considered by Narula and Vidyasagar, i.e., $P_t - P_o = (Y_t - Y_o) A_o + (A_t - A_o) Y_t$ will also yield similar results as shown above.

Substituting again the values of Y_t and A_t in the equation, we get,

$$P_t - P_o = [(Y_o + \triangle Y_o) - Y_o](A_o) + [(A_o + \triangle A_o) - A_o][Y_o + \triangle Y_o]$$

$$= (\triangle Y_o) A_o + \triangle A_o (Y_o + \triangle Y_o)$$

$$= \triangle Y_o A_o + \triangle A_o Y_o + \triangle A_o \triangle Y_o$$

= share of yield + share of area + share of interaction of area and yield.

Since similar objections regarding weights would hold in this method also, Narula and Vidyasagar suggested yet another method to reduce the biases of weights which, according to them, given the 'best' method —'the least bias method'. This method, which uses A_w and Y_w in place of A_o and Y_t used in the alternative method when worked out after substituting the values for A_w and Y_w, shows nothing more than the fact that $P_t - P_o = A_t Y_t - A_o Y_o$. Here again, using such weights, Narula and Vidya Sagar have not been able to provide anything new.

Following the methodology used by ESIA and Ramamurthy, if we substitute the values in the 'least bias' equation, we get

$$P_t - P_o = (Y_t - Y_o) \frac{A_t + A_o}{2} + (A_t - A_o) \frac{(Y_t + Y_o)}{2}$$

$$= \frac{[(Y_o + \Delta Y_o) - Y_o][(A_o + \Delta A_o) + A_o] + [(A_o + \Delta A_o) - A_o][(Y_o + \Delta Y_o) + Y_o]}{2}$$

$$= \frac{(\triangle Y_o)(2A_o + \triangle A_o) + (\triangle A_o)(2Y_o + \triangle Y_o)}{2}$$

$$= \triangle A_o Y_o + \triangle Y_o A_o + \triangle A_o \triangle Y_o$$

= Share of area + Share of yield + Share of interaction of area and yield.

Even the 'least bias estimate with variable base' used by Narula and Vidyasagar, which obtains various contribution from the identity.

$$P_t - P_{t-1} = \frac{(Y_t - Y_{t-1})(A_t + A_{t-1})}{2} + \frac{(A_t - A_{t-1})(Y_t + Y_{t-1})}{2}$$

also yields nothing more than what is given by the least bias equation as seen below :

$$P_t - P_{t-1} = [(A_t - Y_t - A_t Y_{t-1}) + (A_{t-1} Y_t - A_{t-1} Y_{t-1})]/2$$

$$= 2(A_t Y_t - A_{t-1} Y_{t-1})/2$$

$$= A_t Y_t - A_{t-1} Y_{t-1}$$

Nothing new seems to be discernible from this scheme of decomposition also.

Again in their own methodology, Narula and Vidyasagar have defined the contribution of area and yield to change in crop production in the following manner :

1. Contribution of Yield :

(a) $\dfrac{100(Y_t - Y_o) A_o}{P_t - P_o}$

(b) $$\frac{100(Y_t - Y_o)A_t}{P_t - P_o}$$

(c) $$\frac{100(Y_t - Y_o)A_w}{P_t - P_o}$$

2. *Contribution of Area :*

(a) $$\frac{100(A_t - A_o)Y_o}{P_t - P_o}$$

(b) $$\frac{100(A_t - A_o)Y_t}{P_t - P_o}$$

(c) $$\frac{100(A_t - A_o)Y_w}{P_t - P_o}$$

where $A_w = \frac{A_t + A_o}{2}$ and $Y_w = \frac{Y_t + Y_o}{2}$

From (1) and (2) we can have nine sets of combinations of area and yield to change in production. However, we present three sets namely, [1(a)+2(a)]; [1(b)+2(b)]; and [1(c)+2(c)]. These sets, after substituting the values for A_t and Y_t would be :

(i) $$\frac{100(Y_t - Y_o)A_o}{P_t - P_o} + \frac{100(A_t - A_o)Y_o}{P_t - P_o}$$

$$= \frac{100(\triangle Y_o A_o)}{\triangle P_o} + \frac{100(\triangle A_o Y_o)}{\triangle P_o}$$

$$= \frac{100}{\triangle P_o}(\Delta Y_o A_o + \Delta A_o Y_o)$$

Here, the sum is not equal to the sum of all the factors of decomposition as it excludes the values of the interaction of area and yield.

(ii) $$\frac{100(Y_t - Y_o)A_t}{P_t - P_o} + \frac{100(A_t - A_o)Y_t}{P_t - P_o}$$

$$= \frac{[(\triangle Y_o)\ (A_o + \triangle A_o) + (\triangle A_o)(Y_o + \triangle Y_o)]100}{P_o}$$

$$= \frac{[\Delta Y_o A_o + \Delta A_o \Delta Y_o + \Delta A_o Y_o + \Delta A_o \Delta Y_o]100}{P_o}$$

The sum of these factors in this case would be more than 100 percent which is meaningless.

(iii) $$\frac{100(A_t - A_o)A_w}{P_t - P_o} + \frac{100(Y_t - Y_o)Y_w}{P_t - P_o}$$

Substituting first the values for A_w and Y_w we get

$$\frac{100(Y_t - Y_o)(A_t + A_o)}{2(P_t - P_o)} + \frac{100(A_t - A_o)(Y_t + Y_o)}{2(P_t - P_o)}$$

$$= 100/2\triangle P_o[A_t\ Y_t - A_t\ Y_o + A_o Y_t - Y_o A_o + A_t\ Y_t - A_o Y_t + A_t\ Y_o - A_o Y_o]$$

$$= 100/2\Delta P_o[2A_t\ Y_t - 2A_o Y_o]$$

$$= 100/\Delta P_o\ [A_t\ Y_t - A_o Y_e]$$

Now substituting the values for A_t and Y_t in the above equation, we get

$$100/\triangle P_o\ [(A_o + \triangle A_o)\ (Y_o + \triangle Y_o) - A_o Y_o]$$

$$= 100/\triangle P_o\ [\triangle A_o Y_o + \triangle Y_o A_o + \triangle A_o \triangle Y_o]$$

= Percentage contribution of area + percentage contribution of yield + percentage contribution of interaction of area and yield changes.

The decomposition terms of the change in production are correct in the last set, but turn out to be the same as given in ESIA report and Rama-

murthy's study. In all the studies where 'weights' are used, they are based on some economic logic but no such economic logic is given in Narula—Vidya Sagar study. And unless such weights are backed by economic logic, they cease to be meaningful.

Estimates presented in tables 1 and 2 based on the data provided by Narula and Vidya Sagar and on the methodology used in ESIA report and Ramamurthy's study show that the contribution of interaction component is positive and large in some cases. This component, though difficult to interpret, is not altogether barren of interpretative significance. Moreover, for all practical purposes, one cannot neglect its contribution if the values of its contribution are large.[10] The results of our analysis prove that as the values of the interaction component turns out to be non-negligible the term cannot be ignored in the models.

Conclusions

(i) Narula—Vidyasagar approach, as seen earlier, does not examine fully the existing literature.

(ii) Depending on the number of factors of decomposition of production, the values of the factors change. In the three-factor decomposition scheme 'area effect' is not the same as the 'area effect' seen in the case of four-factor decomposition scheme. This point has been illustrated in Ramamurthy's study.

(iii) If we consider change in the production of all crops and its der composition, Minhas—Vaidyanathan approach of either four-facto-decomposition model or the seven-factor model serves the purpose For all crops whose production is homogeneous and so additive,. crop production need not be considered in value terms and the absolute production will serve the purpose. Only when we consider crops whose production cannot be added, we have to consider the value of crop production as it gives the 'additive' property to the crops.

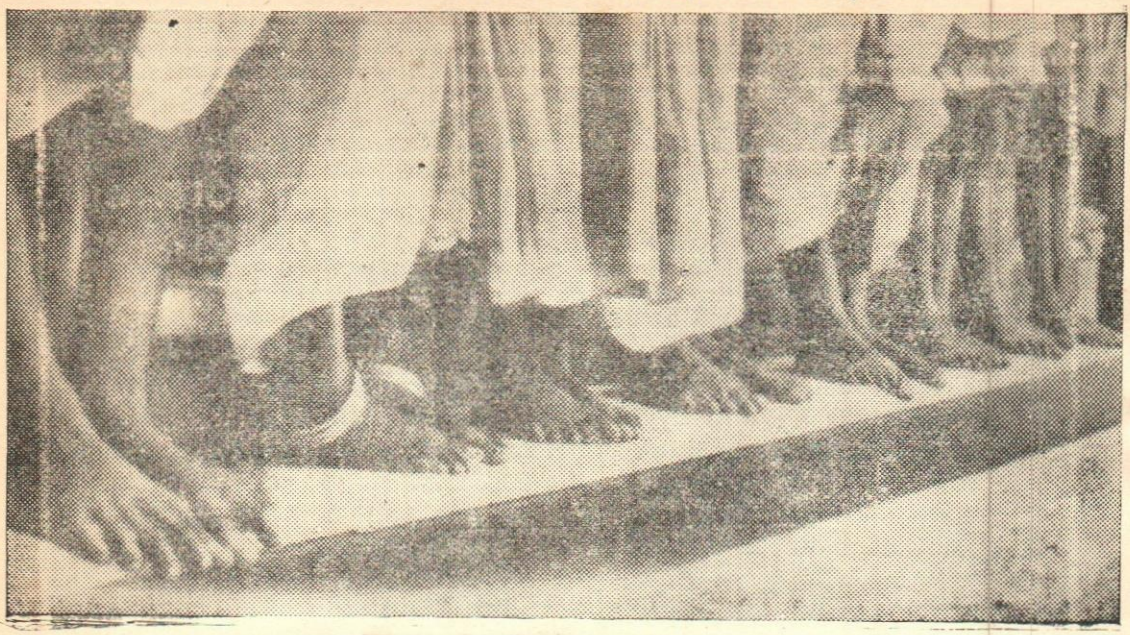
(iv) In the case of change in a single crop, the three-factor decomposition of change in crop production, i. e. change of area, change of

10. Minhas-Vaidyanathan, *op. cit.*, p. 235.

yield and the interaction of changes of area and yield is the best among the decomposition schemes we have.

(v) The decomposition factors of Narula—Vidyasagar methodology, when analysed properly, turn out to be the same three factors as seen in the case of ESIA and Ramamurthy, i. e., area effect, yield effect and interaction effect of area and yield. So the analysis of Narula—Vidyasagar does not add anything new to the existing knowledge on the subject.

In India Tomas Bata saw these feet—calloused and hurt by numerous injuries.



The Battle against Bare Feet

About half a century ago, the founder of our company Tomas Bata noted our country's need for mass-produced footwear to clothe and protect millions of bare feet.

Today, we commemorate the hundredth year of Tomas Bata's birth, and keep on producing shoes that are priced within the reach of the millions.

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Productivity, Human Capital Intensity and Stages of Economic Development

Autar Dhesi*

One of the notable impacts of technical progress is on the occupational structure of the labour force with a gradual shift from professions with low skills to professions with high skills. Since it is accompanied by an increase in the number of sophisticated machines in the economy and there is a corresponding hierarchical structure of machines determined by the degree of mechanisation, a similar quantitative and qualitative upward shift in the skill profile of the labour force can be expected. In other words, the magnitude and distribution of human capital is likely to be highly correlated with the structure and the level of development of an economy.[1]

Model

$$X = f(l_1, l_2 \ldots l_n, K) \qquad (I)$$

where

X = Output;

$\sum_{i=1}^{n} l_i = L$ = total labour and l_i denotes the amount of labour of skill category i;

K = capital stock

Production function (I) is assumed to be homogeneous of degree one and can be rewritten as

$$\frac{X}{L} = f\left(\frac{l_1}{L}, \frac{l_2}{L}, \ldots\ldots \frac{l_n}{L}, \frac{K}{L}\right) \qquad (II)$$

Defining $w = \frac{X}{L}$, $k = \frac{K}{L}$,

h(human capital intensity $= \Sigma \gamma_j \frac{l_j}{L}$

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The author thanks D. Liggins, University of Birmingham and S. Gomulka of London School of Economics for their comments and suggestions.

1. Human capital is defined as the 'creative capacity' of man as compared to his physical power, and this capacity, it is assumed, can be enhanced within the framework of the formal educational system as well as outside it.

where $0 \leq \gamma_j \leq 1$, all j

Eq. (II) becomes $w = f(h, k)$ (III)

Differentiating (III) with respect to time

$$\frac{dw}{dt} = \dot{w}, \quad \frac{dh}{dt} = \dot{h}, \quad \frac{dk}{dt} = \dot{k}, \text{ (IV) becomes}$$

$$\dot{w} = \frac{\partial w}{\partial h}\dot{h} + \frac{\partial w}{\partial k}\dot{k} \qquad (V)$$

which can be rewritten as

$$\frac{\dot{w}}{w} = \frac{\partial w}{\partial h} \cdot \frac{h}{w} \cdot \frac{\dot{h}}{h} + \frac{\partial w}{\partial k} \cdot \frac{k}{w} \cdot \frac{\dot{k}}{k} \qquad (VI)$$

Now $\alpha = \frac{\partial w}{\partial h} \cdot \frac{k}{w}$

$=$Elasticity of productivity with respect to human capital intensity.

and $\beta = \frac{\partial w}{\partial k} \cdot \frac{k}{w}$

$=$Elasticity of productivity with respect to physical capital intensity.

By substituting α and β into (VI) we obtain

$$\frac{\dot{w}}{w} = \alpha \frac{\dot{h}}{h} + \beta \frac{\dot{k}}{k} \qquad (VII)$$

In discrete terms (VII) can be rewritten as

$$\frac{\Delta w}{w} = \alpha \frac{\Delta h}{h} + \beta \frac{\Delta k}{k} \qquad (VIII)$$

Some empirical studies have shown the existence of strong multicollinearity between indicators of human and physical capital intensity.[2] Therefore, *a priori*, we expect that most of the variation in w will be explained by the variable h,

$$\text{i.e.,} \quad \frac{\Delta w}{w} = \alpha \frac{\Delta h}{h}$$

For lack of adequate time-series data, we used cross-country data and tested instead, $\Delta w = \alpha \Delta h$ where

$$\Delta h = \sum_{j=1}^{n} \gamma_j \frac{\Delta I}{L}$$

Variables used in Regression Analysis

X_0 = Professional, technical and related workers

X_1 = Administrative, executive and managerial workers

X_2 = Clerical workers

X_3 = Sales workers

X_4 = All others

H_0 = Harbison's composite index of human resources development[3]. It is the arithmetic total of (i) enrolment at second level of education as a percentage of the age-group 15—19 adjusted for length of schooling (ii) enrolment at the third level (higher) education as a percentage of the age-group 20—24 muitiplied by a weight of 5.

2. (a) H. Correa : *The Economics of Human Resources,* Netherlands Economic Institute, Rotherdam, 1962.

   (b) Vladimir Stoikov : *Productivity and the Quality of the Labour Force,* British Journal of Industrial Relations, Vol. 6, 1968.
   Effect of multi-collinearity on the estimated coefficients is as follows :

   $k = ch$ where c is a constant, $w = f(h, k) = hf(I, c) = ch = \frac{c \sum \gamma_j I_j}{L}$

3. Frederick Harbison and C. A. Myers : *Education, Manpower and Economic Growth,* McGraw-Hill, 1964.

Table 1: Results of Regression Analysis[4]

			X_o	X_1	X_2	X_3	X_4	R^2	$\bar{R}^2$	N	D W.
1.	w	18.28	3.4 (0.87)	6.8 (0.81)	1.04 (0.82)	0.23 (0.86)	0.07 (0.55)	0.993	0.985	14	2.3
2.	w	−9.85	3.3 (0.73)	6.7 (0 85)	−1.06 (0.82)			0.993	0.985	14	2.2
3.	w	−1299.05	539.46 (86.238)					0.875	0.875	14	1.99
4.	ln w	5.164	0.243 (0.059)	0.088 (.09)	0.03 (0.05)			0.997	0.889	14	1.29
5.	ln w	5.156	3.3139 (0.03693)					0.926	0.926	14	1.3
			$\ln X_o$	$\ln X_1$	$\ln X_2$			R^2	$\bar{R}^2$		
6.	ln w	4.18	1.37 (0.33)	0 23 (0.24)	0.276 (0.365)			0.998	0.919	14	1.99
				$X'=(X_o+X_1)$							
7.	w	−1337.07		392.356 (25.72)				0.975	0.975	14	1.6
8.	ln w	5.327		0.206 (0.023)				0 932	0.932	14	1.6
			X_o	X_1							
9.	ln w	5.777	0.202 (0.174)	0.362 (0.513)				0.914	0.908	18	2.099
10.		5.913		0.2588 (0.0415)				0.84	0.842	18	2.23
				$X'=(X_o+X_1)$							
11.		5.807		0.214 (0.019)				0.912	0.912	18	2.02
				H_o							
12.	w	−294.974		28.769 (5.344)				0.841	0.841	14	1.255
13.	ln w	6.05244		6.01296 (0.00393)				0.689	0.689	14	0.703

4. Regressions from 1—8 are based on data in Table II and from 9—11 on data in table III.

Table 2 : Occupational Structure of the Labour Force and Output per Worker by Country

Country	Year	*Productivity in U.S. $*	X_0	X_1	X_2	X_3	X_4	*Total*
U.S.A.	1960	7,080	10.8	8.3	13.3	8.9	58.7	100
Canada	1961	5,120	9.7	6.3	12.9	8.9	62.1	100
Sweden	1960	3,410	11.6	2.0	8.5	9.5	68.4	100
Norway	1960	2,930	8.1	3.2	7.0	7.6	74.2	100
France	1961	2,820	9.7	2.0	7.1	9.1	72.2	100
U.K.	1961	2,670	8 7	2.7	13.1	9.8	65.3	100
Costa Rica	1963	1,090	5 2	1.3	5.2	8.0	80.2	100
Greece	1961	890	4.0	0.5	3 6	9.8	82.1	100
Peru	1961	740	3 7	1.3	3.3	7.7	84.0	100
Japan	1960	730	4.9	2.3	10.4	10.4	71.8	100
Portugal	1960	660	2.8	1.3	4 5	6.4	85.0	100
Egypt	1960	520	3 2	1.1	3.7	8.2	83.9	109
Korea (Rep, of)	1962	250	2.4	1.3	2.6	8 3	85.5	100
India	1961	160	2.8	0.6	1.6	4 2	90.8	100

Sources : I.L.O. Year Books, U.N. Statistical Year Books.

Table 3 :

Country	*Year*	*Productivity in U.S. $*		X_0	X_1	X_2	X_3	X_4	*Total*
U.S.A.	(1970)	10,959	(1970)	13.2	9.8	16.6	5.9	53.4	100
Canada	(1970)	9,028	(1970)	13.3	9.2	14.2	6.4	54.9	100
Sweden	(1965)	6,629	(1967)	15.3	2.2	9.5	9.3	63.7	100
Switzerland	(1965)	5,015	(1967)	8.9	1.2	13.6	6.8	69.5	100
Denmark	(1965)	4,871	(1967)	9.5	1.6	28.7	8.2	59.5	100
New Zealand	(1966)	4,859	(1967)	10.2	5.9	13.7	8.2	62.0	100
Australia	(1966)	4,847	(1967)	9.3	6.3	14.7	7.7	62.0	100
U. K.	(1966)	3,907	(1967)	9.6	3.1	13.7	9.6	64.0	100
Italy	(1965)	3,309	(1967)	5.3	8.0	11.6	24.8	51.3	100
Ireland	(1966)	2,603	(1967)	7.8	1.3	8.1	9.8	73.0	100
Japan	(1965)	2,059	(1967)	5.5	2.9	12.8	11.6	67.0	100
Libya	(1964)	1,503	(1963)	3.1	1.4	4.8	6.0	84.7	100
Algeria	(1966)	1,111	(1965)	3.4	0.8	3.5	4.5	88.5	100
Iran	(1966)	871	(1967)	2.7	6.1	2.1	6.7	87.8	100
Philippines	(1965)	808	(1967)	3.3	3.2	3.1	6.1	84.3	100
Rep. of Korea	(1966)	497	(1967)	2.6	0.8	3.9	9.8	82.9	100
Pakistan	(1968)	363	(1967)	1.8	0.4	1.3	7.4	89.1	100
Nigeria	(1963)	209	(1963)	2.4	0.2	1.2	15.3	81.9	100

Sources : I.L.O. Year Books, U.N. Statistical Year Books.

Results of regression analysis in Table 1 confirm our hypothesis that there is a significant positive correlation between productivity and human capital intensity and that human capital is mainly embodied in higher professions. Only the coefficients for the first two categories of labour are significant in the linear case and for the first category of labour in the non-linear case. The combined share of the first two categories in the total labour force (X′) performed better as an index of human capital intensity than Harbison's composite index of human resource development. This is probably because Harbison's index accounts for human capital produced only through the educational system. Though there is a strong relationship between occupational and educational profiles of the labour force, recent empirical evidence suggests that entry into various occupations should be considered independently of the variations in years of schooling.[5] The persons who enter into professions with qualifications lower than the average will absorb additional knowledge on the job. Therefore, our indicator encompasses human capital generated on the job as well as that produced through the formal institutions.

Moreover, our index is also a good indicator of effective investment of human capital (it means effective utilisation) while Harbison's index is merely concerned with its production and it does not take into account the fact that due to political and other social reasons, the educational level of the labour force in a society may change in excess of that which is necessary to keep pace with the skill requirements of jobs.[6] In the latter situation, there is a likelihood of redundant human capital in the society. For policy purposes, changes in occupational structure are likely to provide a better index of human capital intensity required at various stages of economic development.

Human Capital Intensity Vis-a-vis Economic Development

Harbison *et al* made a pioneering attempt at constructing various quantitative indicators of human resource development and highlighted a number of conceptual problems.[7] As pointed out by them, there are two basic types of indicators : (a) those which measure a country's stock of

5. Anne Mayhew : *Education, Occupation and Earnings:* Industrial and Labour Relations Review, Vol. 29, No. 2, January, 1971.
6. R Collins : *Functional and Conflict Theories of Educational Stratification in B. R. Cosin* (Ed) : *Education : Structure And Society*, Penguins, 1972.
7. F. Harbison and C.A. Myers : Op. Cit.

human capital, and (b) those which measure the additions to this stock. The first category indicates the level of human resouce development which has been achieved by a country and the second one its rate of human capital formation and its improvement. In both cases, a further distinction is made between those indicators which will be regarded as ideal if data were available and the 'second best' for which data is available.

Ideal Indicators

(1) Levels of Educational Attainment.

(2) The number of persons in relation to the population or labour force, who are in high level occupations.

Second Best Indicators

1. Number of teachers (first and second level) per 10,000 population.

2. Engineers and scientists per 10,000 population.

3. Physicians and dentists per 10,000 population.

4. Pupils enrolled at first-level (primary) education as a percentage of the estimated population aged 5 to 14 inclusive.

5. The adjusted school enrolment ratios for first and second levels combined.

6. Pupils enrolled at second-level education as a percentage of the estimated population aged 15 to 19 inclusive adjusted for length of schooling.

7. Enrolment in third-level (higher) education as a percentage of the age group 20–24.

They found that a composite index based on the last two indicators gave the highest correlation with indicators of the level of development. Obviously, it ignores the human capital production outside the formal educational system. Secondly, it is inadequate if one is interested in approximating the intensity of human capital required at a given level of development as it merely indicates the supply of human capital and not the demand for it.[8]

Additional Index of Human Capital Intensity

It is similar to the second 'ideal' index of Harbison *et al* based on relative shares of the following two categories of workers in the labour force i. e., (i) Professional, technical and related workers, and (ii) Administrative, executive and managerial skills.[9] We have been encouraged to construct this index after finding a high correlation between productivity and these two categories of labour for two sample size belonging to two different periods.

Choice of Countries and Grouping

The choice of countries in the sample was influenced by the availability of data and the effort to have a sample fairly spread on the economic development range. However, the grouping by the level of human capital intensity was arbitrary except keeping in mind the size of each group.

Methodology

First, we regressed productivity (w) on the first two categories of labour using cross-country data :

$$\ln w = 5.777 + 0.202X_0 + 0.361X_1$$

$$(0.174) \quad (0.0513)$$

T. Value 5.77 3.402

$$R^2 = 0.914, \ \bar{R}^2 = 0.908, \ D.W. = 2.099$$

8. One can construct another index of stock of human capital based on expenditure on education, training on the job adjusted for earnings foregone.

9. These are the first two of the five categories according to which I.L.O. classifies labour force.

The predicted values of $I_n w$ from the above equation were regressed on X_o and X_1 to give

$$I_n w = 5.777 + 0.20184X_o + 0.17518X_1$$

	(.00018)	(.00025)
T value	1143.115	701.115

$R^2 = 1.0$, $\bar{R}^2 = 1.0$

Standard error of estimate adjusted for DiF=0·003.

The net (partial) regression coefficients (b's) are simply weights expressing the relative influence of the independent variable. The actual comparative importance of each independent variable was obtained by converting the b's into beta coefficients which recognise the dissimilarity of the units of variables and their variances. Beta coefficients (βs) can be shown as the straight-forward regression coefficients of the standardised variables[10].

$$\beta_i = \frac{b_i \ \delta X_i}{\delta w'}$$

	Standard deviation δ
w'	1.291
X_o	4.592
X_1	3.2215

indicator	*Beta Coefficient*	*Percent of Total weight of Betas*
X_o	0.717	61.9
X_1	0.440	38.1

The index of human capital intensity (H) is calculated by using the following relationship for 39 countries*

$$(0.717X_o + 0.44X_1) \times 1000$$

10. (i) A. Goldberger : *Econometric Theory*, pp. 197–8.

(ii) Ajmer Singh : *The Local Business Activity Index : Its Construction and Uses*, Journal of Regional Science, Vol. 7, Summer 1967, No. 1.

*For countries in the sample and groups, values of Index see Appendix I.

Relationship between Our Index of Human Capital Intensity (H_i) and Indices of Economic Development.

Table 4

	H_i	Y_1	Y_2
H_i	1.0	0,9175	—0.8464
Y_1		1.0	—0.7484
Y_2			1·0

Correlation Matrix

H_i = Index of Human Capital Intensity as constructed above
Y_1 = G.N.P. per capita
Y_2 = Percentage of total labour in agriculture

$$H_i = 378.864 + 0.249Y_1 - 3.753Y_2$$
$$(0.03) \quad (0.823)$$
$$t \quad 8.117 \quad -4.56$$

D.W. = 1.609, N = 39, $R^2 = 0.949$, $\bar{R}^2 = 0.947$

The Use of Harbison's Composite Index (H_b) gave the following results :

Table 5

	H_b	Y_1	Y_2
H_b	1.0	0,784259	—0.62478
Y_1		1.0	—0.7799
Y_2			1.0

Correlation Matrix

$$H_b = 20.58826 + 0.06084Y_1 - 0.0744Y_2$$
$$(0.0159 \quad 0.04418)$$

$R^2 = 0.785$, $\bar{R}^2 = 0{\cdot}775$
N = 28, D.W. = 1.795

Table 6 : Indicators of Human Capital Intensity and Economic Development

No. of Countries	11	10	9	9	39
Group	I	II	III	IV	$\frac{IV}{I}$
H_i	154.4	270.8	407.2	672.1	4.35
Y_1	156.82	314.4	543.45	1319.9	8.4
Y_2	63.52	45.53	31.0	16.66	0.262

Table 7 : Arithmetic Means by Level of Human Capital Intensity

No. of Countries	8	12	8	28
Level	I	II & III	IV	$\frac{IV}{I}$
H_b	30.187	35.96	115.57	3.8
Y_1	152.12	359.58	1380.5	9.06
Y_2	62.775	42.77	15.89	0.253

Significant Statistical Relationships

There is a very high positive correlation between H_i and G. N. P. per capita (0.91) and a high negative correlation between H_i and the percentage of labour force engaged in agriculture (—0.84) as expected. These values are higher than those given by the relationship between H_b and the indicators of level of development in our sample (see table 5) as well as those calculated by Harbison[11]. The data in table 6 shows that H_i in the average country from group I to group IV increases half as fast as G. N. P. per capita. Apparently, the result seems to be contrary to what Harbison *et al* found. Their calculations showed that the composite index

11. Harbison *et al* (op.cit) found a positive correlation between composite index of human resource development (H_b) and G.N.P. per capita (0.888) and a negative correlation between H_b and the percentage of active population engaged in agriculture equal to—0.814. Their sample size was 75 countries.

increases 3 times as fast as G.N.P. per capita from level I to level IV. This anomaly can be explained probably by the differences in sample sizes and the grouping of these countries. This view seems to have support in results obtained by using H_b and a smaller number of countries (see table 7). Alternatively, one may try to explain the different results in terms of conceptual divergences in the construction of the two indices. Harbison's composite index deals with production of human capital including the part which may never be used as well as the element of consumption of human capital, whereas our index is mainly concerned with human capital which is effectively utilised or invested.

The data also indicates that the highest rates of human capital intensity should be made in levels I and III in contrast to Harbison's results which indicate these in levels I and II.

These differences in emphasis which these two indices imply at different levels of development may arise due to differences in sample sizes and the element of arbitrariness in grouping the countries. But we can put forward some plausible economic arguments to explain our results. In group I, countries embarking on the road of development start almost from scratch. Programmes of universal primary education, public health and other public works which are prerequisites for initiating the process of development will create a rapid increase in demand for human capital. However, there is no inherent reason why this should continue increasing at the same rate except if these countries try to develop their own technology. For countries at level II, the technological gap is wide enough to depend on imported technology almost completely rather than create their own. But in group III, an average country may find difficulties in acquiring the required technology abroad such that it may have to create its own which may explain an increased rate of human capital intensity in this group. The difficulties in acquiring technology may arise due to donor's reluctance to disclose technical know-how to potential competitors. Generally, technically advanced firms are more willing to disclose technical know-how to less-sophisticated partners in developing countries than they are to industrially advanced firms, which may eventually become serious commercial rivals in third markets.[12] Transfer of technology among industrially advanced partners does take place but usually on a reciprocal basis.

12. Jack Baranson : *Technology Transfer Through the International Firm*, A.E.R., Papers and Proceedings, May, 1970.

Appendix I

H_i = Index of Human Resource Development as developed in this paper

H_b = Harbison's composite Index of Human Resource Development

Y_1 = G. N. P. per capita

Y_2 = % of labour in agriculture

Country	H_i	H_b	Y_2	Y_1
Thailand (1960)	88.9	35.1	82.0	94 (1963)
Angola (1960)	89.52		69.0	170 (1963)
Pakistan (1961)	101	25.2	75.0	78 (1960)
Liberia (1962)	130.47	4.1	80.9	164 (1963)
India (1961)	143.33	35.2	72.9	70 (1960)
Ghana (1960)	155.23	23.15	58.0	182 (1960)
Syria (1960)	159.04		46.6	203 (1963)
South Korea (1961)	179.04	55.0	52.6	146 (1960)
Morocco (1960)	189.99		56.3	135 (1960)
Malaysia (1957)	227.61	23.65	57.5	356 (1958)
U.A.R. (1960)	233.8	40.1	56.6	127 (1960)
Level I				
Greece (1961)	237.13	48.5	53.9	440 (1961)
Jamaica (1960)	248.09	26.8	36.1	363 (1960)
Guyana (1960)	248.09		34.2	265 (1960)
Mexico (1960)	257.64	33.0	54.2	315 (1960)
Peru (1961)	261.42	30.2	49.7	191 (1960)
South Africa (1960)	268.56	40.0	29.5	387 (1960)
Cyprus (1960)	282.39		40.3	496 (1960)
Paraguay (1960)	287.86	22.7	54.7	149 (1960)
Spain (1960)	291.89	39.6	41.3	317 (1960)
Dominican Republic (1960)	324.76	14.5	61.4	221 (1960)
Level II				

Country	H_i	H_b	Y_2	Y_1
Brazil (1960)	355.72	20.9	44.2	90 (1960)
Panama (1960)	358.56		46.2	349 (1960)
Italy (1961)	367.6	56.8	28.3	738 (1961)
Barbados (1960)	370.47		24.3	330 (1960)
Chile (1960)	375.7	51.2	27.7	245 (1960)
Venezuela (1961)	385.94	47.3	32.3	859 (1960)
Brunei (1960)	478.55		33.5	973 (1963)
Iceland (1960)	479.98		22.9	616 (1960)
Trinidad (1961)	509.98		19.9	691 (1960)
Level III				
Argentina (1960)	532.34	82.0	17.8	531 (1963)
Austria (1961)	554.27		22.8	835 (1961)
Finland (1960)	568.54	88.7	35.5	1001 (1960)
W. Germany (1961)	580.54	85.8	13.4	
Belgium (1961)	594.26	123.6	7.2	1126 (1960)
Norway (1960)	617.12	73.6	19.5	1093 (1960)
France (1962)	682.4	707.8	15.1	1570 (1963)
Canada (1961)	949.51	101.6	12.1	1870 (1960)
U.S.A. (1960)	969.51	261.3	6.5	2559 (1960)
Level IV				

Sources : U.N. Statistical Year Books, I.L.O. Year Books, Harbison *et al*, op. cit.

Ergonomics : Its Impact on Productivity

P. V. Kulkarni*

Importance of human factor in production need not be overemphasised. Even automation cannot by itself reduce significance of human factor in production, though it may imply a switchover from unskilled to skilled labour component. Ergonomics plays vital role in enhancing productivity. It maximises the output potential of labour component. Impact of ergonomics on productivity is indeed significant and it would be interesting and worthwhile studying it in detail.

What is Ergonomics ?

Ergonomics is primarily a research discipline. It is a relatively new science which has developed from biological sciences.[1] E. F. L. Erech defines ergonomics as a scientific study of relationship between man and his working environment and a convenient grouping of relevent research in independent disciplines of functional anatomy, applied human physiology and applied psychology.[2] J. A. Larkin considers it to be an inter-disciplinary science involving functional anatomy, anthropometry, physiology, physics and engineering which provide information that cannot be ignored by work study personnel.[3] He further observes that this sphere of scientific research explores demands that can arise from working environment and capacities of peoples to meet these demands.[4]

The International Labour Office defines ergonomics as an application of human biological sciences in conjunction with engineering sciences to worker and his working environment so as to obtain maximum satisfac-

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1. Alan Fields, "*Method Study*", Cassell Management Studies, London, 1969, p. 97.
2. *Op. Cit*, "*The Principles and Practice of Management*", London, 1966, p. 604.
3. *Op. Cit*, "*Work Study, Theory and Practice*", New Delhi, p. 13.
4. *Ibid.*, p. 12

tion for worker which, at the same time, would enhance productivity.[5] This definition seems to be more interesting, as it lays emphasis on operator satisfaction. It contributes that productivity must follow as essential corollary to operator satisfaction. Sir Wilfrid Le Gros Clark observes that man and machine may be regarded as a functional unit of industry and the aim of ergonomics is perfection of this unit so as to promote accuracy and speed of operation and ensure minimum fatigue. It is towards this end that physiologists, psychologists, anatomists, engineers and bio-metricians are converging their attention.[6] J. D. Radford and D. B. Richardson consider ergonomics as something associated with work study which brings out relationship of man to his work and environment.[7] They further observe that it is a study of relationship of people and their working environment.[8]

Thus, ergonomics is, in essence, a non-manufacturing function. Nevertheless, it sets out relationship of man to his working environment. It is true that, left to itself, it does not produce anything. However, if properly exploited as an indispensable function in industry, it is capable of producing significant results.

From this point of view, ergonomics has largely arrested the attention of method study experts. Ergonomics can be split up into two words—"ergo" meaning work and "nomos" meaning natural laws. As such, it is popular for its laws relating to work. It is extensively and widely adopted in industrial management and occupies a definite place in industry particularly in advancing patterns of business administration. It is that dimension of work study technique which aims at fitting the work to man and motivating man to work. The intention behind application of this technique is to get the "whole" man out of him. It follows, therefore, that work environment requires to be re-adjusted so as to suit him and meet his physical and mental capacities and limitations.

It may also be recalled here that ergonomics, with a more resounding title, is different more in name than in substance or approach from early

5. Cited by Krish Pennathur in *"Method Study"*, National Productivity Council, New Delhi, 1967. p. 24.
6. Quoted by S. Dalela in *"Elements of Work Study"*, Delhi, 1971, p. 279.
7. *Op. Cit*, *"The Management of Production"*, London, 1972, p. 8.
8. *Ibid*, p. 127.

studies of impact of nature and environment on man's capacity to work.[9] It would be absurd to suggest that, before the term ergonomics was coined, those engaged in the organisation of human work were unaware of basic disciplines in these biological sciences. On the contrary, many of the principles can be classified as "common sense" rather than as part of scientific discipline.[10] Krish Pennathur also observes that birth of separate discipline under a distinct name does not signify that knowledge pertaining to that field did not exist before. What obtains now is the concept of a combined approach by specialists in these fields. With the need for full-time research, ergonomics has merely led to the evolution of a new scientific discipline.[11]

It would not serve much purpose to go into controversy about the origin of ergonomics. If we carefully probe into F. W. Taylor's scientific management, we find that ergonomics has been duly considered and applied in shop management, although this terminology was till then not in vogue. Taylor's warning to the employer not to subordinate man to machine or overburden worker with initiative, as also to the worker not to segregate his interest from that of the employer were but an indirect expression for ergonomic considerations. By a clear-cut departmentation of operational areas to foremen, by separating planning from doing and by prescribing incentives for wage payment, Taylor encouraged workers to concentrate on production instead of bothering over other things. He thus provided, in what may be called "his sermons" the necessary adjuncts to man-machine responsibility and enhanced productivity.

Thus, basically the earliest application of ergonomics in a systematic manner can be traced to F. W. Taylor. Many of his experiments, however, were primarily conducted for developing the optimum design of equipment for specific types of work. The later advance was made by the enunciation of principles of motion economy by Frank Gilbreth. Advances in experimental physiology, psychology and method study have made possible detailed investigation of the human body and mind to work.[12]

9. E. F. L. Brech *et al*, *Op. Cit*, p. 604.
10. *Ibid.*
11. *Op. Cit.*, p, 23.
12. Krish Pennathur, *Op. Cit.*. p. 24.

Moreover, as a combined discipline blended out of basic information from specialised faculties like anatomy, anthropometry, physiology, psychology and so on, it is relied upon as thorough and realistic. Anatomy highlights on body structure, anthropology on body size and physiology on body functioning. Psychology, at their apex, explains an overall nervous system and interprets into the dictums of human behaviour.

It shoud be remembered that the scope of ergonomics is more comprehensive than the study of plant layout problems. It uses a systems approach and considers operator, machine, work place and environment as an integrated system.[13] It covers anthropometry to measure man's physical dimensions, determines his physical, aural and visual capabilities and limitations, measures influence of autonomic nerves and kinaesthetic senses on his ability to work and to receive and process information from his environment.[14] Anthropometry helps ergonomists to find out the area of the easiest reach for the operator.

Alan Fields discovers that the range of clearest vision covers an angle of 30° on each side of centre line at right angles to the eyes and of 10° above and 45° below eye level.[15] The kinaesthetic sense which the operator develops enables him to carry out blind positioning movements.[16] Ergonomics is a systematic research with which techniques of functional anatomy and physiology are applied to physical problems of human work and those of psychology to mental problems of work and a study of environmental conditions is undertaken.[17]

The various streamlines entering ergonomics make it so enriched that they enforce its acceptance for an entire range of human activities. Krish Pennathur observes that ergonomics is applicable at home, on land, on the high seas, in the air and even in the space. It is the promoter of the catalyst work study which activates in the management a restless urge to improve.[18] Ergonomics as a research discipline probably resembles scientific management of F. W. Taylor which suggests that its funda-

13. Alan Fields, *Op. Cit.*, p. 97.
14. *Ibid.* p. 98.
15. *Ibid.* p. 101.
16. *Ibid.* p. 104.
17. E.F.L. Brech & Others, *Op. Cit.*, p. 605.
18. *Op. Cit.* p. 27.

mental principles are applicable extensively to all kinds of human activities ranging from our simplest individual acts to the work of great corporations and can be applied with force to all social activities.[19] Ergonomics enfolds a study of immediate and general working environments. Even organisational matters like measurement of enegy expenditure, fatigue, inspection etc., can also be duly reckoned with under ergonomic considerations.[20]

Man-Machine Relationship

Ergonomics is also known as "human engineering". It adapts work environment to human body as a component in effective work accomplishment by placing all machine controls within operator's normal reach working area such as letting him sit on the job, using mechanised handling on and between processing points, eliminating job safety hazards and making sure that overall conditions are good.[21]

Man works with machine, developing understanding for the latter. Man-machine system is the function unit of industry and ergonomics strives hard to build up an integrated work unit. Machine designed layout, ability and motivation of man, physical factory environment, psychological human complexes, etc., do have a positive interaction in determining man-machine relationship. Extreme heat or cold, poor lighting, excessive noise and vibration, inaccessible machine controls, prolonged muscular contractions and, above all, psychological stresses and strains are good instances of "have-nots" in administering man-machine harmony. Psychological environments easily override physical environments and greater productivity is obtainable from a happy group of workers working under deplorable conditions than could be obtained from an unhappy group working in near-perfect conditions.[22]

Conflicting relationship between man and machine may invite fatigue, accident hazards, machine breakdowns, prolonged production runs, production losses, sacrificing customer service standards, loss of cus-

19. *Op. Cit*, "*Scientific Management*", London, 1964, in "*The Principles of Scientific Management*", pp. 7-8.
20. Alan Fields. *Op. Cit.* p. 98.
21. H. N. Broom, "*Production Management*," Richard D. Irwin-Inc., p. 384.
22. J. D. Radford & D. B. Richardson, *Op. Cit*, p. 130.

tomer goodwill and so on and may even provoke situations of indutrial unrest. Machines and working conditions must be adjusted to capacities and health requirement of human body. Unhealthy stresses in forces to be exerted and postures to be taken put a heavy premium on effort and vigilance. J. A. Larkin observed that an ill-adjusted man-machine environment situation results in losses caused by industrial fatigue, industrial disabilities, accidental deaths etc.[23]

In this connection, it will be appropriate to recall the observations of Leon C. Megginson. While explaining how men and machines are complementary, he discovered that machines serve men as tools and as production systems. Use of unmanned machines as complete production system poses a difficult problem. Human support for machines is essential, until machines are more-nearly perfected than at present. Some members of the human race will have to be used and wlll continue to be needed. Machines are merely adjuncts to people. They are still a means to an end rather than an end in themselves.[24] When man uses machine, he and the machine form a control loop. Man receives information, processes it and takes necessary action with controls, until the required result has been achieved.[25]

In the design and development of any particular system, it is necessary to optimise man, machine, task as a whole or as an integrated part of the system with proper co-ordination to product itself.[25] In the context of exploding technological revolution, Leon C. Megginson observed that it is important to understand relationship between new technological revolution and culture in which it is occurring. Both are immediate and powerful determinants of human behaviour. Man must adjust to this new environment, just as he has been forced to adopt himself to changes in other physical and social environments of the past. Those who cannot make orderly adjustment may not survive. New organisational relationships and different motivational techniques will be required to satisfy changed relationship resulting from sense of insecurity, isolation and centralisation.[27]

23. *Op. Cit.* pp. 12-13.
24. *Op. Cit.* "*Personnel : A Behavioural Approach to Administration*", Homewood, Illinois, 1967, pp. 133-34.
25. J. D. Radford & D. B. Richardson, *Op. Cit.* p. 128.
26. S. Dalela, *Op. Cit.*, p. 280.
27. *Op. Cit.* pp. 35-36.

As machines become more complex, it is more necessary to think of operator and machine as parts of one unit whose combined effectiveness is dependant on each individual and on interaction of each upon the other. Operator and machine must perform as a closed loop system.[28] Ergonomists have carried out studies on ability of various types of instrument displays to convey information accurately to the user and on designs of controls which enable operator to use equipment without error so that, together, operator, machine, its information display and controls would form an integrated whole.[29] In this connection, it will be worthwhile to draw attention to the "Cranfield man" of the ergonomic laboratory of the College of Aeronautics, Cranfield. The Cranfield man with specific height, shoulder width, elbow height and arm span is found to be particularly suitable to operate lathes from a central position.[30]

In an ergonomic investigation of a work system, an analysis is based upon check-lists following a broad classification like attitude and aptitude, human characteristics, working condition and environment.[31] Work place must enable smooth performance of a job. Gilberth gave a set of rules under "principles of motion economy", whereas Ralph M. Barnes gave a few characteristics of easy movements. Range of movement, area of easy vision, maximum lifting capcity of men and their effect on position of machine controls could thus be calculated.[32] However, the work of Gilberth and his successors is only a particular aspect of ergonomics.[33] A work study officer has to examine process chart critically so as to know a group of therbligs with characteristics which, when incorporated in methods adopted, make for easier working.

Research in ergonomics indicates that principles of minimum, simultaneous, symmetrical, natural, rhythmical, habitual and continuous movements are reasonably well-founded, provided they are accepted with certain qualifications.[34] A work study man must know practical ergonomics.[35]

28. Alan Fields, *Op. Cit.* p. 101.
29. *Ibid.* pp. 107-108.
30. *Ibid.* pp, 98-99.
31. For a detailed discussion of check-lists, consult Krish Pennathur, *Op, Cit.* p. 26.
32. Alan Fields, *Op. Cit.* p. 97.
33. *Ibid.* p. 98.
34. J. A. Larkin, *Op. Cit.* p. 82.
35. For a detailed discussion, *Ibid.* pp. 81-83.

One specialised form of charting multiple activities is man-machine chart. Two columns of therbligs are plotted to a common time scale, one concerning machine and the other concerning man's activities, thereby showing relationship between operator activity and machine or equipment utilisation, when a task is dependent on both operator and machine.[36]

A Scientific Discipline

Importance of ergonomics as scientific discipline is growing with mechanisation as indispensable strategy for survival. A more capable, versatile and complex equipment has emerged as essential corollary to technological advances. However, for its effective performance, human element will have to be matched with machine element. Ergonomics may be described as a double edged tool. At one edge remains maximum human satisfaction and, at the other, enhanced productivity. Both edges are sharpened by each other. Contribution of ergonomics is of direct significance to industry in cutting out optimum working methods. Production engineer and work study expert are main beneficiaries of this discipline.

Distinction between ergonomics and work study is arbitrary and one of degree. In no sense are they contradictory.[37] While work study aims at moral and material betterment of each individual and, therefore, of the community, ergonomics provides facts for evaluation of the means of making this aim a live reality.[38] Both work study and ergonomics are concerned with fitting job to worker.[39] Ergonomics approaches problems from opposite direction to that of work study. It argues that machines and workplaces should be designed around capabilities of man. Work study solution to problems of human efforts is likely to be sub-optimisation of the ergonomic answer.[40]

It will be interesting to recall here the observations of Keith Davis who discovered that one way of reducing man's dislike for assembly lines and

36. *Ibid* p. 79
37. E.F.L. Brech and others, *Op. Cit.* p. 605.
38. Krish Pennathur, *Op. Cit.*. p. 27.
39. J. A. Larkin, *Op. Cit.*, p. 13.
40. Alan Fields, *Op. Cit.*, p. 97.

other machine operations is ergonomics. There was a time when ergonomics meant to many persons a synonym for "human relations" Finally, it was recognised that people cannot be engineered and the term was restricted to mean a design and a way out of equipment and processes to make machine and man a more integrated work unit. This helps operator and machine work together with less human fatigue, error and conflict.[41]

"Human Engineering" in man-machine system was developed as one of the programmes by industrial psychologists during the second World War.[42] This is a well-conceived research discipline which has been immensely made use of in western corporations. It appears, however, that Indian corporations have not as yet been attracted to it in a large measure. The reasons, therefore, can be traced to a peculiar situation obtaining in the country, in as much as use of versatile, complex, highly-sophisticated equipment is restricted to handfull of industrial units. However, to present an onslaught of strikes, lockouts, lay-offs, etc., it is necessary to provide new dimension to problems of industrial relations. The apparent economic discontent behind the outbreak of industrial unrest with big corporations may perhaps be a sick man in disguise and the real reasons for such a phenomenon may not be far to seek. Under the circumstances, it will be worthwhile undertaking a searching analysis of ergonomic considerations, which will, in all probability, enable our managements to reach the principal object of maximum prosperity for employer and employee which is supposed to be the most cherished goal of scientific management. From this specific point of view, it is high time we develop ergonomic techniques in our country so as to enhance our productivity and help accomplish our national goals.

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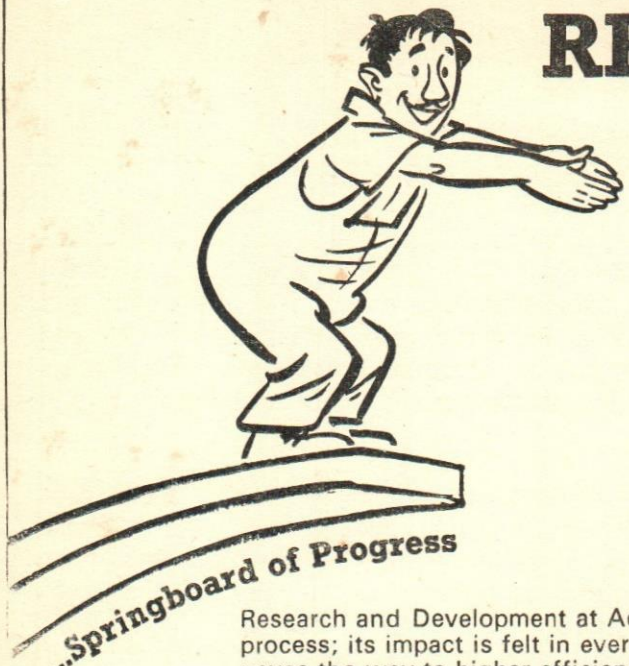
41. *Op. Cit.* "*Human Relations at Work*, "*The Dynamics of Organisational Behaviour,*" Delhi, 1967, p. 460.

42. Leon C. Megginson, *Op. Cit.* pp. 44-45.

RESEARCH



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Productivity Enlargement in Jobbing and Mixed Quantity Production by Group Technology

Narendra Nangea* **Ravi Choudry*** **Om Nangia****

Group Technology (GT) can be simply defined as "the logical arrangement and sequence of all facets of company operation in order to bring benefits of mass production techniques to jobbing or mixed quantity production and obtain greater productivity". Originally the concept of group technology was conceived by some of the industrial units in U.K. by grouping a few components and machines to overcome specific problems on the shop floor and thereby getting greater production from machines. However, the most modern concept of group technology is to implement it to the entire system, i.e., from system to individual components rather than moving from individual machines and components to entire system. Significant benefits in terms of higher productivity can be achieved through the application of the modern concept of group technology.

Group technology is no more a piece-meal subject or practice. To be effective, it must be concerned with all facets of business. It can be said that Group Technology is perhaps the only management technique which embraces all other known management techniques.

Need for Group Technology

Following are some of the advantages of group technology that can accrue to various industrial units specially those working on jobbing production :

(i) GT provides for total integration of effort in conformity with a plan and a well-defined way of carrying out that plan, and hence create an environment that brings out latent talents that remain unknown otherwise.

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(ii) It creates facilities for providing accurate information for delivery dates and to keep those dates.

(iii) It provides a coded system for identification of all parts, assemblies and products.

(iv) It reduces stocks and work-in-progress to a minimum.

(v) It institutes tight control on all materials movement and recording.

(vi) It facilitates the shortest through-put times from receipt of orders to despatch.

(vii) It reduces cost of jigs and fixtures.

(viii) It reduces manufacturing cycle to almost fifty percent.

(ix) It minimises the resetting time in machine shop.

(x) With the application of group technology, production is based purely on the sales forecast, and not on Economic order quantity.

Methodology

The first step in the implementation of group technology is to classify, code and group each product, piece part, commodity and raw material.

Even without being aware of classification and coding, almost all manufacturing units have some method of identification of the products, piece parts, commodities and raw materials. These methods consist of identifiying each component or product either by full description in words or by numbers. These methods may be satisfactory for a factory manufacturing a few product but for a large factory, identification becomes rather difficult as the raw materials, products, piece parts commodities increase beyond controllable numbers. For any new product which is demanded by the consumers, drawings are made, specifications listed and product given new numerical number or description for identification. It also means making new planning and operation sheets, patterns, core boxes, tools, jigs & fixtures, gauges, stores space, and relevant records in practically all departments of the factory.

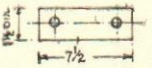
The idea of an alternative system for classification and coding was thus conceived, taking into consideration the above requirements. This system was of significant number i.e., coding and classification.

The code can be understood as simply a symbol representing an element in a pre-conceived systematic plan. Their classification provides means for a methodical concept of grouping them by their similarities and separating them by their differences. For example, in any factory engaged in production, classification could be done as under :-

(a)	Ideas	—Class 0
(b)	Materials	—Class I
(c)	Commodities—	
	(i) manufactured items not to design	—Class II
	(ii) components to design	—Class III
	(iii) product to design	—Class IV
(d)	Tools	—Class V
(e)	Machines	—Class VI
(f)	Building, services	—Class VII
(g)	Scrap	—Class VIII

It also becomes necessary that each part, product, raw material and commodity has a unique drawing having a unique significant number composed of classification and coding. The natural result is the rationalisation of components, products, etc. Hence by simple changes in one or more piece parts and commodities, a new component could be manufactured or a new drawing made to accommodate specifications of two or more parts. This would lead to a great deal of parts being combined and thus reducing the total number of items.

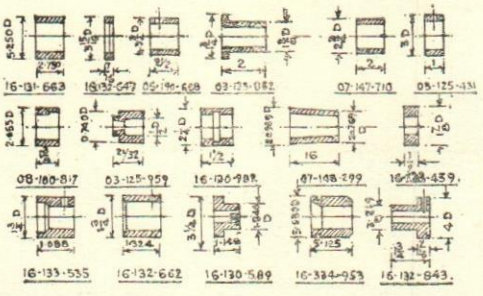
No fresh drawings need then be made until and unless reference is made to those already existing in order to determine whether an existing drawing could be used or a small modification made. This would avoid duplication and savings of a considerable amount of work in various departments of an organisation. A typical example of similar items having different nomenclature and numbers and dissimillar items covered under same name is given in Fig. 1



NAME	DRAWING NUMBER
POST BRAKE PIN	07-46-679.
PLAIN PIN (DRILLED)	71-017-618.
DRAW HEAD PIN.	67-145-750.
SHEAVE PIN.	07-150-116.
LOWER PIVOT PIN	07-131-662.
PLAIN PIN	71-017-875.
LATCH PIN	16-132-814.
LEVER PIN	03-124-385.
HINGE PIN	03-124-712.
PIVOT PIN	03-123-117.
PIN	03-124-980.
ROD PIN	16-130-303.
CLEVIS PIN	16-135-647.
PELLETIZER PAN PIN	07-149-231.
CABLE COUPLING SHAFT.	07-149-704.
FULCRUM PIN	16-132-813.

SIMILAR ITEMS HAVING DIFFERENT NAMES AND NUMBERS

SLEEVES.



DISSIMILAR PARTS CONCEALED UNDER A COMMON NAME.

Fig. 1

As stated above, the first task in planning and implementation of GT is to determine which of the following methods will be most useful for grouping components. The various methods are given as under :

(a) Family formation of components based on rule-of-thumb.

(b) Family formation based on universal component classification i.e., Opitz system.

(c) Family formation based on tailor-made component classification (monocode) including additional tailor-made production feature information (Polycode) i.e. Brisch System.

(d) Production flow analysis as expounded by Professor J.L. Burbidge.

(e) Four-Digit Code from Czechoslovakia.

The above methods of family formation except the code from Czechoslovakia have been physically implemented in various industries in U. K. and these methods have been analysed by researchers. They have examined the selective merits, deficiencies in ideas and concepts of various methods. The explanation of each method and its merits and defieiencies are discussed in the following paragraphs.

Family Formation Based on Rule-of-Thumb

This method of family formation is based on rule-of-thumb by having local product knowledge being produced in a factory. This method can be employed by young junior managers to classify components which are being manufactured by a section of machine shop he is working in. No doubt, he will be able to achieve greater output from some machines in the short run by rule-of-thumb in a hope to sell GT to higher management. But this method has little or no impact on total company operation. On the contrary it might even prevent top management from moving towards an overall approach, because they could believe that GT has already been established. This method may, therefore, be used to overcome some specific problems on the shop floor but should be discounted if an overall approach is to be made to the introduction of GT.

Opitz System

This system uses universal component classification as created by Professor *Opitz* at Aachen. This system maintains that in all engineering factories the percentage of round parts to non-round parts is roughly similar irrespective of what its products are. This system looks at the geometry of a component rather more from the point of view of the way it will be manufactured. This system was created not keeping in mind the group technology. It was used in analysis of a large number of components to find the capacities of machine tools which logically should be most in demand.

One merit of Opitz system is near independent significance of each

digit which makes it easier to learn and simplifies the section of families out of a long list of component codes. Hence the classification in Opitz system is carried out by members or employees of the company who interpret pre-determined rules.

It is normally felt that Opitz system of classification cost nothing or is inexpensive as compared to the costly Brisch system which will be discussed later. However, it is a mixed blessing in the sense that though it is cheaper and easier, a company could get into trouble with an inexperienced attempt at applying it. Also the fact that investment in personnel required to code by this method does cost something.

Brisch System

This method or system of component classification is a tailor-made approach as represented by Professor Brisch. The philosophy behind this system is that the products and, therefore, the components of every engineering company are often quite different. This means that component classification should be designed to cater specifically for each factory. This classification is known as Mono-code. It is essentially design-orientated. It brings together in a group all the components which are similar in shape, material, and size or else have similar functions. This system achieves component variety reduction in the design office. Since it is tailor-made for individual applications, there is no reason why it should not be found eminently suited for GT.

One advantage of Brisch system is that in addition to geometry defining Mono-code, there can be any number of additional production feature code known as Polycode for specifying size, range, surface finish, type of screw thread, and so on, so that with sufficient digits, parts with various types of common characteristics can be brought together. In application of Brisch system, a consultant has got to be called to examine the company, its general and specific requirements, and analyse a sample of currently-produced components to evolve classification and codes that fulfil the requirements. The analytical stages are carried out by the consultant who acquaints the representative of the company with the rules of classification so that when he leaves, classification can continue to progressively embrace all components being produced by the factory or company. This system is certainly costlier than the Opitz system.

Production Flow Analysis

A different technique to classify the components for GT was conceived by Professor Burbidge. It is known as production flow analysis. In this classification system, the components are classified by using their production planning sheets instead of their drawings. Classification thus involves bringing together in one list all components that take same route, or part of the same route through the factory or go through the same machine tools in the same order. This method of production flow analysis in its pure form has not been used as yet by any factory.

Four-Digit Code from Czechoslovakia

In recent years, considerable work has been done in Czech research establishments on machined components work-piece statistics. As a result, Research Institute for Engineering Technology and Economics (VUSTE) in Prague has developed a four-digit code. (See Fig. 2.) This code has the following advantages :

(a) Complete shape of component is given in one sheet.

(b) Due to its construction and use of illustrations, it is easy to understand.

(c) Adequate scope is allowed for further specialisation and expansion.

(d) Although the code is intended for machined parts, it can also be used for press work.

How to Use the Code

(a) *Part type :* The first digit is read across the top of the diagram and covers 6 types of parts like rotational with centre, without centre, flat or curved sheet, etc., which can be easliy seen and understood from the diagram.

(b) *Part class :* It is read down the diagram in the respective column depending upon the first digit classification.

(c) *Part Group :* This can be read at the bottom of the diagram in 3 and 4 digits.

BASIC GEOMETRIC SHAPE CODE

PART TYPE	ROTATIONAL: WITHOUT HOLE ON AXIS (1)	ROTATIONAL: WITH HOLE ON AXIS (2)	SHEETS & SECTIONS: FLAT ($\frac{H}{8} < \frac{1}{2}$) (3)	SHEETS & SECTIONS: BENT (4)	SOLIDS (INITIAL CLASS: BASE 'Z' ARM 'R' BASE 'Z' BORE $\frac{H}{8} > \frac{1}{2}$ PROJECTION) (5)	SOLIDS (6)
0	WITHOUT SHAPE		+LIMITED VARIATIONS	SHEETS 1 BEND	'R' + 'O'	PRISM-LIKE
1	ONE SIDED SHAPE		+LIMITED CURVES	2 BEND	'O' ∥ TO 'Z'	FLAT $\frac{H}{8} < \frac{1}{2}$
2	TWO SIDED SHAPE		+LIMITED VARIATION & CURVES	3 OR MORE BENDS	'O' ⊥ TO 'Z'	FRAME-LIKE
3	SHAPED FROM MIDDLE		FULL SECTIONS	1 BEND	'O' ∥ & ⊥ TO 'Z'	Z + 7 'S'
4	COMBINATION OF 1 & 3		OPEN THIN WALL SEC.	2 BENDS	'O' ≠ TO 'Z'	Z + 2 OR 3 'S'
5	WITH CURVED SURFACE		CLOSED THIN WALL SEC.	3 OR MORE BENDS	'Z' TO R	Z + 4 'S'
6	COMBINED WITH SIMPLE NON ROTATIONAL SHAPES			COILS - SPRINGS	BRANCHED 'R' ⊥ TO EACH OTHER	Z + MULTIPLE 'S'
7	ECCENTRICS			HOLLOWS REGULAR	BRANCHED OTHERS	
8				IRREGULAR		
9						

PART GROUP

0	1	2	3
NO FEATURE	GEAR & SPLINES	THREADS	GROOVES & SLOT
1+2	→	→	
1+3	→		→
2+3		→	→
1+2+3	→	→	→

0	1	2	3	
NO FEATURES	PLAIN HOLES	FLATS	OPENING INTO FACE	
1+2	→	→		4
1+3	→		→	5
2+3		→	→	6
1+2+3	→	→	→	7

TYPE 2 1 43
CLASS 1 1
GROUP 1

TYPE 1 55
CLASS 1 8
GROUP 1 31

Two Total Approaches to GT

As per modern concept of total approach towards GT, there are just two approaches which, at least in so far as a full range of components are concerned, are consistent. These are Brisch system having information by monocode along with polycode and production flow analysis.

Formation of Cell

Once on the basis of the above classification and coding methods, component families have been formed, construction of cells is further necessitated. The cell constituents are the following :

(a) Number of machine tools

(b) Plants and equipment

(c) Number of operators

(d) Labour

The construction of cell is like organising orchestra pieces of music with varying arrangement. The cell should, however, be flexible as regards number of machines and operators employed and consequently requires flexibility of labour according to variations in product-mix and quantities required. The above constituents of a cell already exist in a factory; the only need is to rearrange the necessary items into individual cells by placing the required plant alongside conveyors for easy flow of the piece parts between machines. For example, let us say we have selected a family of 100 parts to be manufactured in a cell. The cell should be so constructed that it caters for complete range of items. The simple one may take only 3 or 4 operations, while the more complex ones may take 7 to 10 operations. It may be borne in mind that although maximum number of operations may be 10, but number of machines required may be 13 or 14. This will, of course, depend upon the number of split operations to be carried out in order to balance all the operations involved as far as possible.

Evaluation in Relation with Conventional Jobbing Production

Most of us are quite familiar with conventional method of jobbing production. However, a comparison of jobbing production and with the application of GT is discussed in the succeeding paragraphs, bringing out advantages, by refering to examples, wherever possible.

Layout :

The layout of a machine shop will be considerably different from conventional layout where all similar types of machines are installed together in one place say, lathes, milling machines, drilling machines, etc., all placed type-wise together in a conventional layout. Obviously the routes to be followed by items will be exceptionally longer and time-consuming, whereas in a cell layout, as explained earlier, various types of machines required for manufacturing a family of items will be grouped together irrespective of types of machines involved. Hence, the movement of items or piece parts under construction would follow the shortest route and the time consumed in movement of the item from one machine to another would be almost negligible as compared to conventional layout. This itself would considerably reduce the production time of item in Cell type of layout.

The conventional layout demands wide gangways and ample space for at least two containers at each machine, whereas cell layout being very compact would require only one container at the begining of the cell and the other at the end. Hence space required in cell-type layout is much less.

Fig. 3 indicates the conventional layout of machine shop and a few routes to be followed. It can be seen that long and time-consuming routes are to be followed by the items under manufacture which are avoided in the case of a cell layout.

Manufacture Concept

It has been stated above that manufacturing time can be reduced to half as compared to conventional batch or jobbing production. Similarly there are other advantages already discussed in a cell-type production using GT. Let us take an example of say 200 piece parts which have

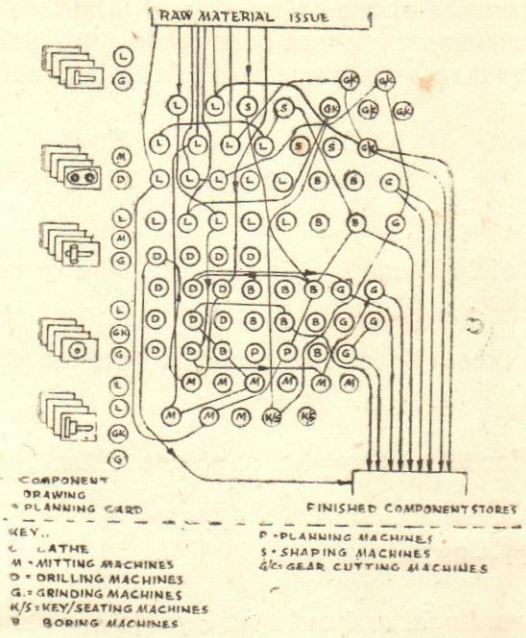


Fig 3

been grouped together using any one of the methods, viz., Brisch, Opitz, etc. since they have somewhat similar shapes and require a large number of common operations.

From the past experience and old operations sheet of each of the 200 items which have been grouped together in one family, we know the number of operations required and time required for each operation and in case of doubt these could be cross checked with current practice and updated records.

Assuming that we take a batch of 100 to be manufactured by GT method out of a family of 200 items selected above, we already know the throughput time of each operation. Let us also take that each piece part or item requires on the average 7 operations, each taking 3 minutes. The total time required by conventional method is :

$$\text{Total time} = \text{batch qty} \times \text{No of operations} \times \text{time}$$
$$= 100 \times 7 \times 3 = 2100 \text{ minutes}$$

It will be seen from the above calculation of total time that time required in materials movement has not been taken into account whereas in actual practice it takes quite some time with a conventional layout.

No 1	No 2	No 3	No 4	No 5	No 6	No 7
3 mts	3 mts	3 mts	3 mts	3 mts	3 mts	3 mts Stores

The same batch of 100 under GT and cell-type production would take total time as under :

First piece time = No of operations × time for each
$= 7 \times 3 = 21$ mts

Total time for 99 pieces = No of pieces × Max. time of an operation
$= 99 \times 3 = 297$

Total $= 21 + 297 = 318$ mts

The conventional and cell type layouts are shown in Fig. 4

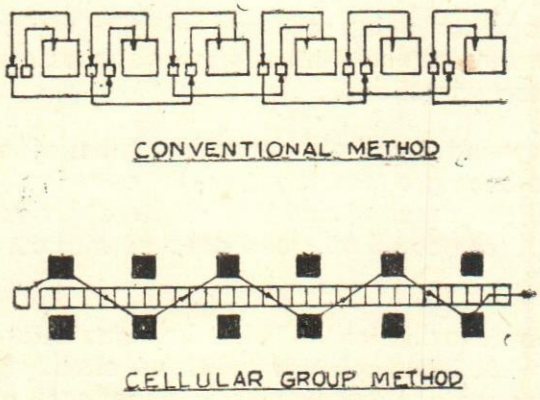


Fig. 4

In this method of cell-type production, it will be seen that first piece part would take 21 mts but the balance 99 parts would take only 3 mts per piece because as the first piece has finished the 7th operation the next piece has finished the 6th operation and is ready for the 7th operation.

In the conventional method, all pieces first undergo the 1st operation and then are fed to next machine for the 2nd operation. From the above example of simple production, the ratio of total throughput time is approximately 7 : 1 between cell and conventional method, even though we have neglected the time consumed for material movement in conventional production method.

The above time of 318 mts assumes that there are 7 operations each working on a machine. If the targets laid out by the marketing division allow some additional allowance of time, i.e., more production time, the operators could be reduced to half and increasing time for each piece by 6 mts as against 3 mts.

The above example was taken of a simple piece part and to illustrate how throughput time in cell-type production is reduced substantially. Let us now take an example of a most complex piece part of the family requiring ten different operations with timings for each operation as under :

Operation No	1	2	3	4	5	6	7	8	9	10
Time reqd. (mts) for each	2	7	5	4	9	11	6	3	2	7

Total time required by conventional method
for batch of 100 piece parts is : $100 \times 56 = 5600$ mts.

Time required by cell-method is : $1 \times 56 = 56$ mts for first piece

$$99 \times 11 = \frac{999 \text{ mts.}}{1055 \text{ mts.}}$$

The time for balance 99 each piece part is 11 mts as it is the maximum operational time and, therefore, controls the rate of output of balance 99 piece parts and, thus the throughput time is reduced by approximately 5 times even without taking into consideration the time required for materials movement.

Continuous effort should be made to reduce the throughput time by effecting decrease in the maximum operational time. Supposing it is

reduced to 9 mts, i.e., for No. 6 operation from 11 mts to 9 mts, the new throughput time can be worked out as under :

Operation	1	2	3	4	5	6	7	8	9	10
Time in mts	2	7	5	4	8	9	6	3	2	7

Total ouput time with No. 6 operation time reduced to 9 mts and grouping (1&2), (3, 4) (7, 8) (9, 10) the total time for each is 9 mts.

(a) $6 \times 9 =$ 54 mts for first piece

(b) $99 \times 9 = 891$ mts for subsequent pieces

Total = 945 mts (as against 5600 mts by conventional method)

Reduction in Number of Operators

In the above example we have grouped the operations to reduce the output time. At the same time, the number of operators could also be reduced by training them to work for at least 2 operations. Here, in the example one operator each could work for 1 & 2 operations as total time required for 2 operations is 9 mts which is equivalent to maximum operational time. Similarly, for 3 & 4, 7 & 8, 9 & 10 operations, we would require one operator each for each pair of operations. Hence keeping the same output time for a batch of 100 piece parts as 945 mts the operators required would be 6 as against 10 originally required. This could bring down the cost of labour, and the cost of item too.

Delivery Dates and Work-in-Progress

In GT production, the delivery dates could be strictly adhered to because exact time required for a batch could be worked out easily whereas in jobbing production, exact time required would be more and, therefore, it is difficult to correctly assess the rate of production. Hence delivery schedules in cell production would be not only shorter, but reliable. Work-in-progress would also reduce in the same ratio as that of output time.

Loading and Progress Chasing

In the conventional method individual loading of each machine has to be seen whereas in the cell method, only loading of complete cell has to be seen, and the machines in the cell will automatically be loaded. The inspector can easily check the progress at end and does not have to go to individual machines.

Cost of Jigs and Fixtures

In a cell-type production, since items are similar in nature, shops requiring common operations are grouped together in a family. Therefore common jigs and fixtures which can be used for a complete family can be manufactured and used as against having various jigs and fixtures required for each type of item being manufactured. Reduced costs of jigs and fixtures also reduce the setting and change times.

Communication and Labour Relations

In the above paragraphs the advantages of cell production using GT over the conventional methods have been discussed. In any industry it is essential for the management to have effective communication and labour relations for healthy growth of the industry. Effective communication, means that any major decisions should be taken by the management after active participation by representative of the workers. The management should let the workers know about the extent of the changes being expected and the reasons thereof. Most acceptable reason perhaps is money and GT provides ample benefits in terms of money. Once the workers get the benefit of GT in terms of bigger pay packet, neater layout in workshop, cleaner operational procedures and job-evaluated wages and salary structure, they would have a sense of willing participation in the change.

Conclusion

The more-efficient and effective 'high productivity' methods of large mass production techniques can be adopted for jobbing and mix-quantity

production by using Group Technology. The main constraint of mass production, wherein standard parts are required, can be overcome by using GT. In fact it provides for the long-awaited breakthrough for the developing countries to catch up with latest mass production technology in batch production. Although at present GT has found major application in machine tool manufacture and sheet metal work, there is no doubt that in years to come it will be used in all batch/jobbing or mixed quantity production of other products as well.

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NATION REGAINS
SPIRIT OF ADVENTURE 1975-76

Drive Against Black Money

- The underworld of smugglers smashed. Top smugglers behind the bars; 42 smugglers declared absconding and their property seized.

- Ceilings clamped on vacant urban land. Transfers within ceilings forbidden.

- Limits on area of dwelling units set. Valuation of luxury houses to nab tax evaders. Direct taxes collection up by 27.4 per cent since July 1975, following tax raids.

- Income and wealth exceeding Rs. 15,870 million disclosed by over 250,000 declarants under Voluntary Disclosure Scheme. Tax revenue Rs. 2,490 million.

davp 76/90

DELHI'S ACHIEVEMENTS IN THE YEAR OF FULFILMENT

Decline in Prices

Price rise arrested; negative rate of inflation achieved; model public distribution set-up; people's cloth being sold through 253 coops, and 2251 Fair Price Shops in urban and rural areas.

Home for the Homeless
Land for the Landless

4136 acres of agricultural land distributed to 4538 Harijan and poor landless families. 5000 house sites distributed to poor and Harijan homeless. Rs. 18 lakhs distributed to Harijans, as housing subsidy.

Apprenticeship

3529 young men placed as apprentices in industries as against the target of 3500.

Public Enemies on the Run

2259 raids on dishonest traders. Suppressed transactions of Rs. 16 crores detected. 14,000 raids against hoarders, black-marketeers.

Relief for Students

Book Banks in 853 schools, stationery at cheaper rates; hostel food costs less; 12 point programme for school improvement. Free text books to all primary students. Rs. 8 lakhs spent in providing school uniforms to the poor students. Additional Rs. 8 lakhs this year.

Production Picks Up

600 industrial sheds constructed, Rs. 3.5 crores distributed as loan to industries.

Vegetable cultivation increased from 16.20 thousand hectares in 1972 to 19.72 thousand hectares in 1976. Multiple cropping popularised. Marginal Farmers and Labourer's, Development Agency helping the weakest farmers.

Beautification

City area has a new look. Jama Masjid complex re-developed and beautified. Subzi Mandi shifted to Azad Pur. 200 non-conforming industries shifted to the conforming area. 20 Resettlement colonies, with 50,000 plots having basic amenities, set up. New hopes of better life and opportunities for the poor and the weakest. To make Delhi greener 10 lakh trees being planted, of which 6 lakhs have already been planted.

Rural Development

50 villages to benefit from integrated programme under Cleanliness, Prohibition and Family Planning in the first quarter of 1976-77. All villages to come under its ambit by the end of 1976-77.

Delhi Tops in Family Planning

Against the national average of 16.1 percent, Delhi has covered 58.6 percent couples in the procreative age-group by the end of March, 1976. This percentage is higher than the Fifth Plan Target of 38 percent. As a result of an intensified drive 70,000 more sterilisations have so far been done this year.

WE ARE ON THE PATH OF RADICAL TRANSFORMATION UNDER THE DYNAMIC AND INSPIRING LEADERSHIP OF SMT. INDIRA GANDHI. LET US SINK OUR PETTY DIFFERENCES AND WORK UNITEDLY FOR THE GREATER GLORY OF THE CAPITAL CITY OF DELHI.

ISSUED BY THE DIRECTORATE OF INFORMATION & PUBLICITY : DELHI ADMINISTRATION : DELHI

Book Reviews

Cooperative Organisation & Management

K.K. Taimni
WAFM Farmers' Welfare Trust Society, New Delhi, 1976, pp. xii+319, Rs. 45.00 ($8.00)

Reviewed by J. D. Verma*

Too much of state guidance, protection and control, democratic character of the managing committee, absence of adequately qualified and well trained executive, limited applications of the modern norms of business management and, above all, the local character of the cooperative societies in India have kept the movement confined to the traditional system of administration and operation. Even now, after nearly three quarters of a century since the cooperative movement in India made a beginning, the executive machinery of majority of the cooperative societies, particularly those which do not have apex system of functioning, is in the hands of the elected executive which is not necessarily possessed of the specialised knowledge of scientific method of organising and controlling an economic enterprise. Besides numerous factors responsible for this situation, the socio-economic conditions in Indian villages and small towns particularly, the membership of cooperative societies is not always available to all sections specially the weaker ones which may rightly need such institutions to promote their enterprise as also further the cause of their business. At times, the patronage emanating from the political leadership whose interest is more to earn the following of members of organisation for a political end and less to determine the objective economic policies to be followed for the promotion and growth of the enterprise has limited the scope of the application of modern methods of management to the cooperative societies.

As a result, in actual practice it has been observed that cooperative movement has suffered from diluted objectives which is evident from the fact that there is general lack of objectivity in decision making, integration between the organisation and the work-force. Management is often vulnerable to external pressures and there is always problem of identity and image. These are some of the reasons which call for an evolutionary look at the administrative system of the cooperative societies. Thanks to the introduction of principles of

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modern management in cooperation in various European and other countries as also to the advancement in the means of communication and transport, that the Congress Party immediately after assuming power in 1947, thought of upgrading not only the socio-economic structure of the movement but also invoking the necessary spirit among the people at the helm of affairs, to introduce some of the principles of efficient and modern methods of business organisation in this sector. That the principles of management are applicable to all social and economic organisations and that attitudes of social relationship at work and group behaviour rather than the physical environment machines and compulsions are more important to the success of an organisation, are the potent factors to support the change in the statutory approach to the management of the cooperative societies. Added to this are the multiple of new activities which have entered the realm of cooperatives. There is ample proof that the discipline of modern management is adaptable in the cooperative enterprise. The concept of Welfare State, which has been given a place of pride in the Preamble of Indian Constitution, has brought about the marked change in the attitude of the State towards the working class which was hitherto the torch-bearer of the cooperative movement all the world over. The State in India has rightly recognised the cooperatives as an agency for bringing about social and economic changes and for restructuring of the rural economy. As such, the vital role assigned to the cooperatives has necessitated research for appropriate management practices which can help improving their performance and thus assist in realising the course set before them.

Mr. Taimni has dealt with the subject in well organised drill, explaining in the beginning the principles of management and principles of cooperation and how these could be integrated so as to ensure transferability of management practice in cross-cultural situations prevailing in the heterogeneous structure of cooperative movement in this country. In doing so, he has not been shy in highlighting some of the basic structural weaknesses of the cooperative movement in the country. The major among these is the role of vested interests and "politicalisation of cooperatives." However, he has assumed that the lessons drawn from the working of the cooperative movement in India thus far, as also the results of improvement that have been brought about in the working of the cooperative societies in some of the developed countries of the world, provide a sound base to choose and adopt the modern methods

of management, keeping in view the local socio-economic conditions. He has discussed various models and approaches which can be considered for application by the State as well as the membership of the cooperatives given due training, guidelines, opportunity and statutory support.

Special emphasis has been placed on the role of the Board of Directors which has to replace the present democratic structure of the executive, because it is the Board which has to decide the goals to be achieved as also the policies to be adopted for the purpose. However, the implementation of these policies will be in the hands of the paid executives which is supposed to have been delegated necessary powers and authority to function. Executive has ultimately to consist of professionals with necessary education and training in modern methods of business management. However, the author has not gone in detail to realise that howsoever, cherished the principle of modern management may be, its application and practice will ultimately depend on the knowledge and quality of leadership of the local membership from among whom ultimately the so-called Board of Directors would be formed. Of course, he has made a detailed mention of the training facilities as are necessary for not only the Board of Directors, but also other functionaries in a cooperative society. This again, as it is today, is so inadequate that only cooperative societies in certain areas can take advantage of the facilities already available. Perhaps their extension to wider area, a right coordination between the local unit and the regional units, regional units and the state units and finally, state units and the national apex body are most essential.

Emphasis has also been laid on the quality of the trainer and the aptitude of the trainee and this has been illustrated by the analysis of the experience of the Vaikuntha Mehta National Institute of Cooperative Management, Poona, which is at present only a regional body. To overcome that, Mr. Taimni has suggested that there should be a National Institute of Cooperative Management at New Delhi which should have the assistance of Programme Committee, Advisory Council and the Governing Council so that the National Council is possessed of the most practical and yet modern methods of business enterprise and cooperative which could be imparted to affiliated bodies irrespective of their sizes and location.

In this connection, it may be mentioned that the newly created National

Council for Cooperative Training and Research of India has drawn up a five-year development plan to solve the "crisis of management" in the cooperative movement by setting up a number of training institutions in the country.

After mentioning how the working class has so far been kept away from paticipation in the management of the cooperative societies, which has undoubtedly created a wedge between the management and the employees, often to the detriment of the smooth working of the enterprises, the author has laid special emphasis on the role of labour in the cooperative movement and how it has to be further improved and integrated with the role of executive which will ultimately transform the present economically dormant societies into scientifically-managed business enterprises.

The author has, no doubt, drawn on the experience as gained in some of the developed and developing countries, as also on the researches and knowledge of renowned economists and administrators. He would have added to the usefulness of the book if while recommending the specific course to Indian cooperative movement, he had not ignored the age-old structural weaknesses of the movement which will certainly offer hindrance to the desired change. However, it does not mean that the cooperative movement in India neither needs adopting the modern methods of management nor is it capable of doing so; it only requires gradual approach, particularly so when, the rural economy is still undergoing a vast change from a purely agricultural society to agro-industrial society. Perhaps the author has left this to those who have ultimately to look at his thesis from a microscopic eye for adoption in a local situation as may prevail in a given area of operation. The book needs editing; nevertheless it will serve as a useful *ade-memoir* for the policy maker and the administrator who are concerned with the promotion and growth of cooperative movement in the country.

Guide to Quality Control

Dr. Kaoru Iahikawa

Asian Productivity Organisation, Tokyo 107, Japan, 1976, pp. 226.

Reviewed by Navin Chandra Joshi*

Industrialisation has brought in its train a serious concern for quality control in the production process. The concept 'Zero-Defect' has made it imperative for industrial societies to develop methodology and techniques for striving towards higher and higher levels of perfections. Yet, however, as defects are removed, standards of quality go up and consequently, newer problems of quality require to be solved.

The present book usefully serves as a guide for lower levels of workers in coming to grips with techniques in locating defects and improving quality. The book mainly concerns itself with data collection and analysis. As such, it gives a practical orientation to issues of quality control.

Starting off with an explanation of how to collect data, the book takes us through the subsequent phases of drawing diagrams, check sheets, graphs, control charts and sampling inspection. The book ends up with the chapter on practice problems which contains a number of tricky questions and their solutions on the basis of what has been described in the earlier chapters.

It is said that quality dispersion occurs because of raw materials, machines or equipment and the work method. Raw materials differ slightly in composition according to the source of supply and there are size differences within the permitted limits. Machines may seem to be functioning in the same way but dispersion can arise from differences in the axle sleeve fittings or because a machine is operating optimally only part of the time. In the same way, work methods differ slightly although they appear to be the same.

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The author explains the possible causes of dispersion in the quality characteristics arranged in the cause-and-effect diagrams. In order to reduce the number of defectives, it is necessary to know the kind of defects and their percentages. Since every defect has different causes, it is of no use just to list the total number of defects. We must find the number of defects caused by each reason and appropriate action must be taken beginning with places where there are many defects. Check sheets must be made to keep equipment working efficiently and trouble-free. Some checks of tests are made daily, others weekly, still others monthly or at fixed intervals. With even the slightest absent-mindedness, it is easy to forget a check-up or even whether a test was really made or not. In such cases a check sheet helps in carrying out the work with certainty.

The author emphasises on the use of what he calls "Pareto Diagrams." These diagrams tell us which factors are most important and deserve concentrated attention for improvement. Likewise, graphs of various kinds help in giving a snapshot view of statistical data. A control chart depicts the average value of defects for each day. It also gives the extent of change in the production process.

The book fruitfully explains the sampling process and the cybernetics of inspection. After describing the various kinds of sampling, it is recommended that selected sampling is more precise than random samples as the former is easy and economical though there is always some bias in it from the population mean. In order to avoid problems involved in total inspection, it is necessary to determine just how many characteristics will be inspected and which inspection method to use.

The book will be found interesting by persons in industrial production process. It will help the non-technical employees in effectively improving quality of products by using statistical concepts and techniques.

Bridging Communication Gap in Agriculture : Aspects of Agriculture in India, 1975

Edited by G. G. Mirchandani

Allied Publishers, New Delhi, pp. iv+435, Price Rs. 60.00

Reviewed by V.S. Mahajan*

While agriculture has been the major economic activity in the country through 1950s and 1960s and is still very important (at present nearly 50 per cent of national product is derived from agriculture; 2/3rd of the workforce is engaged in agriculture), unfortunately, there has been considerable communication gap in this sector. This has been a serious handicap both for the policy makers as well as for the researchers. The United News of India (UNI) has, therefore, done a good job in attempting to bridge this gap through launching "in July 1970 a pioneering news service known as the UNI Agriculture Service. Blazing a new trail in agriculture in India and abroad, this service provides a steady flow of factual material on a vide variety of subjects to all thoseinterested in agriculture in India and abroad. In a weekly packet of approximately 8,000 words the UNI Agriculture Service packs information on different aspects of agriculture which is of immense value to farmers and others engaged in agriculture," (Foreword). The present volume also testifies that UNI has succeeded in its mission. The book under review gives an extensive account of what happend in agriculture in the course of last couple of years. It touches at the various aspects of agricultural development.

First chapter deals with general state of agriculture and makes a broad survey of this sector touching on topics like 'Farm Development Outlay', 'Targets of the Fifth Plan', 'Plan for Step Up Multiple Cropping', 'MFAL Development Agencies', etc. Chapter 2 is devoted to food-grains production; progress of agriculture in States is dealt in Chapter 3. Agricultural research finds place in Chapter 4 and a good part of the space here is devoted to the recommendations of the National Symposium on Agricultural Resarch held in March 1973 in

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New Delhi. Chapter 5 deals with food crops and is mainly devoted to rice and wheat, the two major food crops of the country. It is stated that if the entire 60 million tonnes of paddy is "husked by modern rice mills, an extra yield of 1.8 million tonnes of rice, 0.5 million tonnes of rice oil, and 2.25 million tonnes of de-oiled rice bran could be made available to the country", (p.113). We are further told that on account of research done by the All-India Coordinated Rice Improvement Project, Hyderabad, two new high-yielding varieties of rice have been developed; and further that "these varieties would be well received in the upland areas of the Andhra Pradesh, Uttar Pradesh, Punjab and Haryana," (p.114). Now rice being the principal foodgrain of the country, accounting for over 50 per cent of total food production, much, of course, depends on how farmers respond to the introduction of new high-yielding varieties in rice and how the rice output is maximised through the introduction of modern techniques of paddy husking.

Chapters 6,7 and 8 are devoted to industrial crops like oilseeds, sugar and cotton: cash, plantation and horticultural crops find their places in Chapters 9,10 and 11. We are told that there are fairly good prospects of India soon reaching the goal of self-sufficiency in the production of long-staple cotton. This is based on the results obtained from growing this variety of cotton at the newly-started Raichur (Mysore) state-owned farm (p.170). Much again would depend on how far the results of the Raichur farm are successfully transmitted to farmers cultivating cotton.

Among the plantation crops, India is developing a good export market of coffee. In 1973-74 coffee fetched over Rs. 45 crores of foreign exchange which was 36 per cent higher than exchange earnings during 1972-73. It was expected that the exchange earned during 1974-75 would be near Rs. 45 crores. It is interesting to find that the USA and the USSR are the two major markets for the Indian coffee. Cashew-nuts which fetch nearly Rs 60 crores of foreign exchange are the second largest dollar earners. Attempts are being made to raise "select varieties of high and quick-yielding cashewnut seedlings for distribution to farmers," (pp. 201-2) and further that 200 acres of hilly land have been set apart by the Karnataka State Farm Department for this purpose. This is expected to result in a major breakthrough in cashewnut production and earning more foreign exchange.

Land reforms are dealt in Chapter 12 and farm finance in Chapter 13. The Approach Paper to the Fifth Plan had envisaged that cooperatives would have to disburse farm production credit to the tune of Rs 3,000 crores by the end of the Fifth Plan (and this was 50 per cent higher than what had been estimated in the last year of the Fourth Plan). While this is so, the Annual Report of the Ministry of Agriculture (Department of Cooperation) presented to the Parliament in 1973 had pointed out that one of the most disquieting features hampering the growth of cooperatives had been a steady increase in overdues (p. 238). It would, therefore, be not safe to plough such a vast amount of credit into the farm sector unless effective measures are taken to cut down overdues.

Chapter 16 is devoted to farm machinery. Other inputs like irrigation, seeds, manures and fertilizers are dealt in Chapters 17,18 and 19 respectively. Rural electrification is covered in Chapter 22. We are told that by 1981 at least 50 per cent of villages in each State would be electrified (p.337). The reviewer, however, feels doubtful of this and this is particularly so when one considers the fact that by the beginning of 1973 only 24 per cent of the villages had been electrified. Thus it appears a heroic job to electrify 26 per cent of the villages within a period of eight years. Further, one has to ask, how far are we justified in electrifying the villages when the industrial sector is facing power difficulty ?

One is happy to learn that new techniques of dry farming are getting popular in agriculture (Chapter 23). It is estimated that 75 per cent of the total cultivable area is under dry farming and it accounts for 40 per cent of the total food production. There appears to be considerable scope for raising productivity of dry farms through the application of modern techniques. Unfortunately, despite promising results, dry farming techniques have not received enough attention from the policy-makers so far.

Forestry, animal husbandry, dairy industry and fisheries find their places in Chapters 24, 25, 26 and 27 respectively. We are told that by the end of the Fifth Plan there would be 22 agricultural universities in the country (Chapter 22). It would serve little purpose by multiplying these universities unless these (as also has been rightly pointed out by the Union Minister of State for Agriculture, Shri Shinde, (p.395)

practise on their campuses and farms all what they preach to others. Thus through demonstration of the benefits had from new techniques through creation of a network of model farms and through sending their students to rural areas to preach what they had learnt on their campuses, these universities would be justifying their existence.

Briefly the book is a mine of information for those interested in agriculture and would prove specially useful for researchers and even for policy-markers. The book is well edited and highly readable. It also contains a list of agricultural universities and institutes in the country.

NATION REGAINS
SPIRIT OF ADVENTURE 1975-76

Towards Greater Discipline

- Marked improvement in discipline and punctuality.
- Prompt and speedy disposal of work in public and private organisations.
- Greater sense of dedication and devotion to duty.
- Growing attitude of cooperation and sense of belonging.

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NATION REGAINS
SPIRIT OF ADVENTURE 1975-76

Consumer Protected

- Cortrolled prices ensured by price tags and price lists at retail outlets. Supplies to vulnerable sections maintained.

- Public Distribution system streamlined by removing constraints of inter-State movement, easier flow of goods. In this, help of consumer cooperatives enlisted.

- System of sole-selling agents abolished in some vital consumer-oriented industries.

- Model scheme for equitable distribution through cooperatives and approved agencies in Delhi shows the way. Cochin, Coimbatore, Durgapur and Nainital follow suit.

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New Books : Annotated List*

Basic Arts of Budgeting

McAlpine, T. S.

London, Business Books Limited, 1976, 223 pp, £6.00

Budgeting is the accepted basis for profit planning and control. It has been practised effectively and profitably by many progressive companies who, generally regard it not simply as a procedure, but as one of the more important processes of management. But Budgeting is still an underdeveloped function of management. There is considerable scope for applying it more effectively and more extensively. This book considers budgeting in all its aspects in relation to business operations and to the factors that can influence performance, showing that budgeting is a central factor in effective planning. This is a practical and an informative book for all levels of management and for students of management, accounting and business studies.

Developing Tomorrow's Managers Today

Dinsmore, Francis W

Nwe York, AMACOM, 1976, 130 pp, $9.95

The purpose of this book is to develop a better understanding of managers as they are and of how they can be changed to maximise what works best, not universally, but in one particular organisational environment. The book has been designed to serve as a guide for all busy managers, particularly, those at the middle and higher levels. An attempt has, therefore, been made to keep it brief, concise, and to the point.

How to Negotiate a Raise

Tarrant, John J

New York, Van Nostrand Reinhold Company, 1976, 195 pp, $9.95

This book is a step-by-step guide to raise negotiation. It covers the ways in which one can size up the people and situations affecting one's

*Prepared by Mr. S. N. Vig, Documentation and Information Officer, National Productivity Council, New Delhi.

chances; the selection of goals; the avoidance of pitfalls; the development of strategies; and the use of tactics that best carry out one's strategy. It also shows how to start planning for a raise on the day one is hired—how to discuss money with the boss in a way that makes big salary increases almost inevitable. There is a complete chapter on interview plays.

The Impact of Multinational Enterprises on Employment and Training

Geneva, International Labour Office, 1976, 32 pp, 12.50 Swiss Francs

This is a first analysis of the information collected by the ILO on the very controversial issue of the impact of multinational enterprises on employment in developing and industrialised countries, and on the transfer of knowledge to the host countries. Chapter 1 deals with the influence of the operation of multinationals on the growth of employment in developing countries—both direct job creation and indirect effects. In chapter 2, the employment effects on industrialised countries are distinguished according to whether the countries in question are capital-exporting or capital-importing. Chapter 3 covers the contribution of multinationals to the advancement of knowledge in the developing countries through the transfer of technology and the training of personnel.

Income Distribution : Analysis and Policies

Tinbergen, Jan

Amsterdam, North Holland Publishing Co., 1975, 170 pp, Fl 40.00 (about U.S. $16.75)

Surveys the literature on trends in the inequality of individual and family income in developed countries. The general pattern that emerges is one of a long-term decline in inequality, including the post-World War II period, although the data end at 1966. This finding, however, warrants more words of caution than are offered. The data prior to the 1930s are few in number and of questionable quality and comparability to the more recent data. At least in part, the larger inequality during the Great

Depression than in the post-World War II period may reflect a cyclical rather than a secular phenomenon.

Multinationals in Western Europe : The Industrial Relations Experience

Geneva, International Labour Office, 1976, 72 pp. 17.50 Swiss Francs

Based largely on direct interviews held with representatives of employers and workers' organisations and with government officials, this study compares the industrial relations experience of multinational enterprises in the food and related industries and in the metal industries (with special reference, in the latter case, to the engineering industry and, particularly, its automobile and electrical-electronics sectors) in six European countries, namely Belgium, France, the Federal Republic of Germany, the Netherlands, Sweden and the United Kingdom. Special attention is paid to such major issues as union recognition, the role of multinational managers in employers' associations in the various countries surveyed, labour problems and union reactions connected with the investment, production and employment policies of multinationals and union and employer experiences and attitudes regarding transnational labour relations.

Sources of Variation in Agricultural Productivity

Mukhopadhyay, Sudhin K

Delhi, The Macmillan Company of India Ltd., 1976, 121 pp, Rs. 40.00

This book presents an econometric inquiry into the structure of agricultural production in India and offers estimates of the contributions to regional and temporal variations in output by measured inputs, unidentified regional factors and weather variables. The author analyses agricultural production within a general framework that can consider the various sources of difference in output among regions and over time. An analytical model is developed, combining cross-section and time series observations, which permits one to decompose the measured sources of growth and regional variations in agricultural output.

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TERENE wool

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