Productivity
1984, XXIV, 4, 431-437

Environmental Impact Assessment--Panacea for Environmental Management

CHRIS C. PARK

A central dilemma within environmental management centres around the need to integrate conservation of environment with development, in both developed and developing countries. Whilst the planning systems and contexts of environmental decision-making vary considerably between countries, there is overall a mounting awareness of the inherent limitations of many existing planning systems which focus on relatively short time-scales, place short-term social and economic gain above long-term environmental stability ond sustainability, and in general fail to appreciate the fundamental links between the human and physical environments.

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Recent years have witnessed mounting concern over the quality of environment in both developed and developing countries. Since about 1970 in particular the search for more sustainable, more appropriate and more ethically responsible approaches to the planning and allocation of environmental resources has both diversified and intensified. The spirit of global environmental interdependence, born at the 1972 United Nations conference on the human environment in Stockholm has recently been reactivated in the World Conservation Strategy. Whilst much of the driving force for improved environmental management has come from the developing countries in general, and from the United States and Great Britain in particular, the urgency of finding rational and sustainable solutions to environmental problems in the developing countries (where direct dependence of the population on rural environments is generally the norm) is recognized and appreciated by all. The conflicts between conservation and development are most acutely seen in the developing countries. Yet conservation and development are not of necessity mutually exclusive, and the World Conservation Strategy echoes the sentiments of many thinking peoples in calling for 'conservation based development'. The WCS argues that 'development that is inflexible and little influenced by ecological considerations is unlikely to make the best use of available resources', an argument which lies at the very heart of recent debates about the advent of post-industrial society in some western countries by the mid-1980's, as well as the North-South debate on development, and the earlier Blueprint for Survival proposed in Britain in the early 1970's.

and environmental protection (such as nature conservation). The most important single catalyst for NEPA was growing appreciation of the need to consider fully all possible environmental and social side effects when evaluating project proposals. NEPA, which aimed 'to declare a national policy which will encourage productive and enjoyable harmony between man and his environment', was thus a timely milestone in the evolution of environmental thinking in the United States. But its impact has spread far beyond the shores of America, because environmental legislation and administration in a growing number of countries (both developed and developing) has been based on modifications of American practice, designed to capitalise on American experiences and to cater for the peculiarities and priorities of the adopting countries.

NEPA created two institutions in environmental planning which have been mirrored elsewhere—one a formal institution (the Council on Environmental Quality, or CEQ), and the other an institution in practice (Environmental Impact Assessment, or EIA). Whilst CEQ plays a major role in the implementation of environmental management policies in the United States (through setting environmental quality standards, monitoring changes in environmental quality and so on), it is the EIA system introduced by NEPA that has so captured the interest of environmental planners throughout the world.

NEPA directed all federal agencies in the United States to 'identify and develop methods and procedures which will ensure that presently unquantifiable environmental amenities and values are given appropriate consideration in decision making, along with economic and technical considerations'. More importantly, the Act introduced measures designed to ensure that systematic environmental protection is incorporated into all stages of policy formulation, programme preparation and specific project appraisal—so that the assessment of environmental impacts would need to be carried out for all types of development from the site specific proposal (such as the building of an airport at a named site) to broad policy and programme proposals (such as nuclear power plant developments nationwide).

There are five principal objectives behind Environmental Impact Assessment, as introduced in America through NEPA:

1. to consider the environmental impacts of the proposed action,
2. to consider any adverse effects which could not be avoided if the proposal were to be implemented,
3. to consider alternatives to the proposed action (including doing nothing at all),
4. to consider the relations between local, short term use of the environment, and the maintenance if not enhancement of long term productivity, and
5. to consider any irreversible commitments of resources involved in the proposed action.

The basic product of carrying out an EIA on a particular proposal is a detailed report (the Environmental Impact Statement) where the evaluation of possible environmental impacts is set into context, alternative schemes which would produce similar results to the proposed action are evaluated, the original environment of the area in question is described in detail, and the long term and broad scale implications of the proposal are summarized and evaluated. Environmental Impact Statements tend to be extremely lengthy documents—as indeed one might expect from so important and wide ranging an assessment—and they provide the background on which planning decisions are made. Between 1970 and 1980 around 12,500 EIS's were filed in the United States by over 70 federal agencies.

Procedural aspects of the EIA process have commanded much attention. If the aim of EIA is to reach rational decisions concerning applications for developments which might have adverse impacts on environmental quality, then EIA procedures must be as rational and objective as possible. Most schemes for identifying, examining and evaluating environmental impacts are quantitative ones, which involve some form of numerical assessment of the likely magnitude and importance of different types of impact stemming from the various activities involved in the proposed develop-

ment. The Leopold Matrix, which comprises a lengthy check-list of possible interactions between environmental elements (such as air quality, noise, vegetation and so on) and development activities (such as blasting, construction traffic and highway construction), is typical of these approaches and has been widely used.

One of the main strengths of formalized EIA systems is the requirements to justify the proposed development, and to consider alternative ways of achieving similar objectives. For example, the Assessment of a proposed nuclear power plant would have also to evaluate the extent to which other means of producing power (such as tidal barrages, fossil fuels, hydro-electric or wind power) could meet the same demands, and also the extent to which they would produce more acceptable environmental impacts overall. The difficulty arises in attemping to balance the various environmental impacts of radically different schemes (eg nuclear versus wind power), and this is compounded in trying to draw rational judgements about the viability (in economic or engineering terms) of alternative schemes and at the same time weighing up the likely environmental impacts of the different alternatives.

At the end of the day political factors can (and often do) play a dominant role in reaching decisions about development proposals. It is sometimes claimed, particularly on the basis of American experience, that powerful developers with vested interests in the outcome of particular EIAs (these interests might be in favour of the application if the developer is the one who has proposed it, or against it if it would benefit a competitor) can manipulate the outcome of the Assessment in their favour. Environmental decision makers are not immune from the pressure of local or national politics, if the investment opportunities in certain large project proposals, or the political prestige of certain types of development, or employment generating prospects of proposed developments in areas with high unemployment, become important elements in the final decision-making, to be viewed alongside the environmental arguments. The rationality of decision making based on formal systems of EIA can markedly be influenced by political lobbying, distortion of information input into the evaluation procedures (either wilfully or by neglect), and the adoption of partisan attitudes by those charged with the vetting and evaluation of development proposals. The ambitious politician, entrepreneurial developer or unscrupulous administrator can influence the outcome of EIA decisions as much as he can most other types of planning decision.

In evaluating the possible contribution of EIA in developing countries, it is necessary to weigh up the merits and drawbacks of EIA in both theory and practice.

The merits of EIA are numerous, and they all relate to the improvement of decision making concerning environmental quality. It is generally necessary to consider all technically feasible options of meeting a proposed need, and so EIA enquires that the environmental side-effects of all options be evaluated, with the implication that the chosen scheme be that which makes least overall impact on the environment (an implication which is more theoretical than practical). EIA also requires a detailed justification for the proposed development, which can be judged in the public arena. Political factors can markedly influence the openness and rationality of this public justification however. EIA also requires more and more open public consultation over possible environmental (and socio-economic) impacts of a proposed development, and the need to examine all possible impacts creates the need for more information on the form of the development, the environment in question, and the possible side-effects of the different phases of the life-cycle of the development (from construction, operation to final abandonment and rehabilitation). Without doubt the most important benefit of EIA is the enforced broadening of the whole scope of planning control, to encompass broad environmental factors alongside more immediate socio-economic factors. EIA has also promoted an increased environmental-awareness and consciousness amongst planning practitioners, so that planning decisions which do not require EIA evaluation by statutory designation might even gain from greater awareness of the environmental factors involved.

Exponents of EIA point to a series of drawbacks which must be appreciated alongside these undoubted

merits. Many problems arose during the initial implementation of NEPA in the United States, during the early 1970's. These stem ultimately from the zealous manner in which EIA was adopted from the beginning; environmental commentators in the United States have identified a massive overkill which produced excessive documentation (too many EIS's of excessive length), lack of coordination in Impact Statement preparation, needless delays in approving worthwhile projects, and excessive beaurocratic involvement in environmental decision making. In some ways the EIA tail was beginning to wag the environmental dog. Since the mid-1970's legislation has been introduced in the United States, designed to rectify some of the inherent problems of the EIA machinery introduced in 1969 via NEPA, and delays have been reduced, report lengths have been reduced, coordination has been increased, and the decision making machinery has been rationalized. But there still remain some drawbacks within EIA. One stems from the essentially negative philosophy underlying EIA—the assessments concentrate on the negative or adverse impacts on environment, but some projects are highly compatible with maintenance of environmental quality, and others might even improve environmental quality (by careful site design and landscaping of some developments, for example). Some environmentalists feel that a more creative, positive basis of environmental decision making, where certain actions were encouraged positively (rather than simply discouraging certain actions, as with EIA), would greatly benefit the environment. Problems also arise from the focus of many EIA's on direct and essentially local effects. Often little attention is given to broader scale, longer term environmental impacts. Another suite of problems stem from the inherent difficulties of balancing environmental factors alongside non-environmental factors. How can you make rational judgements involving social, economic, environmental, ethical, political and even strategic factors simultaneously, for example? The final judgement must in many ways depend on the dominant value system involved. In the final analysis, for example, most American EIA decision making involving military installations takes strategic factors as dominant and all others (including environmental impacts) as subservient to the strategic needs. Yet another family of problems stem from the questionable rationality of the EIA process and decision making based on it. The impartiality of EIA assessors has at times been questioned, as has the political inclinations of those involved most centrally in the ultimate decision making.

At the end of the day it becomes a matter of faith (in the environmental management system) whether one sees EIA as having more benefits than drawbacks, or vice versa. Critics of EIA argue that it has slowed down economic recovery in the United States through needless bureaucratic involvement in planning decision making. Proponents of EIA argue that precisely because of NEPA and its legislative innovations, the quality of the American environment has been preserved if not enhanced, for the benefit of future generations and for the long term sustainability of the American economy. Two aspects of EIA have fuelled extensive dialogue, particularly outside the United States as EIA in one form or another has been introduced into the formal planning machinery of countries like Australia, Canada, and some member states of the European Community (excluding Great Britain in a formal sense, at least to late 1983). These relate to the scale at which EIA should operate, and the rigidity of applying EIA procedures in different cases.

Scale of implementing EIA procedures is highly important. The debate centres on whether EIA should operate only at the small scale, or whether it should span the full spectrum of scales from the site specific proposal to the general policy or programme issue. Project proposals are site specific; a particular project is proposed for a named site, and in many existing EIA systems the attention is focussed almost exclusively at this scale. Policy proposals on the other hand, are not site specific, so that environmental evaluations are more complicated and they must take into account broader issues such as the need at national level to embark on a particular policy which might adversely affect the environment (such as the decision by central government in the United kingdom to embark on an expanded programme of nuclear power station construction between the mid-1980's and 2000 A.D.). Many environmentalists argue that EIA should span both project proposals and policy issues.

Rigidity of application within existing EIA machinery is also of basic importance. It would be impossible and unwieldy to introduce a system of EIA which must be applied to all development proposals, no matter how small, and no matter how inconsequential to environmental quality. Therefore a cut-off point must be built into the environmental planning system, below which statutory EIA evaluations would not be demanded. During the early 1980's the Council of the Commission of European Communities has been giving much thought to the need to introduce a formalized procedure for EIA into member states of the EEC, because of broad differences in environmental policy and in environmental quality standards between member states which might introduce competitive distortions via favouring economic developments in some (more environmentally-lenient) member states than others. Central to this process of enviromental planning has been the question of what types of development would require mandatory EIA assessments, and which could be covered by discretionary assessments. The EEC favour the two tier approach, whereby EIA would be mandatory for certain types of project (such as oil refineries, steel and cement works, motorways, coal mines, airports and petrochemical complexes) which would inevitably have pronounced environmental impacts; and it would be discretionary for projects like forest management, reservoir developments and major urban expansion.

The lessons from experience of EIA in the United States and elsewhere (mainly in developed countries to date) should prove of considerable value when evaluating the need to and scope for introducing formalized EIA procedures elsewhere (particularly in developing countries). But the lessons from accumulated experience cannot be directly transferred between countries, because of inevitable differences in planning policies and practice, in public consultation procedures, and in long term national goals and objectives. The World Conservation Strategy underlines the need to adopt more global and cross-national perspectives in all aspects of environmental planning and monagement, and it remains to be seen now how these can be realized in the closing years of the twentieth century. But there are some broad conclusions about NEPA and about EIA which must be pointed out. Both NEPA in general, and the evolution of formal procedures for assessing possible environmental impacts of proposed developments *in advance*, have served as useful catalysts in the formulation of a new environmental ethos amongst planning practitioners, and they have without doubt increased environmental awareness and sensitivity. EIA has also made important contributions to the rationalization of environmental management. Since 1970 it is possible to detect in the United States and elsewhere a more systematic approach to project appraisal, a more sympathetic environment input into project design, and a greater environmental awareness amongst planners and decision makers. Whether EIA could become the panacea of environmental management, as many of its more fervent protagonists would claim, is perhaps open to debate. In the final analysis, however, there is no doubt in environmental management that PREVENTION IS BETTER THAN CURE, and EIA can rightly claim to put this concept into practice. Environmental decision making, even with the existence of formalized EIA procedures, may not in the long term be changed, and economic factors may at the end of the day still overshadow environmental factors in planning decision making, but the least which emerges from EIA is that the implications for environmental quality of a planning decision will be both clarified and publicized in the public arena. The environmental planner will perhaps always be constrained by socio-economic arguments until the wisdom of caring for the long term survival and sustainability of environmental quality is appreciated by all thinking men. EIA offers one step in that direction.

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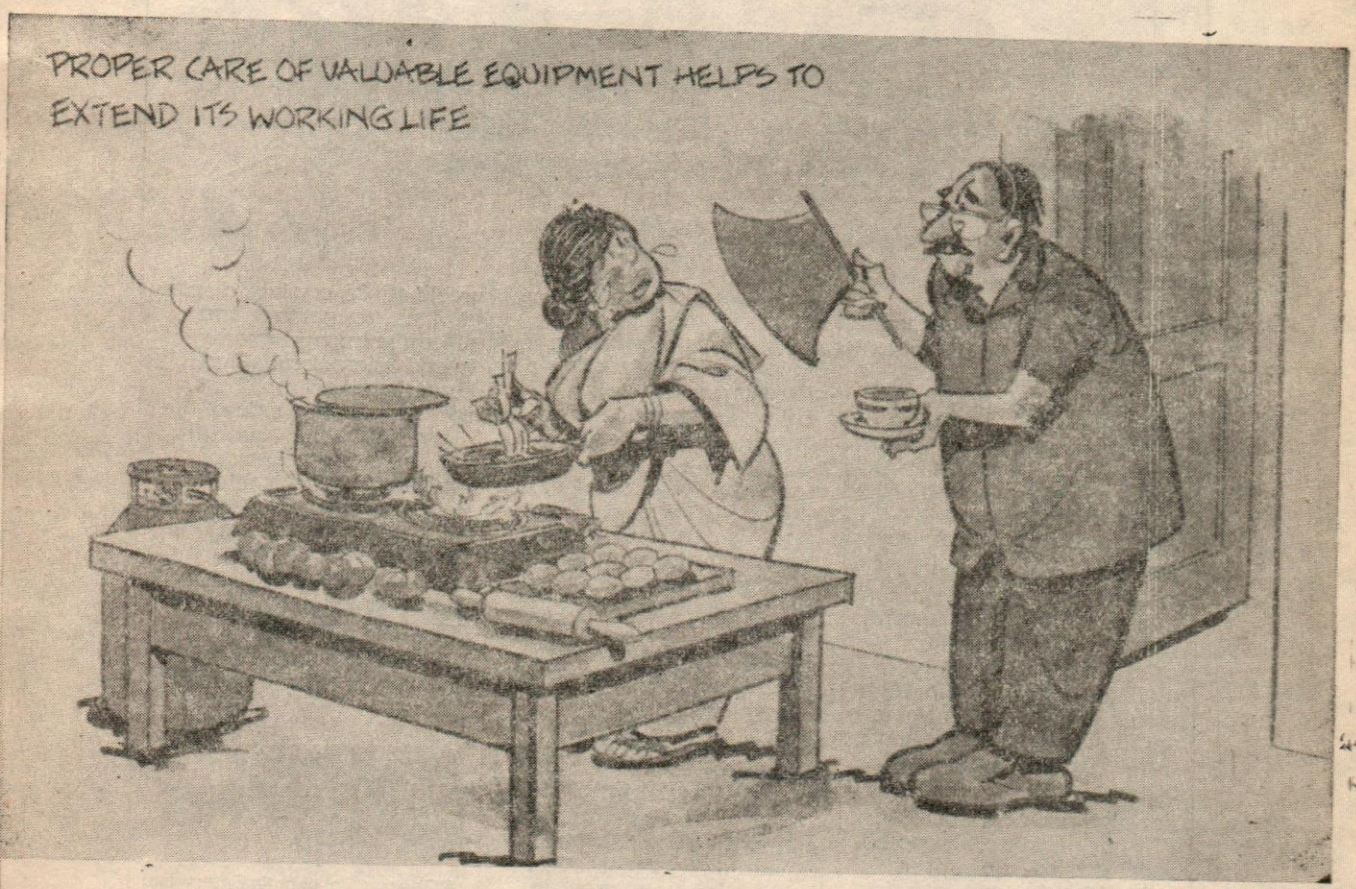

Productivity
1984, XXIV, 4, 439-441

Managing For Improving Environment

DR. MICHAEL G. ROYSTON

How can a worker be motivated when he realizes that the pollution which he produces 8 hours a day, he and his family has to breathe for 16 hours a day? How can a worker physically deliver high productivity and high quality when he is being choked with dust, defended by noise and asphixiated by fumes? The worker is the one closest to the production technology, who understands it best and who knows better than anyone in the company how to improve it for his and everyone else's benefit. The paper discusses various approaches for improving Environment and discusses the role of organisation in this.

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Management of the modern enterprise is beset by many problems—cost inflation, productivity, quality, innovation, motivation, relevancy of products, pollution, project failure, safety, criticism from government and local communities, image, problems of planning and many more, including problems of entrepreneurship and planning. All these problems arise, to some degree, because of the way in which we organize things.

For thousands of years we have been taught that if you want to analyse anything you must first chop it up into its component parts. Learning did just this, and the different faculties of the medieval universities argued endlessly as to which was the sole possessor of the truth.

Modern management has perpetuated the error by organizing enterprises so that different functions operate in different, vertical, water-tight compartments with no connection between them. The organization becomes fossilized, unable to change with the times. For example, Production has no design responsibilities but sees the impact of rising energy costs. The design engineers don't share their knowledge because they are isolated from Production, and insist that their original design is still good.

In the west this is reinforced by design engineers and production engineers belonging to different professional bodies, and attending different seminars. In Japan the engineers don't say "I am a design engineer and I work for Mitsubishi", they say "I am a Mitsubishi man responsible for design".

In Japanese companies there is a great horizontal flow of information between departments. There is

much more identity and sense of common purpose and much more grouping together in task forces or multi-disciplinary project teams to solve problems. Because of this, Japanese firms face far fewer problems than western firms in for example, responding to external cost push factors such as increased energy cost: far few problems in continuously improving their production technology; and far fewer problems in achieving high quality and high productivity. Why?—Simply because by breaking down these vertical water-tight barriers, the lower levels of management and the workers see the larger picture on the one hand, the 'environment' in which they work and in which their efforts have results—and on the other hand they sense and exercise a greater degree of responsibility for the impact of their work on the 'environment' of others within and without the company. Hence they come up with highly relevant suggestions for improving the quality of the work-place to make it healthier and safer, to make it produce less pollution and waste and to become more efficient. In short, because they see where they fit in the internal and external environment they are more highly motivated to perform well for the company and the community.

How can a worker be motivated when he realizes that the pollution which he produces 8 hours a day, he and his family has to breathe for 16 hours a day ? How can a worker psysically deliver high productivity and high quality when he is being choked with dust, deafened by noise and asphixiated by fumes ? And on top of all this, the worker is the one closest to the production technology, who understands it best and who knows better than anyone in the company how to improve it for his and everyone else's benefit.

Equally, the project manager or the marketing manager sitting in his water-tight compartment has no idea of the impact of his project or his product on the community at large or indeed whether it will be accepted or rejected by them. And yet paradoxically both project managers and marketing managers are the ones in the organization who spend the most amount of time wilh people in the community.

Those responsible for setting business policy have a blinkered view and see no virtue in sub-contracting substantial parts of production outside, despite the fact that this wider, horizontal, 'environmental' view (which is followed by Japanese companies), reduces costs, reduces stock levels, increases flexibility and management effectiveness, and leads to employment in small-scale businesses and in their upgrading if accompanied by help in training, equiping and financial guaranteeing. It also helps spread development benefits throughout the community, as does the other 'environmental' policy of industrial enterprises adopting villages and helping them with water supply, seeds, tree planting, education, or with energy systems to replace the demand for fire wood where cutting leads to erosion and the destruction of the whole physical and even social environment.

Environmental management therefore means organizing oneself in the open horizontal way rather than the closed vertical way. It means managing the enterprise as a total system within an even larger system. It means giving priority attention to motivation, to responsibility and to communication. It means developing a high quality internal and external working environment. It means a people-oriented, development-oriented, management system. It means making the enterprise prosper as never before, and at the same time ensuring that the community and its environmental resources prosper.

The implementation of environmental management requires firstly a formal commitment by management to its development responsibilities. Then it requires that each manager be made responsible for the quality of the internal and external environment. Then it needs a broadening and a flattening of the organizational structure, to extend it by self-managed groups, task forces and project teams across the organization and outside into the community, and it needs to reduce the levels of command so that managers can truly communicate with those working under them and understand their needs and what motivates them.

By this means pollution issues will be resolved and made profitable by being seen as problems of resource waste and inefficiency ; community needs and values will be met by culturally sensitive products and market-

ing techniques ; development benefits will spread through encouragement of small businesses ; agricultural and rural development will prosper through technical help, particularly in water supply, alternative energy systems and soil conservation ; quality and productivity will increase through better working conditions and higher worker motivation ; innovation will take place continuously, without relying on formalised, expensive indigenous or foreign R & D inputs ; energy water and other resources will be conserved by a multitude of minor adjustments and improvements ; planning will be realistic because it will represent an on-going process of dynamic interaction between all, rather than an isolated academic production of irrelevant plans by the few ; projects will thrive with the full cooperation of man and nature, and the enterprise will at last be the most cost-effective vehicles for national and social development.

Productivity
1984, XXIV, 4, 443-449

X-Efficiency of Past Environmental Management

CLIMIS A. DAVOS

The recent economic crisis forces us into a new era of Environmental Management. The efficiency of this management in the past will be of primary concern. However, the application of the conventional efficiency assessment obscures a number of critical issues. Hence, the X-efficiency of past environmental management is considered. The issues raised are those of effort entropy—degree of coordination among objectives and actions—and inertia-stagnation into established routines, habits and conventions. A high X-inefficiency is the inevitable conclusion after examining these issues in association with past environmental management. To reverse it, pressure and motivation will not suffice, as past experience suggests. Participatory decision-making, qualitative evaluation and synthesis appear to be more promising.

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Introduction

With the recent economic crisis we entered a new era in Environmental Management. Which legacies this new era will leave is too early to perdict. To a great extent, however, they will depend on the lessons derived from the experiences of the past. Hence a continuous reflection upon the latter is essential.

In this paper the efficiency of past environmental management as an integrated entity, in the U.S.A. is discussed. It does not concern with individual management actions for achieving individual environmental ends such as the control of sulfur dioxide emissions or the regulation of nuclear energy generation. The rational for this analytical perspective has no particular significance here but it can be found elsewhere [1].

Of greater importance is my abandonment of the conventional measure of efficiency which compares committed resources and effort with achieved end results. The significance of this comparison notwithstanding, its elevation to a sole measure of efficiency obscures a number of other critical issues for the success of environmental management to advance towards its goals.

The appropriate framework for examining these other critical efficiency issues is the X-Efficiency theory that raises them [2]. Unavoidably, its application to environmental management requires certain conceptual adjustments and parallelisms. A brief review of the major theses of this theory precedes its application.

Productivity
1984, XXIV, 4, 451-456

Industrial Pollution Control Constraints and Conflicts

DR. NILAY CHAUDHURI

Like most of the developing countries in the South East Asia and Pacific Region, India entered in the realm of environmental protection in the decade of seventies. The tenth year since the introduction of the Water Act (Prevention and Control of Pollution Act) of 1974 is knocking at the door. The implementation of industrial pollution control programme has its successes and failures. It is but logical that developing countries are under chronic shortage of all relevant resources such as finance, technology and techno-scientifically competent manpower. But all the above listed constraints are surmountable if the pollution control implementation programme is backed-up by a strong political will. India is fortunate in this regard. It is known to the world that the Prime Minister of India is out and out an environmentalist.

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Commoner in the street, so also hon'ble members in the Parliament often pose a question almost similar in nature. The question is "how many industrial entrepreneurs are put behind the prison for polluting the environment" since the introduction of the Water (Prevention and Control of Pollution) Act in 1974. The answer had been naggingly no, till August 13, 1983. On that day came a judgement for the first time in India wherein the honourable additional Chief Judicial Magistrate awarded two years' simple imprisonment in addition to a fine of rupees two thousand to the manager of a paper mill, located in the State of Rajasthan. The manager may serve the jail sentence if the proprietor does not appeal against the judgement. Even on appeal from the Magistrate Court to High Court and finally from High Court to the Supreme Court, if the paper mill loses and the additional chief judicial magistrate's verdict stands, the manager, the salaried person, goes to jail, probably as a part of his duty, the proprietor remains still an honourable citizen. In addition, the verdict spells nothing about stopping the pollution, the very cause of evil., Pollution Control Legislation with its various operative sections should be considered as a stockpile of arsenals. It need not be considered exhaustic of arsenals for combating pollution. Even to use the various arsenals as the only stockpile provided in the pollution control legislation one must be judicious in choosing and picking the appropriate arsenal from the stockpile that would aid positively in achieving the end objective which is cleaner environment. Time-bound implementation programme on behalf of the

proprietor of the paper mill as an affidavit in the Chief Judicial Magistrate Court should have been preferred to imprisonment of the manager. The indicator for pollution control should not be the number of prosecutions launched against polluter and the number of convictions obtained in favour of pollution control enforcing agencies or the number of salaried managers are either fined or imprisoned or both. The indicator should be the volume of pollutional load, liquid, gaseous, or solid, made innocuous enough to be accepted and assimilited by the receiving environment without manifesting any sign of deterioration. While the former indicator may have news value but the latter indicator has a lasting value on the environment.

> Should the industrial manager be sent to jail for industrial pollution or be forced legally to control industrial pollution. Pollution control boards would adopt that course which society demands. If society wants news values let the boards fight legal battles to send the industrial managers to jail. For lasting protection of environment recalcitrant industries must be forced to control industrial pollution.

Like most of the developing countries in the South East Asia and Pacific Region, India entered in the realm of environmental protection in the decade of seventies. The tenth year since the introduction of the Water (Prevention and Control of Pollution Act) of 1974 is knocking at the door. The implementation of industrial pollution control programme has its successes and failures. It is but logical that developing countries are under chronic shortage of all relevant resources such as finance, technology and techno-scientifically competent manpower. But all the above listed constraints are surmountable if the pollution control implementation programme is backed-up by a strong political will. India is fortunate in this regard. It is known to the world that the Prime Minister of India is out and out an environmentalist.

The Water (Prevention and Control of Pollution) Act was introduced only in 1974, hence the country has acquired a reasonable experience in this regard. Significant advancement has been made in the field of water pollution control. In the Federal form of Government with the State Government's autonomy on the control of water the very introduction of a single piece of legislation applicable in all the four corners of a country which has 22 States and 3.25 million square kilometre in command, manifests a strong political will for pollution control. The enforcing agency created in each State named as State Pollution Control Board when administers the same water protection law the industrial entreprenuers are left with no choice of flocking in a State permitting all possible incentives including pollution.

Regional imbalances in industrial growth do exist in the country which were prompted not by slackness in pollution control in some States as compared to others. These regional imbalances are more because of uneven distribution of raw material, market skill and other industrial infrastructural support. This disparity in industrial growth which is a part of history now has put dissimilar pressure on some State Pollution Control Boards as compared to the others. Thus, Assam, a State in the north-east and Himachal Pradesh, a State in the north-west are to control not more than 20 polluting industries in each of these two States. In contrast, Maharashtra and Gujarat are required to control no less than 400 to 600 industrial units in each State. On top of it more and more industrial entreprenuers are looking for opening more industrial units in these two latter States. In the backdrop of such disparity in industrial growth between States a uniform piece of legislation for the entire country has become a strong cementing force in pollution control. It is further strengthened by the creation of a Central Pollution Control Board at the Federal level, as conceived in the Water Act. This apex body not only advises the Government of India but also coordinates the activities of all the State Boards by having full involvement in all conceivable aspects of pollution control.

> In a federal form of government introduction of a common water pollution control act applicable in whole of India indicates a strong political will to combat pollution. Above precedence helped to have a common air pollution control act. Such a common law prevailing throughout the country has become a strong cementing force in

pollution control. Creation of a central board as the apex body serves that cementing force.

During the formative years of pollution control, State Pollution Control Boards, in their zeal to show result initiated asking industries to control of pollution in a 'pick 'n kick' fashion. In this process many industrial units were chased whose pollutions were not worth looking at, and thus the regulatory agencies lost otherwise gainfully utilisable time. This error in approach crept in as because the State Pollution Control Boards used the list of industrial units maintained by the Department of Industries of the State Government as the guide book for pollution control enforcement. With time when the State Boards realised that many major polluting industries were not included in the 'pick 'n kick' list, the significance of inventory of pollutionally relevant industries and arranging the pollutionally relevant units in the order of severity in pollution was appreciated. In this process the Andhra Pradesh State Board realised that by tackling 13 industrial units in a total list of 133 units in the city of Hyderabad, more than 90 percent of industrial wastewater by volume would be controlled. Similarly in Delhi control of 16 industrial units would control more than 95 per cent of industrial waste by volume.

For the 14 States (including Jammu & Kashmir, excluding Maharashtra, Tamil Nadu, Orissa and 5 North-East Hill States) and the 9 Union Territories such as Delhi, Chandigarh, Goa, Andaman and Nicobar, Arunachal, Mizoram, Pondicherry, Dadra & Nagar Haveli, and Lakshwadeep, the Central Pollution Control Board conducted an industrial survey during April-May, 1981. Out of a total 2,700 *large* and *medium* industries, 1,700 water polluting industries were identified. The progress in industrial wastewater pollution control was also noted along with legal prosecution. The information is summarized in Table 1. Slightly less than 50 per cent of industrial

TABLE-1

Statewise Polluting Industries and their Status of Pollution Control Enforcement

Sl. No.	*State*	*No. of Industry*	*No. Relevant to Water Pollution Control*	*No. of Industries control Ind. waste*	*No. of Industries under Prosecution*
1.	Andhra Pradesh	300	114	54	10
2.	Assam	42	30	8	Nil
3.	Bihar	161	95	14	5
4.	Gujarat	509	389	68	25
5.	Haryana	145	110	16	87
6.	Himachal Pradesh	30	20	1	Nil
7.	Jammu & Kashmir	28	3	1	Nil
8.	Karnataka	224	166	142	3
9.	Kerala	165	130	60	4
10.	Madhya Pradesh	277	119	108	Nil
11.	Punjab	143	68	21	19
12.	Rajasthan	156	108	82	20
13.	Uttar Pradesh	180	102	47	10
14.	West Bengal	200	120	53	2
15.	Central Board for Union Territories	140	136	36	56
	Total	2,700	1.700	781	241

units is already under control in a period less than a decade. Should it not be considered as a signifiant progress in industrial pollution control?

> Inventory of pollutionally relevant industry is a prerequisite for systematic control of pollution. Pick 'n kick approach leads you nowhere.

Any country introducing pollution control legislation at any time would have a stock of industrial units with antiquated or no pollution control and also with processes either facing obsolescence in terms of age, process changes for efficient production and lesser pollution. Pollution Control for these units is more difficult as compared to new industries because of higher cost at no or marginal benefit. Phsychologically also these entreprenuers remain averse to pollution control viewing such investment as unproductive. To hasten establishment of pollution control in the existing group of industries, the Central Pollution Control Board evolved industry-specific pollution control strategy through a strenuous process of developing industry-specific Comprehensive Industry Document. This document covers numbers, sizes, geographical distribution, material inputs, processes adopted, product mix, by-products recovery, water consumption, various waste streams and their characterization. The document particularly deals in prevention and control methods of wastewater vis-a-vis their cost implications. This is the most important aspect of the document as any specific type of industry must know the extent upto which their effluents must be treated so that they can discharge the treated effluents either on land for irrigtion or to rivers or lakes or in estuaries or in sea depending on the location of the industry. The document evolves the industry-specific MINIMAL NATIONAL STANDARDS (MINAS) by evaluating cost of various levels of treatment. The capital cost of various levels of treatment is converted in annuity taking relevant interest on capital and depreciation. This annuity is converted into annual burden by adding annual operation, maintenance, and repair cost for each level of treatment. The level of treatment for which the annual burden remains within 3 per cent of annual turnover of the specific industry is accepted as the approriate level of treatment, to be installed by each existing industry of the type. The concomitant effluent quality is termed MINAS which cannot be relaxed by any State Pollution Control Boards. Stricter effluent quality is prescribed if a specific location so demands. The consultant engaged for evolving each of the Comprehensive Industry Document is continuously guided by an Industry Committee constituted for each of the industries. The specific Industry, the Executive Ministry, Industry Association, Indian Standards Institution, Directorate General of Technical Development, and Department of Environment are all represented in the Industry Committee.

> Industry must know its financial burden to control pollution. To fulfil this requirement industry-specific minimal national standards (MINAS) are evolved correlating annual burden of pollution control to annual turnover of the industry.

The prescription of MINAS based on annual burden of treatment as certain percentage of annual turnover of the industry, is liked by industries as because the industry can pass on the cost of pollution control to the price of product. So long this is within 3 per cent, a product costing one rupee can be increased to one rupee and three paisa without creating any stir in the mind of industrial entreprenuer and consumer too. It is heartening to note that this percentage remains within one for many types of industry, and crosses the upper limit of 3 per cent for industries generating synthetic chemicals such as pesticide, pharmaceuticals, Dye & Dye Intermediates or industries having extremely high organic pollutant such as molasses based alcohol distilleries.

The nation wide implementation of industry-specific pollution control has its merit as reflected in Table 2. The 8 types of industry put in Phase I are vigorously pursued for implementation of pollution control. The preparation of Comprehensive Industry Document for the types of industry grouped in Phase II is in advanced stage, awaiting finalisation for nation wide implementation of pollution control.

While clearing the backlog of industrial pollution mess created by existing industries the regulatory

TABLE-2
Industry-Specific Pollution Control

Sl. No.	*Types of Indusrry*	*Number of Units*	*Number of Units with Efficient Treatment Plant*
1.	Sugar	300	104
2.	Distillery	128	34
3.	Caustic Soda	38	27
4.	Fertiliser	65	55
5.	Oil Refinery	13	13
6.	Man Made Fibre	29	22
7.	Integrated Steel Mill	7	7
8.	Textile (Cotton & Wool)	300	155
	Industry to be controlled in Phase I	880	417
9.	Pulp and Paper	150	55
10.	Pharmaceutical	120	56
11.	Pesticide	50	16
12.	Petrochemicals	10	10
13.	Inorganic Chemicals	150	34
14.	Dairies	50	32
15.	Thermal Power Plant	150	59
16.	Non-Ferrous Metal	12	8
17.	Dye Manufacturing Large Engg. using Electroplating, Large Tanneries and Misc.	128	24
	Industry to be controlled in Phase II	820	294
	Total	1.700	711

agencies should not loose sight of controlling new industries; otherwise the backlog would keep on mounting instead of melting. Any new industry draws attention of the provisions of the Water Act only at the stage of discharging the industrial wastewater. If the new industry does not install any wastewater treatment plant along with the commissioning of the industrial plant, the State Boards as regulatory agencies often find it difficult to ask the industry not to discharge untreated wastewater until the treatment plant is built. Because such refusal tantamounts to virtual closure of the industry, which a developing country can hardly afford. To avoid such last mo ment embarrassment, and at the instance of the Central Pollution Control Board, the Government of India issued an executive order. As per this executive order the Industrial Licensing Committee of the Government of India allows conversion of letter of intent into industrial license provided the entrepreneur through the respective State Industries Department obtains a No Objection Certificate (NOC) from the respective State Pollution Control Board. Majority of the States is not practicing this procedure and the Industrial Licensing Committee of the Government of India also

The Indian environment is said to have deteriorated mainly due to population growth, urbanization, industrialization and the modernization of agriculture. Population growth by itself brings in its wake problems like those of water supply, sewage and waste disposal. In many cases the city corporations and municipalities have failed to meet the demands of the growing population in a satisfactory way. Furthermore, the concentration of economic activity and population in large cities has caused an agglomeration of industries resulting in polluting the natural environment and also bringing in its wake problems of urbanization, thus worsening matters. As if this is not sufficient, chemical fertilizers, insecticides and pesticides are used to meet the demands of the rising population for agricultural products from a limited area which, in turn, result in the further deterioration of the environment.

From the above, the environmental problems facing India can be stated as:

(i) Population Growth;

(ii) Urbanization;

(iii) Industrial Pollution;

(iv) Agricultural Pollution.

Before going onto study certain major environmental legislations, it is essential to determine the legislative competence of the Union and State Legislatures to legislate on the identified problem areas.

At the very outset it must be mentioned that the subject "Environment Pollution Control" as such does not figure anywhere in the Constitution (The 42nd Amendment Act which incorporated some provisions relating to environmental protection is dealt with separately). But a look into the Seventh Schedule which classifies various legislative entries into three groups, viz. (a) the Union List; (b) the State List, and (c) the Concurrent List, reveals various entries which can be related to the protection of the environment. On the face of it, it is the State Legislature alone which is empowered to legislate on some of the most vital matters effecting the environment.

When the Constitution of India was amended for the 42nd time in 1976, certain environmental provisions were incorporated into it. These provisions need careful study for this was the first time that the expression 'environmental protection' found a place in the Constitution and that the environmental philosophy of the government was spelt out. They are also important because the changes brought out led many scholars to wrongly judge that by the Amendment the Central Government wanted to gain certain powers, which it did not have, to protect the environment. Art. 48 A, was added to the Directive Principles of State Policy which stated:

> "The State shall endeavour to protect and improve the environment and safeguard the forests and wild life in the country".

The only other provision dealing with environment found place in the Chapter on "Fundamental Duties" which was inserted after Part IV of the Constitution as Part IV-A Art. 51 A (g) of this Part provided:

> "It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wild life and to have compassion for living creatures".

A new entry 20 (a) was inserted in the Concurrent List after entry 20. This entry deals with "population control and family planning". An explanation was added to Articles 55, 81, 82 and 330 to the effect that:

> "The expression 'pollution' means the population as ascertained at the last preceding census of which the relevant figures have been published: Provided that the reference in this explanation to the last preceding census of which the relevant figures have been published shall, until the relevant figures for the first census taken after the year 2000 have been published be construed as a reference to the 1971 census".

Besides this, the entries dealing with "forests" and "wild life" were dropped from List II and inserted in the Concurrent List.

These were mainly the changes effected by the 42nd Amendment Act. What was the Government's objective in bringing about these changes? Did the government want to give expression to its willingness to prevent environmental pollution or did the government

think that it could not go about preventing pollution without occupying itself with more powers?

If, as posed above, the government's intention was only to give expression to its willingness, the incorporation of Art 48 A in the Chapter on Directive Principles of State Policy certainly served the purpose. Because of this, for the first time, the world environment was used in its broadest sense in the Constitution.

But if the intention of the government was to have more powers, then the question has to be considered at depth and at two levels: (a) What additional powers did the government gain by these changes; and (b) in what way they were incremental to the existing provision.

To start with, the provision incorporated in the Chapter "Fundamental Duties" does not make such sense, for Art 51 A (g) starts with words like "It shall be the duty of every citizen of India to protect and improve the natural environment...". As is clear, there is no enforcing machinery. When one reads this provision along with the one incorporated in the Directive Principle of State Policy, it becomes clear that the "duty" is much more sweeping and all-encompassing than the "directive". What additional powers this article gives is hard to understand.

As to the rest of the changes, the insertion of an entirely new entry (No. 20 A) in List III, on "Pollution Control and Family Planning", by its very place in the concurrent list, would give an upper hand to the Centre, *should the Centre decide to pass a Law.*

And lastly, by bringing the entries of 'forests' and 'wild life' from the State List to the Concurrent List, the Centre was not taking away the State's right to make Laws. It only meant that from then on the Union government could also pass laws covering these two areas. One may ask the question: does not the Union Government have these powers otherwise? The question is pertinent not only to study the real gains of the 42nd Amendment Act from the environmental protection point of view, but also to scrutinize the commonly held view that it is the state legislature alone which is empowered to make environmental laws. This view gains strength if one looks at the reasons as to why the enactment of the some of the Central Acts relating to environmental protection took so much time.

The much forgotten Art. 253 of the Constitution: says:

> Notwithstanding anything in the foregoing provisions of this Chapter, Parliament has powers to make any law for the whole or any part of the territory of India for implementing any Treaty, Agreement or Convention with any other country or countries or *any decision made at any international conference, association or other body* (*Emphasis added*).

This Article is in conformity with the object declared by Article 31 (e) and entries 13 and 14 of the Union List embodying the above provisions in the form of a legislation entry. Entries 13 and 14, read with Art 253, give the Union power to enact laws virtually on any entry contained in List II. A close reading of Art 253 reveals that the Union Government, *even without an international obligation*, can enact laws on matters enumerated in List II.

From the above discussion, whether the framers of the Constitution intended it to be this way or not, it is clear that the Parliament has unlimited power to pass any law, covering the State List entries even without the 42nd Amendment. Then why the Union Government did not take the lead in passing environmental legislation even after taking an active part in the Stockholm Conference on Human Environment, the Bucharest Conference on Population, the Vancouver Conference on Shelter and Human Habitat, etc., needs a more detailed study with some very interesting possibilities. The view that the Union Government does not have the power to enact environmental legislation and that it is the State Legislature alone which can do this is wholly untenable.

It is truly said that India has a multitude of legislation each in turn covering a very minor environmental area. While the number is staggering, the provisions related to environmental pollution are extremely vague and, even if they are precise at times, their implementation has always left something to be desired. However, the enacting of the wildlife (Protection) Act, 1972 and

the Water (Prevention and Control of Pollution) Act, 1974, were acclaimed as ushering in a new environmental era. To these can be added the most recently enacted legislation—the Forest Conservation Act, 1980 and the Air (Prevention and Control of Pollution) Act, 1981. These legislations were looked upon with hope by environmentalists since the legislators clearly had environmental conservation in mind, whereas the legislation brought into force prior to 1972 always had some other objective. The environmental conservation was only incidental to them. A brief study of the environmental legislations brought into existence in India since India's participation in UN Human Environment Conference in 1972 follows. It is proposed to give the salient provisions and then go on with the implementational issues. The questions related to the jurisdictional and procedural matters will not be dealt with since they were referred to above in considerable detail. However, it needs mentioning that the Wild Life (Protection) Act, 1972, and the Water Act, 1974, were passed by the Central Government after following the procedure provided in Art. 252 (two or more States adopting the enabling Resolutions empowering the Parliament to pass a Law on the subject). The Air Act, 1981, was to give effect to the decisions taken at the UN Conference on Human Environment held in Stockholm "to take appropriate steps for the preservation of the natural resources of the earth, which, among other things, include preservation of the quality of air and control of air pollution." With this a beginning has been made to make use of Article 253 of the Constitutian in the passing of environmental legislation.

The wildlife (Protection) Act, 1972, provides for the following:

(i) Constitution of a Wildlife Advisory Board;
(ii) Regulation of Hunting of Wild animals and Birds;
(iii) Laying down of procedure for declaring areas as sanctuaries, national parks, etc;
(iv) Regulation of possession, acquisition or transfer of, or trade in wild animals, animals articles and trophies and taxidermy, thereof;
(v) Provision for penalties for contravention of the Act.

The Act is definitely a great improvement over its predecessor Act in 1912. However, many things that could have been done like the establishment of natural reserves to protect certain areas in their pristine beauty was left undone. Because of the general preoccupation of the academics with such problems as water quality and air quality, the wild life Act has not been put to the same amount of scrutiny and incisive comment. By and large, however, it can be said that performance under the Act is satisfactory.

As the titles of the Water Act and Air Act follow an identical pattern, and since the same Board is to administer both the Acts, it is pertinent to comment on the title. As the titles suggest, the Acts are designed to "prevent and control" water and air pollution—where "prevention" may refer to the new sources of pollution and "control" may refer to the existing sources of pollution.

A brief study of the Water Act would indicate that the Act is very comprehensive in its coverage. It applies to "streams" which were defined to include "river water course, inland water and sub-terranean waters; sea or tidal waters", to such extent as determined by the State Government. Pollution sewage effluent and trade effluent are also fairly comprehensively defined. The Act makes provisions for the composition of the central and state boards. These Boards are autonomous and they can sue and be sued. Section 3 (2) and Section 4 (2) of the Act deal with the Constitution of the Central State Boards. A provision was made to represent the interests of agriculture, fishery or industry or trade and also of the companies or coporations owned, controlled or managed by the Central and State governments respectively. A provision has been made for a full time chairman and a member-secretary to exercise the powers conferred, and to perform the functions assigned to that Board under this Act. Sections 16 and 17 elaborately deal with the functions of Central and State Boards. Besides advising the Central government on matters concerning prevention and control of water pollution the Central Board also acts as the State Board for all the Union Territories.

While exercising the powers conferred, the Central Board is bound by the directions of the Central

Government whereas the State Board is bound by the directions of both the Central and the State Boards. Where a direction given by the State Government is inconsistent with the direction given by the Central Board, the matter shall be referred to the Central Government for its direction.

The Act deals with the control of Pollution in two ways; One, pollution caused by industrial effluents from the existing industry, and two, threatened pollution by effluents from the industries yet to be installed. The former is controlled by the Water Boards by virtue of the powers vested in them under Section 26 of the Act, through the 'application for consent' to charge sewage or trade. The latter can be regulated by the Water Boards in two ways: By imposing restrictions under Section 25 of the Act on new outlets and new discharges of trade effluents and by advising the government concerned with respect to the location of any industry, the establishment of which is likely to pollute a stream or well under Section 17 (1) and (n) of the Act.

The framework of the Air Act follows the pattern set by the Water Act. With a view to have an integrated approach the Central and State Boards established under Water Act will also perform the functions of the Central and State Boards for the prevention Control of Air Pollution. As the Air Act is extended to the whole of India, in States where the Water Act is not in force, it is proposed to constitute separate Boards for the Prevention and Control of Air Pollution. However, one very distressing point that needs mentioning about the Air Act that though the Act has been brought into existence the rules under which the Act is to be implemented could be adopted only after 20 months of delay. Without the rules enforcement of the Act could not begin. The enforcement problems under the Water Act, however, can be stated as follows:

Though the Water Act expressly confers powers and functions on the Water Boards, it is silent on the matter of funds. It leaves the matter to the State Governments. As long as there is an inadequacy of funds and uncertainty about the amount, it is unfair to expect the State Boards to enforce the Act effectively. Keeping this in mind the government considered a proposal to impose a cess to meet the expenses of the Central and State Boards for the Prevention and Control of Water Prevention. An Act, The Water (Prevention and Control of Pollution) Cess Act, 1977, was passed to help augment the resources of the Water Boards for the Prevention and Control of Water Pollution.

The other important provisions that merit special attention include Section 24 (1) dealing with the prohibition on the use of streams or wells for the disposal of polluting matter, etc. Under Section 24 (1) it is an offence to *knowingly cause or permit* to enter into any matter which may tend, either directly or in combination with similar matter, to impede the proper flow of water of the stream in a manner leading or likely to lead to a substantial aggravation of pollution due to other causes or of its consequencies by any persons.

The expression "knowingly" qualified the words "cause" or "permit" thereby making it obligatory for the prosecution to prove in either case the existence of knowledge on the part of the polluter before he can be held responsible. The situation where a person permits polluting matter into any stream by negligence is not covered.

The water board has no authority to directly deal with the erring industries and is required to approach the judiciary for issuing directions. Even when found guilty, a management can be punished with imprisonment and fine, but there is no provision to enable a court to direct any industries to close down. The court's procedures are time consuming and the inherent delays prevent quick and corrective action.

It is true that Section 32 of the Water Act empowers the Board to take some emergency measures. But that is only where it appears to the State Board that any poisonous noxious or polluting matter is present in any stream or well...*due to any accident or other unforeseen act or event.* As such, the following steps which the Board is otherwise empowered to take under this section like "removing that matter from the stream or well, remedying or mitigating any pollution caused by its presence, issuing orders immediately restraining or prohibiting the person concerned from discharging any poisonous, noxious or polluting matter into the stream or well" cannot be taken.

Finally, section 49 (1) provides that "no court shall take cognizance of any offence under this Act except on a complaint made by, or with the previous sanction in writing of the State Board...". Had the right been given to the individual along with the Water Board, the implementation of the Act would have been much more effective. These are some of the anamolies in the Act which, when rectified, would further enhance its efficacy.

India does not lag behind many countries in adopting or proposing to adopt environmental legislation, or for that matter in taking effective administrative measures. But the effectiveness of such measures needs to be judged not by the organizational set up that the legal measures establish, but on the basis of its performance and specific priorities.

As shown in the case of the Water Act, certain provisions reduce the efficacy of the enactment. A common feature with the environmental legislations in India is that they exclude the participation of the people with any genuine direct interest in its implementation. The enterprises which profit at the expense of the environment are always well represented and their interests are always well protected. Too many legislations, even if each of them covers one seemingly distinct area, are counterproductive in the long run for the protection of the environment. Hence, the need of the hour is to start thinking afresh into the entire issue of environmental pollution as suggested in the very beginning of this note, and to develop a unified and comprehensive approach.

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1984, XXIV, 4 463-466

Management of Airspace and Air Transport Environment, and Evironment Protection in India

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In view of airspace being a vital resource for planning and development of modern cities, a new management concept is emerging wherein an integrated view is taken of airspace management. Factors like ecology of a geographical region, climate, prevailing winds, population and industrial development, are taken into consideration for human settlements policy so that airspace is put to optimum use for a certain area.

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Airspace is an important part of environment of man. Like land areas, waters and outer space, air space environment shapes life of man and global society. Airspace is a rich resource also. Though this medium man creates productivity for society in diverse ways. Airspace is used for modern communication, transportation, remote sensing of ground-located resources, and a host of other uses directly and indirectly for society. Management of airspace is therefore an important consideration for our progress. It may also be submitted that creative management of airspace is a challenging task for our scientists, lawyers, air transport specialists, airport and city planners, communication experts and those who are keen to see a stable and ecological society living in harmony with nature. An ecological view of airspace management in recent years has become necessary to secure the protection of airspace environment. Air pollution and noise is causing a lot of concern to our society.

2. A New Look on Airspace Management

In traditional notion of air law, airspace belonged to land-owner and it extended to unlimited height upto the heavens. Modern view of airspace ownership is of course that airspace is a public property. It is therefore a resource which is to be used and cared for by the public interest. Indeed the pollution of airspace around industrial cities is largely due to this tragedy of commons. No single person is responsible to keep air clean. Dumping of waste into airspace and release of discharge from industrial plants have polluted air to a large extent. Thus a common resource which

provides good life for man, is made degradable by indifference of man.

Besides, in view of airspace being a vital resource for planning and development of modern cities, a new management concept is emerging wherein an integrated view is taken of airspace management. Factors like ecology of a geographical region, climate, prevailing winds, population and industrial development, are taken into consideration for human settlements policy so that airspace is put to optimum use for a certain area.

3. Air Transport Management: Objectives

Since the beginning of Air Age in 1905 onwards, airspace environment is by and large synonymous with air transport environment. Of course the next likely revolution through airspace environment is the impact on global society of communication media such as television and telephones and other communication aids being now developed all over the world.

Air transport management's view of airspace is a much debated issue and will continue to be so long as air transport is used for carrying of passengers, mail and cargo, and other uses that aviation is put such as providing aid in distress like in floods, and flight undertaken for hospital purposes etc. Flying for joy-rider and sport is also quite interesting aspect of airspace management.

The question is then how do we manage airspace for purpose of air transport? How do national and international aviation function without harming airspace environment?

International Civil Aviation Organisation (ICAO)

The global aviation management is guided admirably by ICAO a specialised agency of United Nations. Objectives of this world organisation are, *inter alia*, as follows: to ensure safe and orderly development of civil aviation in the world; to encourage arts of aircraft design; encourage development of airports, airways; to meet needs of people for economic and safe air transport; to prevent economic waste caused by unreasonable competition, to ensure rights of states to engage in international air transportation with fair opportunity to all; and promote development of international civil aviation.[1]

The ICAO has various offices in different parts of world with its headquarters being in Montreal, Canada. It has an Assembly, a Council and a Secretariat. It also has Air Navigation Commission, Air Transport Committee, Legal Committee and Technical Assistance Bureau. By ICAO Assembly Resolution No. 21-17, it recognised that the growth of civil aviation can make an important contribution to the economic development of developing countries. By Resolution A 18-11 ICAO also made its position known to the environmental impact of air transport. The Resolution stated that "ICAO is conscious of the adverse environmental impacts that may be related to aircraft activity and of its responsibility and that of its member states to achieve maximum compatibility between the safe and orderly development of civil aviation and the quality of human environment."[2]

It must be stated in depth that airspace environment is not an unlimited entity. Most of airspace or atmospheric space extends upto approximately 10 miles vertically from ground. This fact looks to a laymen even alarming since this is roughly the average distance we traverse daily commuting to office one way. And in this airspace we look for all our answers as if airspace extends to the skies. This is the small area which human kind has been polluting with contempt. Even the carbon dioxide content of this region has increased which is bound to change world climates as scientists warn. An important study by Professor Carl Christol of California University reveals a lot of adverse impact on the stratosphere and the depletion of ozone layer as a result of hydro-carbons and oxides of nitrogen being discharged by aircraft and spacecraft.[3] Indeed for similar assaults on nature, the American Association for the Advancement of Science has warned that men's forces over nature and capacity to change nature have exceeded nature's forces themselves.

4. Environment Protection and Aviation Management

The UN Declaration in Stockholm in 1972 on human environment says in Section 2 that "the pro-

tection and improvement of the human environment is a major issue which affects the well-being of peoples and economic development throughout the world...."[4] In section 6 it further stresses that "discharge of toxic substances or of other substances and the release of heat, in such quantities or concentrations as to exceed the capacity of environment to render them harmless, must be halted in order to ensure that serious or irreversible damage is not inflicted upon ecosystems. The first struggle of the peoples of all countries against pollution should be supported."

To safeguard airports, ICAO have drawn master planning manual for developing eco-systems around airports and for land-use planning so that airspace management is in equilibrium with nature's forces operating in an ecosystem.

The ICAO Airport Planning Manual (Doc 9184-AN/902 Part I and II of 1977) taken an integrated view of airport planning and considers relationship of large land areas needed to airspace necessary for aircraft operations p. 1-3. A systems approach is adopted for preparation of master plan. "The importance of balancing the respective capacities of the many elements and of ensuring flexibility and expansibility to meet changing needs are shown together with methods of achieving these objectives," says the Manual - p. 1-5. The gist of planning philosophy is summed up: "The most efficient plan for the airport as a whole is that which provides the required capacity for aircraft, passengers, cargo and vehicle movements, with maximum passenger, operator and staff convenience and at lowest capital and operating cost."—p. 1-5. Part II of the ICAO Planning Manuals with land-use planning in the vicinity of airports and environmental aspects as no standards have so far been made. In chapter 1, the Manual discusses airport and its environments. Then it analyses the need for environmental control and the need for land-use planning. The latter provides for land use for airport with minimum interference to the environment and public by locating residential areas away from traffic zones and noise level and by developing park lands.

Chapter 2 of above ICAO Manual touches upon ecological considerations of airport planning and use. Exhaust from turbo jets is accepted as lesser evil than from piston-engined aircraft. The study aims at protection of flora and fauna and maintenance of topography around airports and watershed patterns. Depletion of flora content, it says, is detrimental to ecological balance of airport eco-system. Also to avoid bird strikes, it stresses that airport should not be located along routes where birds migrate. Moreover, soil erosion should not be caused by aircraft jet blast. By far the most important environmental factor is to reduce aircraft noise from aircraft. Take-off and landing directions are to be planned so that they do not fall along inhabited and populated areas. Noise abatement measures are needed to control aircraft noise. On pollution by exhaust, much research is going on. Ground run-ups have been cut down considerably.

Lastly, land uses around airports are planned carefully to provide for agriculture for vacant land at airports, and establish recreational areas so that airports are made attractive and environment management improved.

5. Air Pollution Control Act 1981

For better preservation of airspace environment, measures have been taken in India to control pollution of air. Such acts for clean air have come up all over the world for protection of airspace environment. In India, Air (Prevention and Control of Pollution) Act 1981 provides for protection of airspace environment. The said act has been enacted in pursuance of U.N. Declaration on Human Environment in 1972. It defines air pollutant as any solid, liquid or gaseous substance which when in excess concentration becomes injurious to health. It establishes a Central Board for the prevention and control of pollution of air. The State Boards for prevention of water control are also to exercise power for air pollution control under this act. The Central Board may advise Central Government on matters for improving quality of air, plan a nation-wide programme for prevention and abatement of air pollution and co-ordinate the activities of state boards. The State Boards are to advise State Government on measures for prevention of air pollution. Under Section 19 of Act, State Governments can declare air pollution control areas for purposes of control of air pollution. The Act sets up State

laboratories for taking samples of air. It provides for penalties for certain acts which cause air pollution.

Thus we see an eco-system approach being evolved for management of airspace and even air transport environment.[5] As the Report of Committee of Department of Science and Technology for Environmental Protection has said in September 1980: The natural ecosystems may represent our only hope for finding the basic material for restoring the health of completely devastated landscapes...p. 18. It further says: "A basic and vital aspect of environmental conservation is that representative areas typical of the physical beauty and character of country, celebrated in the literary and oral culture from time immemorial, should be preserved"—p. 18.

An ecological view of air transport and airspace management does take all aspects of environment into considerations while we develop aviation for the economic use in the country. Indeed there has to be harmony between scientific concepts and management and legal concepts for eco-developments.[6]

6. Summary

Airspace and air transport management are a creative function of modern planners and scientists. In a crowded world, we have finite airspace. Hence it is our duty to preserve this rich resource base for our good health, our economic development, and live in harmony with nature. Even visual pollution of airspace presents unesthetic sight and clean airspace environment becomes necessary for better quality of life. Laws are there to control airspace pollution and aircraft noise. But what is now emerging as important thinking of man is; to promote an eco-system management ment of airspace around cities, around airports and the whole population settlement areas, so that our population centres manage airspace with an integrated view of other natural order of flora, fauna and water systems etc.

Airspace environment management is therefore a new challenge to those who believe in progress in a creative and finite scientific world of our times. Better management leads to better protection of airspace environment.

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1984, XXIV, 4, 467-473

Management of Toxic Wastes

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With the rapid growth and expansion of the chemical industry, in India, we are likely to face in the near future serious problems of hazardous waste management. It would be in our interest therefore to anticipate some of the problems in the light of the experience of highly industrialized countries. Although highly desirable, complete mechanization and automation of toxic waste disposal may not be feasible in our country.

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1. Introduction

Industrial development is invariably associated with the generation of huge quantities of hazardous wastes of a diverse type. The transport, handling and disposal of these wastes, besides being expensive, have inherent risks to human health. The conventional practice of dumping such waste in lands and sites away from human habitation is also no longer feasible for soon such land has to be pressed into service for some form of productive activity or establishment of industrial estates or housing colonies. This is very clearly borne out by the examples of Bandup and Deonar in Greater Bombay, Naraina in New Delhi or the MRC Nagar on the Adyar creek in Madras. Another serious problem posed by such dumps is the possibility of some of these sites being abandoned after some time and being taken or by private house bailing societies. The Love Canel episode had dramatised in recent times the macabre consequences of such a transformation. There was also wide publicity in mass media in August 1983 of an incidence in which a group of young pioneers in southern France discovered drums of debris collected from the serveso disaster site in Italy in 1975. The private agency which was entrusted with the task of the transport of the drums from Italy to France had to admit publicly that the debris represented all the scrubbings of reaction vessels which were used in the production of dioxins.

International Agencies have been deeply concerned about the inadequate state of our existing knowledge to cope with the many side problems posed by the management of toxic wastes. A joint programme

between UNEP and the Euro Regional office of WHO resulted in a publication entitled 'Hazardous Waste Management—Policy Guidelines and Code of Practice'. This paper attempts to present an overview of the problems of toxic waste management in the context of a developing economy.

2. Definitions

Anything that is not wanted at a given place and a given time and which has no current or future marketability may be called a waste. In view of the fact that even storage of waste by dumping may require space, waste is also something that adds to the capital cost of industries. All wastes are not necessarily hazardous. A waste becomes hazardous when it acquires or has inherent physical, chemical or biological characteristics with a potential to affect adversely human health or the environment. In order to avoid the above risks special handling and disposal techniques are called for in dealing with toxic wastes.

In deriving a definition for the term 'Hazardous wastes' the following criteria are used:

(a) Short-term acute hazards, acute toxicity by ingesation, inhalation or skin contact: corrosive effects on skin or on eyes or the risk of fire or explosion:

(b) Long term or chronic toxic effects upon prolonged or repeated exposure: ability to induce tumor formation which may be induced by an acute exposure but may be detected only after a long latent period, resistance to biotransformation within the body: and

(c) resistance to degradation in the environment: the potential to pollutants surface or underground water.

Wastes with the above properties may arise as bye-products, process residues, spent reaction media, contaminated plant or equipment or when the consumer has discarded them. A hazardous waste of special significance is toxic chemicals which become outdated or stocks of which have been declared surplus and have therefore to be disposed of or toxic chemicals which on transportation from the manufacturing site to the consumer site are involved in an accident or contaminate a cultivated farm land.

3. Criteria for Identification

In some cases, wastes have well defined dangerous properties and are unequivocally hazardous and arise by the use of commonly encountered toxic chemicals like corrosive acids, toxic chemicals like cynanide etc. The majority of wastes which one has to deal with in practice are, however, complex mixtures which do not lend themselves to chemical characterisation. From the point of view of waste management, the hazard characteristics mentioned in Section 2 are more relevant than the knowledge concerning their chemical composition.

Industrial wastes are potentially hazardous by virtue of the following:

— Substances known or unknown are present in the wastes and their concentration and the reactivity cannot be assured.

— the physical form in which the substances are present viz as solid, liquid, or gas can profoundly effect the target

— mobility and persistance of the chemical in the environment.

— targets available in the environment and their vulnerability to the chemical.

— availability of remedial measures and their cost effectiveness as related to benefits.

Ideally the individual components of a waste should be known to estimate the total hazard. In practice, when dealing with a toxic waste broad compositional data alone may be available. This may be adequate for immediate and pragmatic action. Taking waste cyanide heat treatment salts as an example the presence up to 5 percent cynamide in the waste is sufficient to decide as to which handling and disposal techniques are appropriate to the situation.

In general, liquids or sludge waste is more liable to cause water pollution problems than solid waste as inhalation hazard exists, in industries handling or processing asbestos, fibrous waste is inherently more

hazardous than matrix—bound asbestos waste such as asbestos cement.

Particle size of a solid waste is an important criterion. The presence of respirable size particles (less than 5 n m size) is more hazardous than large size particles of the same toxic chemical. Thus finally divided metals are accutely hazardous while the same material in large pieces may be safe. Solids for-med by cooling from the molten state are generally less hazardous. · Thus metal slags are considered relatively non hazardous in spite of their containing high concentrations of toxic metals.

Quantity of the waste is an important criterion. Thus the handling of a few hundred kg of a toxic waste demands a solution different from the one for handling tonnes of relatively non hazardous waste. To prescribe for administrative convenience that a minimum quantity must be present to be treated as a hazardous waste has, however, dangerous implications.

4. Exclusive and Inclusive Lists of Hazardous Wastes

When one draws up a list of known wastes which present no significant short-term handling or long-term environmental Hazards, hazardous wastes may be considered as those which have not to be listed. In the United Kingdom the principle of *exclusive listing* was practised for wastes for which notification of deposit was statutory requirement. An example of exclusive lists is given in Table I· Extra environmental safeguard was incorporated. The exteria of listed waste was mostly qualitative. The list is very simple. The qualitative and subjective criteria used bringing in a certain element of uncertainty.

Listings of hazardous waste with or without accompanying criteria are *inclusive lists* used currently in Belgium, Denmark, France, FRG, the Netherlands, Sweden, UK and USA. The lists comprise wastes from certain industries, wastes containing specific components or specific waste streams identified by the processes from which they orginate. There is substantial international agreement on the components of the wastes designated as hazardous. The inclusive list offers a greater degree of certainty but the disadvantage may be that the omitted items may be significantly hazardous.

5. Waste Hazard in the Management Cycle

The management sequence for any particular hazardous waste comprises

— its generation
— transport
— storage
— treatment and
— final disposal.

Many hazardous characteristics, e.g. corrosivity, foammability and high acute toxicity by ingestion, inhalation or skin absorbtion will be problems at all the above stages. In contrast, many wastes which offer no significant short term handling hazard may cause severe disposal problems based on their physical chemical properties.

6. Examples of Hazardons Wastes

(*a*) *Well defined regular hazardous wastes arising* from the chemical industry.

Currently about 20,000—30,000 chemicals are manufactured at amounts greater than 1 tonne per annum.

Based on the products Chemical industry can be divided broadly into:

— organic chemical industry
— inorganic chemical industry

Organic chemicals—are derived.

i. from oil, natural gas and coal in large scale continuous process plants.
ii. conversion of primary chemicals by chemical transformation into secondary and intermediary products going into diverse streams.
iii. downstream processing of intermediates into final products dyeshifts, cosmetics, pesticides, pharmaceuticals, fine chemicals, plastics, resins, synthetic fibres, elastiomers or detergents.

The majority of both alphetic and aromatic chemicals are today derived from the oil refining and petrochemical industries by distillation of crude oil, steam cracking and catalytic refining of selected fractions.

The continuous nature of the production processes based on a specified feedstock and on standard plant conditions, means that the residues generated from any

particular stream are reasonably constant in composition and properties. However, frequently extremely complex materials and residues occur as solids, liquids or gases.

In the downstream processing, both batch and continuous processes are involved. Chemical conversions are complex and residues may contain unreacted feedstock, byeproducts, tars, filter-cakes, precipitated materials, solvents and acids or alkalies, Residues from the organic chemical industry are usually mixtures of varying complexity, may be soluble, unsoluble, toxic, inert, corrosive, flammable and may contain suspected or known carcinogens.

Inorganic chemicals still dominate chemical industry. Traditional products are sulphuric acid, phosphoric and nitric acids, lime, ammonia, chlorine and alkali.

Worldwide 100 million tonnes of phosphate rock are mined annually for the production of various phosphate salts.

7. Waste Management

Waste management is the organized, systematic channelling of wastes through appropriate recovery or disposal routes consistent with acceptable public health and environmental safeguards.

Treatment:

All methods of treatment on the modification of the physical and/or chemical properties.

Volume reduction:

Precipitation
Dewatering
Immobilization
Detoxication

Physical methods include:

Phase Separation: By filtration or centrifugation

Solidification: Where the waste is fixed on an inert and inpervious matrix.

Chemical Treatment methods aim at complete breakdown of hazardous chemicals into non-hazardous products. Reduce water Solvability.

If it is acid, neutralize. If it is alkaline, oxidize.

Biological Treatment includes both detivated sludge treatment or use of microorganisms for bio degradation.

Disposal:

Landfill
Incineration
Dumping into sea
Underground disposal
Deepwell disposal

8. Environmental Considerations

As a basic principle, waste should be disposed of so that adverse effects are minimised such that

— human health is not threatened,
— livestock, game, non game species and fish are not threatened.
— Water bodies, soil and useful plants are not affected,
— harmful environmental effects are not produced,
— interest of nature conservation, landscape management and townplanning are protected and
— law and order are not disturbed.

9. Legislative and Legal Aspects

Enactment and enforcement of a law a is preprequsite for the development of a comprehensive system for the disposal of hazardous wastes. The first step towards this is the assessment of existing laws and regulations. Thus, legislation on pollution, production and transportation of goods, water and waste water management or health and safety at work might already include basic provisions for hazardous waste management which could be amended or extended in scope. Care is needed to ensure that specific hazardous waste legislation neither duplicates nor contradicts measures already in force. Legislation could be in the form of a law or issue of administrative procedures in accordance with the constitution of the country.

The following general principles may be taken into consideration while enunciating any frame work.

Legal provision

(1) Principles of waste management should be legally binding, the generation of waste should

be minimised, material recovery should be used wherever technically and economically feasible.

(2) Hazardous waste should be defined in a general but unambiguous manner leaving details to be described in administrative instructions.

(3) In the present state of knowledge, it may not be possible to regulate all disposal processes unless sufficient scientific evidence is available.

(4) Legislation should give due regard to predisposal options.

(5) Legislation on waste management can be part of a comprehensive law covering all aspects of hazardous substances, including import, processing and transport.

Regardless of who provides the waste disposal services, the legal responsibility for the disposal of waste should remain with the waste generator. In turn the waste generator should be committed to the following objectives:

— choice of appropriate transport and disposal methods

— avoiding minimizing, and recycling wastes as far as is technically feasible

— correct labelling and declaration

Hazardous waste management should be basically controlled by three different groups of measures:

(a) control of waste—at the level of generating process

(b) control at the level of licensing procedures for potentially hazardous activities.

(c) 'Cradle to grave' systems of notification of wastes.

10. Responsibilities of the Waste Generator

The Waste generator is responsible for:

Declaration of Wastes in Standard proforma to give details of handling, storage, transport and disposal.

The waste generator provides the necessary information on the nature, composition, consistency and the amount of waste and should enunciate clearly the consecutive steps of disposal.

Collection and storage

Empirical studies indicate that most accidents take place during transport. There should be a good licensing system to control contractors who undertake waste disposal.

Storage and Reception Centres

Storage within the manufacturing facility will be regulated by licensing the production activity. Storage outside the production premises and the establishment of reception centres should be regarded as a constituent part of the disposal process.

11 Accident Registers

Very useful guidelines can be evolved by Commissioning objective case study reports. In the United Kingdom, a survey of accidents that had occured on local authority landfill sites revealed that most of the accidents were unrelated to the toxic and flammable properties of the wastes but were more linked to safety aspects of manual and mechanical handling. The Annual Report of the Directorate General of Factory Inspectorate, Government of India gives the number of accidents and fatalities without essential details. The management of chemical industries should be encouraged to keep fully documented case histories of accidents and how they were handled. The National Safety council, and the National Productivity Council should jointly sponsor such studies.

12 Conclusion

With the rapid growth and expansion of the chemical industry, in India, we are likely to face in the near future serious problems of hazardous waste management. It would be in our interest therefore to anticipate some of the problems in the light of the experience of highly industrialized countries. Although highly desirable, complete mechanization and automation of toxic waste disposal may not be feasible in our country. Garbage disposal today is very much dependent upon the exploitation of unskilled labour. The sad state of the civic amenities of our major cities is reflected in the fast deteriorating living surroundings of our houses. When toxic chemical wastes will be loaded to this load, the burden may be too much for the existing system to bear.

Inventories of solid wastes to be handled by local authorities will have to be updated and supplemented with information on the nature of hazardous wastes dumped in landfills. Advanced Institutions of Technological Research and Education should be encouraged to take up extensive and intensive studies on problems of waste management, particularly, their recycling and disposal by non-polluting methods.

Health surveillance programmes on communities living in the proximity of major solid waste dumps should be undertaken to assess as to how far the core disease pattern already existing thanks to the poor environmental sanitation, is modified by the superimposition of chemical wastes.

Public sector undertakings including the Atomic Energy Establishment with a high potential for toxic waste generation set up systems for their safe handling which should be exemplary and a source of inspiration to other waste generators to emulate.

Table 1 Exclusive

Class I	Wastes normally arising in the use of premises for domestic purposes.
Class II	Wastes normally arising in the use of premises as an office, retail shop. etc.,
Class III	Other wastes—construction, repair maintenance or demolition of plant or buildings., launderying drycleaning—working of mines, dry cutting of metals, softening of water, sewage, breeding of livestock, brewing and fermentation.
Class IV	Listing by name of product. paper, cellulose, wood (including saw dust) oiled paper, tarred paper, and plaster board, plastics, clays, cermica, mica, abrasives iron, steel, aluminium, brass, copper, tin, zinc, coal, coke carbon, graphite, ash, clinker, slags, rubber, electrical fittings, cosmetics, sands, boils scales, cement concrete, cork, wool, cotton, soap and detergents, food wastes, vegetable matter. etc.,

Table II Examples of Hazardous Wastes

1. *Wastes from the manufacture of primary and intermediate organic chemicals*
   Acid tar from coal tar industry.
   Tarry wastes
   Waste from chlorinated aromatics.
2. *Wastes from mauufacture of primary pharmaceuticals*
   Mixed solvents
   Aqueous slurry
   Liquid wastes
   Phenols.
3. *Selected wastes from down stream processing;*
   Diphenylamine, aromatic intermediate of dyestuff industry.
   Aqueous wastes of biocides
   Filter press cakes
   Liquid tar
4. *Selected residues from inorganic industry*
   Arsenic
   Ammonia fluorides.
5. *Metal finishing*
   Fluroborates, cyanide, cadmiumum
   Miscellaneous:—Tanks, Storage wastes etc.,

Table III Example of an Inclusive List

List of hazardous substances requiring priority

1. Arsenic and compounds
2. Mercury and compounds
3. Cadmium and compounds
4. Thalium and compounds
5. Beryllium and compounds
6. Chromium compounds
7. Food and its components
8. Antimoni and its components
9. Phenol compounds
10. Isocyanates
11. Orgarohalogen compounds
12. Cyanide compounds
13. Chlorinated solvents
14. Organic solvents
15. Biocide phyico-pharmaceutical preparations.
16. Tarry materials from refining and tar residues from distillation
17. Pharmaceutical compounds
18. Peroxides, chlorates, perchlorates and azides.
19. Ether
20. Lab chemicals
21. Asbestos
22. Selenium and its compounds
23. Tellurium and its compounds
24. Polycyclic hydrocarbons.
25. Metal carbonyls
26. Soluble copper compounds
27. Acid and or basic substances usedf or surface treatment and finishing of metals.

Table IV

Cost of Disposal in West Europe as of 1979

Method	*Cost US$/Tonne*
Simple disposal to land	1-20
Disposal to a land via site lined with plastic sheet.	10-50
Underground disposal by dropping into old wells or mines.	20-150
Land disposal after encapsulation either by mixing waste with cement or by incarceration whole drums in cement	10-100
Coastal sea dumpings from ships barges	5-15
Deep ocean dumping beyond to continental shelf	10-150
Simple incineration without heat recovery	30-150
Incineration with alkaline stock scrubbing	100-350
Incineration on board ship at sea	50-350
All types of chemical treatment Destructions of cyanide by hypochlorate	300-350
Reduction of chromic acid	100-300
Destruction of cyanide	200-250

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Productivity
1984, XXIV, 4, 475-480

Management of Hazardous Wastes The Case of Hongkong

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During the past fifteen years a number of well publicised events have focused public attention on the risks that can result from the uncontrolled disposal of hazardous waste. The paper focusses on harmful effects of waste and also approaches to control waste disposal.

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Introduction

In the Love Canal district of New York State the health of many people was seriously harmed by the effects of hazardous waste dumped several decades earlier. Similar instances have occurred in Europe, though without such serious effects, the cause in each case being the migration of organic material from uncontrolled hazardous waste dumps. In Japan the chronic diseases Itai-Itai and Minimata were eventuatly found to be caused by industrial waste discharges containing cadmium and mercury. Such serious incidents are fortunately rare but they do serve to illustrate the potential results of indiscriminate disposal of wastes containing toxic, or otherwise hazardous substances.

Much more common are incidents involving fly-tipping or illegal dumping which usually do not cause serious risk to large numbers of the public but which can cause death or serious injury to disposal site workers or disruption and pollution of water in supply systems, lakes and rivers and so on. Details of several incidents involving hazardous waste disposal are given in Table I.

Many forms of human activity produce waste which could be considered hazardous but in the case of waste from households, commercial establishments and the majority of industrial firms these hazardous materials comprise a very small fraction of the total quantity and present little risk to the publlc or the environment since suitable collection, transport and disposal methods have been developed through many years of experience.

However some industries and commercial establishments do produce waste which if handled in the same way as ordinary refuse or garbage could present serious risks to either employees engaged in waste collection and disposal or to the environment in the vicinity of the disposal site. These wastes have to be collected and handled separately and may require specialised treatment before finally being disposed of in controlled tips. In order to select the appropriate treatment and disposal method there must be available precise and accurate details of the composition and properties of the waste. This is achieved by legal controls requiring the waste disposal authorities to be notified of the intention to dispose of hazardous wastes.

Hazardous waste generation in Hong Kong

Hazardous waste arises mainly from the manufacturing sector with the heavy industries using primary raw materials being the largest producers. Light manufacturing industries, producing mainly consumer goods, predominate in Hong Kong there being very little primary production, and so the arisings of hazardous waste should be smaller in quantity and variety than in other industrialized countries.

In December 1980 there were a total of 45409 manufacturing establishments in Hong Kong employing 892140 persons [8]. Most of these establishments are quite small companies and two-thirds employ fewer than ten people each. The range of industry is very wide; from food and beverages through clothes and shoes to manufactured chemicals, consumer goods and machinery.

Before 1981 no systematic studies of the types and quantities of hazardous waste in Hong Kong had taken place. The information that was available to the Government had been obtained from small scale surveys to investigate specific problems or from companies which had approached the Government with proposals to set up new industrial processes or for help in disposing of especially hazardous or difficult wastes. In order properly to assess the need for facilities to dispose of hazardous waste a survey of industries producing hazardous waste was needed. At that time (early 1981) the Government's manpower resources in the environmental field were quite limited and so a local consultant, Pypun-Balfours, was commissioned to undertake the work. The study started in October 1981 and the completed report was delivered to the Government in February 1983.

With over 45000 potential hazardous waste producers it is clearly not feasible to interview each one to carry out a complete survey or even undertake a postal survey. A technique was employed therefore which allows the results of a survey of a smaller number of firms to be used to estimate the total. Previous work [9] has demonstrated that the waste production per employee is fairly uniform for each sector of industry, and so provided that the survey covers a statistically significant proportion of the workforce in each industrial category, this factor may be used as the basis for estimating the total arisings of hazardous waste from industry. The industrial survey was based on personal interviews with supplementary information obtained by postal questionnaires. Over 500 interviews were conducted with a bias towards those industries that are more likely to produce hazardous waste. Over 700 questionnaires were despatched, mainly to industries which would not normally produce hazardous waste. Around 140 replies to the postal questionnaires were received, a return rate of approximately 20 per cent.

The survey identified a total production of 16000 tonnes per annum of hazardous waste which can be scaled up on the basis discussed above to give an estimate of total production for Hong Kong of 37000 tonnes per annum. The major industrial sectors producing hazardous waste are non ferrous metal; fabricated metal products; electrical machinery; electroplating; transport equipment; transport and utilities (including oil storage); and professional, scientific and photographic equipment.

Most of the waste identified are liquids or pumpable sludges: oils, acids, alkalis, oil and water mixtures, metal salts, and chlorinated and non-chlorinated hydrocarbon solvents are the most significant. A large number of contaminated containers (250000) and waste dry batteries (2.5 million) are produced by firms covered in the survey. Both these commodities are so variable that they were assessed separately and are not included in the total tonnage. Table II shows the principal cate-

Table 1

Examples of the consequences of improper disposal of hazardous waste

Incident	Year	Country	Reference
Dumping of organic chemical wastes in Love Canal between 1930 and 1950. Chemicals migrated into house basements after unusually high groundwater levels in mid 1970s. Health effects attributed to this cause include spontaneous abortions, birth defects, nervous breakdown, asthma.	1976	USA	Glaubingar [2]
The driver of a road tanker mistakenly discharged five tonnes of waste sulphide liquor into a disposal sump which was reserved for acid waste. The driver of another tanker later discharged acidic waste into the sump and was killed by hydrogen sulphide evolved in the reaction of the two wastes.	1975	UK	Keen [4]
A chemical formulation and packaging company generated approximately forty 210 litre drums of waste as a result of a stocktaking exercise. Each drum contained miscellaneous chemical wastes, mostly floor sweepings. The containers were transported to a hazardous waste controlled tip where one of the drums exploded violently several minutes after being tipped.	1978	UK	Author's personal experience
A transport contractor illegaliy tipped drums of chemicals on a controlled tip. Several of the drums, which were damaged and rusty contained aluminium chloride which reacted with rain water causing clouds of corrosive hydrogen chloride to be emitted.	1980	UK	Author's personal experience

gories of waste identified in the survey and the estimated total production in Hong Kong for each category. Almost 70 per cent of the waste identified in the survey originated in Junk Bay, Tsuen Wan and Kwun Tong with the remainder spread fairly evenly among the other industrial centres in the urban areas, including the new towns.

Present methods of disposal

The survey of waste producing industries also examined the methods presently in use in Hong Kong for disposing of hazardous waste. Despite the wide variety of hazardous wastes produced, the methods of disposal used may be classified into five main types:

(*a*) *In-house liquid waste treatment*

The waste is treated at the factory by physical and or chemical processes in order to detoxify or concentrate it. The residues have then to be disposed of.

(*b*) *Discharge to sewer*

Waste liquids or sludges, are discharged, either directly or after treatment.

(*c*) *Controlled tipping*

Solid wastes or sludges are dumped with household and commercial wastes in landfill sites which are con-

Table II
Hazardous waste production in Hong Kong

Waste Category	*Waste Identified in Survey (t/a) (m^3/a in parentheses for liquids)*		*Estimated Total Waste Arisings for Hong Kong (t/a) (m^3/a in parentheses for liquids)*	
Acid wastes	1528	(1389)[1]	6490	(5901)[1]
Chromic acid (as Cr)	9*		66*	
Alkali wastes	5854	(5322)[1]	7810	(7099)[1]
Copper salts (as Cu)	8.3		28.6	
Zinc salts (as Zn)	0.2		1.1	
Nickel salts (as Ni)	8.4		57.5	
Other metal salts	135		300	
Toxic metals	I23		322	
Hazardous metal oxides	1404		1408	
Cyanide wastes	50.5	(50.5)[2]	141	(141)[2]
Oxidizing agents	4.9		7.9	
Halogenated solvents	475	(325)[3]	1558	(1066)[3]
Non-halogenated solvents	680	(849.5)[4]	3571	(4464)[4]
Phenols and derivatives	0.8		1.9	
Polymerization precursor and production wastes	35.5		40.3	
Mineral oils	1365	(1517)[5]	2950	(3278)[5]
Fuel oil	2015	(2239)[5]	2051	(2279)[5]
Oil/water mixtures	1161	(1161)[2]	7687	(7687)[2]
Pharmaceutical products	0.5		1.0	
Mixed organic compounds	37.5		88.9	
Mixed inorganic compounds	17.0		72.9	
Miscellaneous chemical waste	19.5		33.1	
Contaminated containers*	2.5×10^5		6.5×10^5	
Interceptor and treatment plant sludges	6.1		40.7	
Tank cleaning sludges	720		720	
Tar, asphalt, bitumen and pitch	136		136	
Tannery wastes	125		499	
Printing wastes	10.6		85	
Dyestuff wastes	8.5		36.4	
Plating bath sludges	66.3		114.6	
Paint wastes	187		442	
Waste catalysts	3.5		4.4	
Waste batteries*	26×10^6		3.1×10^6	
Total	16185		36699	

* Included in acid waste arisings
1. Based on specific gravity of 1.1
2. Based on specific gravity of unity
3. Basec on specific gravity of 1.46
4. Based on specific gravity of 0.8
5. Based on specific gravity of 0.9

* Quantities expressed in term of numbers of items. Density of all aqueous sludges assumed to be unity.

structed as layers of compacted waste separated by layers of soft fill material. This method is known as controlled tipping in the United Kingdom and as sanitary landfill in North America.

(*d*) *Incineration*

There are no generally available hazardous waste incinerators in Hong Kong but the Government operates three continuous municipal incinerators which are used occasionally for the disposal of small quantities of hazardous and difficult waste materials.

(*e*) *Recycling*

The recycling of waste materials is an importaut industry in Hong Kong and a significant export earner. Hazardous wastes which are recycled tend to be those which can be reused in place of standard raw materials without much additional processing.

Controls on hazardous waste

Hong Kong has not suffered the serious consequences of indiscriminate disposal of hazardous waste that

has affected some other industrialised countries [10]. The predominance of liquid hazardous wastes and the concentration of industry in coastal areas has allowed most hazardous wastes to be discharged into the sea where the relatively strong local currents have afforded rapid dilution and dispersion. Problems have occurred in localised areas from discharges of hazardous wastes to watercourses in the New Territories and surface water drains and culverts in the urban areas.

In the sixties and early seventies, studies of marine waters in Hong Kong established that the assimilation capacity of the harbour was rapidly being used up and that sewage treatment plants would be needed before 1991 to prevent widespread oxygen depletion [11]. The water in Tolo Harbour and Deep Bay are partially enclosed and require treatment plants to prevent serious pollution resulting from the rapidly increasing population of the new-town developments. Sewage treatment plants are under construction or at the design stage for all major urban areas in the New Territories and will eventually be provided for the urban areas which discharge to Victoria Harbour. Experience elsewhere [12] has shown that it is essential to control the discharge of many industrial wastes to sewage treatment works to prevent serious disruption to the biological treatment units and to limit the concentration of toxic materials in the sewage sludges. This is especally important where disposal of the sludge on the land or at sea is proposed. Control of industrial waste discharges is also required to protect sewer workers from toxic or corrosive fumes and to prevent the release to the receiving waters of harmful materials which are not removal by normal sewage treatment processes.

Control over discharges to sewerage systems will result in a significant increase in the transport to treatment or disposal facilities of both raw wastes and the sludges produced by preliminary treatment on factory premises. It is important to ensure that this does not lead to haphazard disposal or fly-tipping of hazardous wastes, and so proposals are being developed by the Government to establish specialised hazardous waste treatment and disposal facilities and new legislative controls to ensure that all hazardous wastes are stored, transported and disposed of in a safe manner.

Development of legislation

The UK in 1972 became the first country to institute comprehensive legislation to control the transport and disposal of hazardous waste when the Deposit of Poisonous Waste Act [14] was passed following public concern at the discovery of solid cyanide wastes fly-tipped on land used as a children's playground. During the following few years most of the industralised nations passed similar laws but with the difference that whilst the UK law defined hazardous waste by reference to a list of non hazardous wastes (i.e. those that are exempted from control) legislation elsewhere included reference to lists of hazardous wastes or to chemical criteria for defining hazardous wastes [3]. The original UK system which is based on what came to be known as the 'exclusive list' system was eventually replaced in 1981 by the Special Waste regulations [1] which are based on criteria for defining hazardous wastes in terms of their toxicity.

The attraction of the exclusive list system is that it can be drafted very quickly which is why it was chosen as the UK system when new legislation had to be rushed through parliament. However it is imprecise and leads in practice to control over many wastes which are not particularly hazardous. The development of an inclusive list system involves the consultation of lists of hazardous wastes, or of hazardous constitutents of wastes, and its operation frequently requires chemical analysis to establish the composition of the waste.

Any system of control of hazardous waste in Hong Kong has to be both precise and simple to operate. The proposed system would operate as a series of schedules beginning with lists of individual industrial wastes which cover most hazardous waste being produced on a regular basis. Other schedules are being developed to cover potential hazardous wastes from outside the manufacturing sector. Categories of waste which are being considered at present include:

(i) A list of individual hazardous wastes.

(ii) Waste dangerous goods as defined by the Dangerous Goods Ordinance subsidiary legislation.

(iii) Waste pesticides.

(iv) Waste solids, liquids and sludges arising from emission control processes.

(v) A list of hazardous constituents of waste with defined minimum concentrations of the constituents and medium quantities of the waste.

It is envisaged that the list would be run through as a series of screening tests; most hazardous wastes will be covered by the first four categories and chemical analysis will be required on relatively few occasions. Used containers which have held or are contaminated with hazardous wastes may be included in the overall proposals.

Any wastes which are included in the lists would be covered by Section 17 of the Waste Disposal Ordinance [7] which requires notification to the Director of Engineering Development of the intention to dispose of hazardous waste and prohibits disposal other than according to directions given by him. Since almost all waste disposal in Hong Kong is done by the Government, or by contractors on the Government's behalf, these directions will include details which would in other countries be included in the contract or agreement between waste producer and waste disposal contractor.

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Productivity
1984, XXIV, 4, 481-486

The EIA System of the Philippines : In Search for Environmental Quality

AMADO S. TOLENTINO

This paper focuses on the Environmental Impact Assessment (EIA) system of the Philippines. It traces the evolution of the legal framework, describes the procedural flow and analyses the institutional set-up and methodology involved.

Despite its imperfections, the Philippine EIA system is one that contributes to good management and effective cooperation among agencies involved in environmental management. It can thus be of great value not only to the Philippines but also to other developing countries.

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In developing countries like the Philippines, much of the eflort to raise the standard of living involves deliberately modifying the natural environment. Constructing roads, dams, airports, irrigation and sewage systems, power plants, and industrial facilities frequently result in ecological problems because the consequences on the environment were not adequately considered in project planning or implementation. Also, where adverse ecological consequences are forecast, effective steps to prevent or minimize the damage may sometimes not be taken because data on cost effective safeguards of project alternatives are inadequate.

Lately, however, there is evidence of a new movement in the modern world in the field of environmental protection. This involves the use of a new management tool referred to as environmental impact assessment (EIA). Environmental impact assessment is the study of all the environmental impacts of a project and a discussion of the direct and indirect consequences of all such impacts upon human welfare and ecological and environmental integrity. The documentation of the study is called environmental impact statement (EIS).

The Legal Framework

When President Ferdinand E. Marcos created the National Environmental Protection Council (NEPC) on April 18, 1917 through Presidential Decree (PD) 1121, environmentalists in the Philippines knew that the requirement for an EIS was forthcoming obviously because the decree listed as an NEPC function, among

determined that an EIS should be prepared, the proponent is instructed to conduct an EIA.

Once the assessment is done, the proponent submits the draft EIS to the NEPC which will publish a brief description of the same in a newspaper of general circulation and in an conspicuous place in the locality where the project is to be located. At the same time, comments from government agencies with expertise or regulatory power over the project as well as the lead agency and interested parties are elicited after which the NEPC Secretariat collates all the comments received. At this point, the NEPC Review Committee (RC) decides whether a public hearing should be held for a further and thorough solicitation of facts and materials concerning the proposal. The decision to conduct a public hearing may be based on any of the following: substantial environmental, social or economic impacts, the magnitude of the proposed project in terms of economic cost, the commitment of resources or geographic area; the wide response to the project as shown by the number of requests from government agencies and interested parties as well as strong manifestations by environmental defense groups or non-governmental organizations (NGOs).

Taking into consideration the outcome of the public hearing, the proponent prepares the final EIS and submits the same to the NEPC. The NEPC, through its Review Committee, finally determines if the EIS is approved or should be revised or should not proceed at all because of the tremendous adverse environmental impacts it will generate.

If approved, an Environmental Clearance Certificate (ECC) is issued to the proponent which gives him the authority to proceed with the implementation of the project. Said ECC contains conditions which the proponent is bound to comply with. One of these conditions may be related to the mitigating measures which should be incorporated in the project implementation like the installation of specified anti-pollution devices. Otherwise, the ECC could be suspended or cancelled and the project proponent subjected to a fine not to exceed Fifty-Thousand Pesos (P 50,000.00), Philippine currency, at the discretion of the NEPC.

Compliance with the mandate of EIS legislation is growing and this is not primarily due to the penalty provided for by law but because of the awareness granted by the public information program of the NEPC. Besides, inaction or non-compliance on the part of a proponent to file an EIS when required would entail either penalties in the form of such administrative sanctions as withholding of permits or licenses, court injunction and even prosecution for criminal and civil liabilities in case of damage to third parties or the environment for omssion to perform a legal duty.

An Analysis

As noted by environmental experts in Asia and the Pacific, the Philippines has the most comprehensive coverage in terms of environmental legislation in the region. These include general environmental legislations, laws on air and water quality, noise, land-use management, natural resources management and conservation, waste management and cultural environment.

Significantly, the EIS legislations are the ones being implemented and enforced to the best ability available. Without laws that require mandatory preparation and submission of EIS, impact studies will not be as comprehensive as they should be and will extend only up to the point that can be useful to protect proponents. They may not also include the mitigating measures to abate or minimize the adverse impact of the project on the environment. But paramount is whether the administrative processes are consistent with law and good administrative procedures. In this regard, most decisions are consistent insofar as substantial compliance is made with the policy laid down by legislations. Administrative difficulties in the implementation may cause some variation in decisions but are nevertheless done within the purview of the authorizing statutes. Besides, modifications and innovations are undertaken from time to time to simplify the system and make it operational the best it could. At the same time, the different agencies recognized, little by little, the mutual interdependencies between them which provide the basis for continuity of organizational structure.

To further ease the situation, the NEPC, in cooperation with the University of the Philippines Natural

Science Research Center embarked on a series of seminars for decision makers in the government and private sector of the 12 regions of the country from 1979-1981. The industrial sector showed particular interest and some, especially those coming from big companies, manifested the existence of, or plan to organize environmental divisions in their companies. NGOs are always in the list of participants.

These seminars on EIA are apart from the regular programs, seminars, workshops and publications to educate the public on environmental awareness sponsored by the NEPC Public Information and External Relations Office. The Philippines has even gone to the extent of legislation for the integration of environmental education in the curriculum of all school at all levels. Marked progress has been achieved in this regard.

Methodology

For EIA to be an effective tool, there must be a procedure which transfers the findings of the assessment to decision-makers and a program of implementation of environmental protection/enhancement/mitigation measures including the monitoring program. Since individuals involved in preparing an assessment are seldom involved in decision-making, it is important that they present their conclusions to decision-makers effectively.

The choice of methodology as well as guidelines/ criteria and the like are decided and updated through inter-agency consensus. This is done by regular meetings of various technical and legal committees of NEPC as well as the periodic updating made on the National Environmental Enhancement Program. Updating is made to reflect the policy shifts made in the different environment-oriented ministries, changes in the national multi-year development plan and upon directions made by the President of the Philippines.

About 300 EIS applications are processed each year of which roughly 60% are finally issued ECCs. The rest are usually required to provide additional information or more elaborate presentation of impacts. With a complete EIS documents, it takes 2 months, more or less, inclusive of processing time, visual inspection and comments, before an ECC is finally issued. As of 1980, the NEPC has issued a total of 154 ECCs to resource extractive projects (103 for mining, 29 for seaweeds culture pond and 12 for special commercial fishing), 5 to infrastructure projects and 5 clearances to projects classified as heavy industries.

Compliance with the conditions of the ECC is monitored through reports sent in by lead agencies and by the proponents themselves. From time to time, inspection teams are fielded to monitor actual operations usually with an NPCC representative.

Consultation and Comments

A very important part of the EIS system is the consultation and commenting stage. It is a feature which strengthens the linkage of government agencies to the central body charged with implementation of the EIS requisite and ensures continuous and efficient inter-organizational dialogue.

Effectiveness of the commenting portion of the process is best illustrated by an instance where the Ministry of Agrarian Reform, whose comments were sought, gave a written statement that a piece of riceland, through which the contested power line project of the National Power Corporation (NPC) will pass, is not a prime agricultural land and the alternative as presented by the NPC is the best compared to the one which will hit the public school and municipal building. In another application, the comment of the Laguna Lake Development Authority (LLDA) explained that the permit it issued to a battery processing factory is a temporary one, good for only 3 months and it does not intend to issue a permanent permit for failure to comply with LLDA requisites, led to the non-approval of the EIS because LLDA's permit is a condition precedent to the favourable consideration of the EIS.

Comments, however, may be solicited not only from lead agencies but also from pertinent government agencies and interested parties. Usually, the NEPC gives the proponent a chance to reply to comments received.

The Review Committee

The formal implementation of the EIA system in

the Philippines relies heavily on EIS Review Committee (RC). In accordance with the Rules, an EIS-RC was created by the NEPC Secretariat composed of experts from various fields whose main task is to assist the NEPC in evaluating EIS and other documents pursuant to the Rules. A representative of the NEPC sits all the time with the Review Committee.

Depending on the nature of the project under consideration, the RC is, at different times, composed of, among others, an ecologist, limnologist, physicist, environmental chemist, wildlife biologist, botanist, hydrologist, sociologist, environmental economist, marine ecologist, soil scientist, health expert, geologist, environmental engineer, historian/archaeologist and environmental lawyer. Resource persons acquainted with environmentally critical activities likely to be associated with the project are likewise invited at the committee meetings.

Due to the high degree of expertise demanded of the RC, most of the members are drawn from the ranks of the academe with a monthly honoraria depending on the number of meetings attended. Review meetings are called once a week with projects of the same nature taken up in one meeting, e.g. infrastructure projects. Committee members, are, however, provided copies of the EIS weeks in advance.

The RC is assisted in its work by the NEPC Secretariat, in particular, its EIS division. The latter makes perliminary studies of the EIS and conducts ocular inspection of the sites before a project's EIS is transmitted to the RC. At the meetings, Division Members who handled the preliminary studies and who made the inspection trips are always in attendance. Lead agency representatives, more often than not, attend RC meetings for their further information and thorough consideration of the proposed undertaking.

Public Hearing and Public Participation

Among the public hearings conducted by the NEPC, 3 stand out for their susposed extensive environmental, social and economic impacts. The first two are government road projects called Radial Road 10 and Circumferential Road 3, respectively, traversing portions of candy factories and middle and low income residential areas. The third one is a private quarrying and processing plant. A public hearing was decided on the road projects because of the magnitude of the same while the quarrying project was held on strong representation of subdivision residents near the project area assisted by an environmental group and the press.

All three public hearings were attended by numerous people. The road projects dealt mostly on the sociological aspect specifically the dislocation of residential owners while the quarrying project centered on the pollution aspect which accounts for the detonating tests conducted at the site using a modern system demonstrated by Swedish Consultants.

The government road projects were decided favourably after the expropriation law (with compensation) was sufficiently explained to the affected populace and the various alternatives and mitigating measures were discussed. The private quarrying and processing plant, on the other hand, was also granted an ECC subject to certain conditions as to noise and pollution levels.

Conclusion

One of the beneficial results of the campaign for a better environment has been to foster studies that will help to prevent, or at least minimize and rapidly correct, the environmental damage caused by industry. Clumsy and difficult to administer as it is, legislations that make it necessary to file a statement of "environmental impact" before undertaking any large-scale project is a first step in a direction that will certainly be followed in the future especially in developing countries. For one, the Philippines has embarked on an EIA system in its quest for environmental quality.

Productivity
1984, XXIV, 4, 487-492

Measurement of Divisional Performance— A Closer Look

DR. MALAY ROY

In this article an attempt has been made to highlight certain problems, which require serious attention, for the measurement of Performance of a Quasi-independent subsystem for a Semi-indepndent Period.

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Introduction

It is expected that any accounting system for a division must supply necessary information so that :—

(1) It can help the divisional manager in his decision making process.

(2) It can properly guide to evaluate the performance of a divisional manager.

(3) It can help in the appraisal of the performance of a division so as to guide top management in its decision relating to division.

So there is no ambiguity regarding our expectation from a divisionalized account. Though what is expected from a divisionalized account is clear, but the process by which this demand is to be fulfilled is clustered with a lot of controversy. An attempt is made in this article to resolve this controversy from a particular viewpoint, which requires a newer look towards each subsystem.

Division as a Quasi-independent subsystem

The meaurement of divisional performance would have been easier and many a controversy could have been avoided had each sub-system been identified as a completely independent one. But division as a part of the total system, must have to act within certain limitations imposed by the higher system, hence cannot be treated as a completely independent one. According

to David Solomon a division is (1) a company unit headed by a man fully responsible for the profitability of its operations, including planning, production, financial and accounting activities and who usually, although not always, has his own sales forces, (2) the division may be unit of parent company or it may be wholly or partially owned subsidiary.[1] The first part of the definition highlights the decisional autonomy that is to be granted to each division so far management, planning and controlling is concerned and this is the very essence of a divisional management. The second part of the definition draws our attention to the reason which necessitate curving of some decisional autonomy of each division. This section identified each division as apart of the whole. This bondage with the higher system that cannot be partioned automatically confers certain responsibilities that is to be discharged by each subsystem towards the whole and also towards the other subsystems that constitute the whole. This shows the limitation within which each division has to function and which curves the degree of independence of each division. That's why each subsystem can be treated as quasi-independent" that is independent in one sense and restricted in another sense.[2]

In order to measure the performance of a quasi independent system having a constant interaction with the higher system and also with other subsystems, serious attention should be given to develop a prudent accounting procedure for the transfer of goods and services among them.

Measurement for a semi-independent period

Here the attempt is to develop an accounting procedure for the measurement of divisional performance for a semi-independent time period. It is believed that only by this procedure an effective measurement system can be developed to evaluate the performance of a divisional manager, when he is in charge of a division for a sucessive period or when a new manager takes the responsibility of a division at the beginning of a period.

It is assumed that a manager accepts the responsibility to operate a segment of the firm at the beginning of semi-independent period. At the end of the period, on the basis of the past result, owners of the firm first of all have to decide whether it will be wise for them to operate the segment or not, and secondly depending on the previous decision they have to decide who will be entrusted with the responsibility of managing the segment. So it is believed that at the end of a semi-independent period the manager turns his segment in, for review and decision, and after that he or any another new manager gets the same segment back, but in a new period. If the same manager is in charge of the segment for the old and new period, he may be reluctant to transfer income among the periods, so long the transfer of income does not increase the present value of the future income stream. Again if new manager takes the charge of the subsystem, this idea of measurement for a semi independent period, will protect the accounting system from any good or bad result of the earlier period and help to measure the performance of a new manager independently.[3] But to maintain the sanctity of a semi-independent period, any accounting system for the measurement of divisional performance should give special care to the following points.

(1) Firstly the action of the period should not influence the result of another period. This, in essence, refers to the treatment of fixed overhead and valuation of stock.

There are two opposing ideas regarding alternative product costing method, commonly labelled as absorption costing and direct costing. Absorption treats fixed overhead as product cost, hence should be inventoried. On the other hand, Direct Costing treats fixed overhead as period cost, that's why should not be inventoried.[4]

1. For a detail discussion see David Solomon, "Divisional Performance : Measurement and Control", Financial Executive Research Foundation, 1965.
2. Yaqoor Goldschmidt, "Information for Management Decision" Cornel University Press, 1970, pp. 199-207.
3. Yaqoor Goldschmidt, "Information For Management Decision" Cornel University Press, 1970, pp. 199-207.
4. For an indepth discussion see David Solomon, "Divisional Performance, Measurement and Control" (Homewood III, Richard D. Irwin Inc, (1968, pp. 100-115. NAA Research Report No. 23, April 1953, entitled Direct Costing and

Under absorption costing, divisions are encouraged to accumulate inventory, since, by producing for stock they can charge off the inventory account a proportion of their fixed overhead, this increases the profit of the current year forwarding a large amount of stock and hence a portion of Fixed Overhead to the next period. Again efficiency of one period may affect the next period in another way. With the rise and fall of production, valuation of stock also changes accordingly under absorption costing, which is transferred to the next period. So the value of opening inventory will depend upon the performance of the previous year. This will obviously vitiate the sanctity of a semi-independent period.[5]

(2) Secondly, care is to be given to the inventories of previous year, the price of which has already gone up, but sold in the current year.

(3) Third attention is to be given to find out the cost of assets of a semi-independent period. It requires that all assets should be valued at their current price at the beginning and at the closing of the period and this difference would reveal the actual cost of the usage of assets of a semi-independent period. The conventional method of calculating depreciation based on formula of acquisition cost, will not help to measure the actual performance of a division for a semi-independent period.

Keeping in mind the above mentioned facts, an attempt has been made to draw a chart for the measurement of performance of a Quasi-independent sybsystem for a semi-independent period.[6]

A close scrutiny of the given chart will reveal that opportunity cost or shadow pricc has been taken into consideration at all the stages. Although consideration of opportunity cost indulges inclusion of subjective valuation in the domain of accounting, nevertheless it is the only appropriate way to measure the performance of a division for a semi-independent period. Here it is assumed that the manager accepts the responsibility to operate a segment of the firm at the beginning of a period. At that time he is assigned certain resources which are valued at the highest

No. 37 January 1961, Current Application of Direct Costing. Yuji IJiri, Robert K Jacdicke and John L. Livingstone "The Effect of Inventory Costing Methods on Full and Direct Costing" Journal of Accounting Research, Vol-III No-1, pp. 63-74. Sorter and C.T. Hornguen, "Asset recognition and Economic Attributes, The Relevant Costing Approach", The Accounting Review, Vol XXXVII No. 3.

5. This Problem can be solved if inventory is valued on the basis of "Normal Output". This in turn requires the recognition of volume variance, representing the over or under absorption of period costs, in the period of high or low output. This variance is treated wholly as a current expense or gain. No part of it is allowed to enter into inventory.

6. No attempt has been made in this article to develop a comprehensive idea about the measurement of divisional performance. For a detailed discussion on this topics, readers may go through the most valuable writing of David Solomon—"Divisional Performance, Measurement and Control", Richard D. Irwin, 1968.

EXHIBIT

		Rs.	Rs.
(7) Sales to outside customer	—	XXX	XXX
* Transfer to other division :—			
If Market Price exists at Market Price—			
If Market Price does not exist and Marginal Cost—			
If Market Price does not exist and the Production capacity of supplying division is limited at shadow price—			
If Market Price does not exist and the amount transferred is insignificant at Negotiated Price	—	XXX	XXX

7. *Notes* : There are many other alternatives which are not shown in this chart. Transfer pricing is one of the major problem for the measurement of the performance of a Quasi-independent subsystem. For a detailed discussion on this topics see David Solomon P.P.—160-232, John Dearden, "Cost Accounting and Financial Control" Addison Wesley publishing Company, 1973, P.P.—362-411, Harold Bierman Jr. "Topics in Cost Accounting", Mcgraw Hill, 1963, PP 93-101, Jack Hirslefier "Internal Pricing and Decentralized Decisions" in C. Bonini, R. Jaedicke and H. Wanger eds Management Controls, New Direction in Basic Research", New York, Mcgraw Hill, 1969, P. 30.

Less Variables charges of goods sold and transferred i.e Marginal Cost				Conventional Method of Calculating Marginal Cost	
(8) *Input purchased directly at Actual Cost of Mat. and inventories used* :—				—Actual Cost	
Inventories of Raw Mat. used—Replacement { *Current Cost*	—	XXX		(A) Acquisition Cost	
Intermediate goods at Market Price	—	XXX		—Cost of Product	
Goods in process at Market based value	—	XXX		—Cost of Production	
Other variable expenses *Marginal Cost*	—	—	XXX	—Actual Cost	XXX
Marginal Revenue			XXX		
Add (Deduct)					
Fixed charges made to (by) other division for transfers Not Prices at Market Value	—		XXX		
Less					
Controllable division O/H	—	XXX			
(9) *Dep. on controllable F. Asset* :—				Conventional Method	
For Durable liquid asset (Difference in the Market Values of asset between beginning and end of the period)	—	XXX		(B) Dep. based on formula of acquisition cost	XXX
Preperty taxes and Insurance on controllable F. Asset	—	XXX	XXX		
Controllable operating profit			XXX		
Add (Deduct)					
Non operating gains and losses (Realised Cost savings)	—		XXX←		
(Combination of the difference between A and B)					
Realised Profit			XXX		
Less					
Int. on controllable investment	—		XXX		
Controllable residual Income			XXX		
Less					
Non controllable divisional overhead	—	XXX	XXX		
Incremental central expenses chargeable to division	—	XXX	XXX		
Int. on Non-controllable investment	—	XXX	XXX		
Net Residual Income before tax			XXX		
Less Taxes on income			XXX		
Net Ineome after tax			XXX		

8. (a) Current cost of material used =

It is simply the quantity sold X weighted Average purchase price during the period. The value of the current cost of materials used determined by the above formula will be very close to the figure, if inventory is maintained by L.I.F.O. Method.

Realized cost savings = current cost of Material—Historic Cost (F.I.F.O. method) of material used.

(b) If a goods in process can be traded in the market, it should be considered as an intermediate good, and should be valued on the basis of its Market Price. When a market for a goods in process does not exist, a determined value must be used.

(c) If cost of material and inventries used are valued at current cost, different profit concept will be as follows :—

(1) Sales	—	XXX	
Less Cost of Material at (Current price) and other variable expense	—	XX	
Current Marginal operating Profit	—	XXX	
(2) Cost of material (at current cost)			XX
Less Cost of material (at historic cost)			XX
Realized cost savings			XXX

opportunity cost at that time. This figure represents the amount which the firm is consigning to the manager at the beginning of a period for use in promoting the firms' activities during the subsequent period. It can also be treated as the resources which the owners are risking in the short run. Manager uses the resources for the period in consideration, and if he is successful the opportunity cost of the resources at the end of the period will exceed the opportunity cost at the beginning of the period. If this gain exeeeds the interest on the opportunity cost of the firm's resources at the beginning of the period, the owners were wise to permit the business to operate during the period rather than discontinuing it at the beginning of the period. So, for the measurement of performance of a division for a semi-independent period recognition of opportunity cost is important.[10]

It is interesting to note that different cost and Revenue figures have been calculated in the divisionalized chart. The reason is one set of cost and revenue figures cannot satisfy all the informational need of managers in their decision making process, so with different types of adjustments different cost and revenue figures have been identified, so as to facilitate decision making function.

Use of Divisionalized data

There are different uses of divisionalized data. The above chart may be used :—

(1) *For short term decision making*—(use of Marginal cost figure)

(a) Make or buy decisions

(b) Pricing policy for the end product

(c) Output decisions etc.

(2) *For performance measurement* :—

(a) Measuring the performance of a divisional manager

(b) Measuring performance of a division

Divisionalized data for performance measurement

Sometime no distinction is drawn between the success of a Manager and his division. It means the success of one, can also be considered as the success of other. In fact two different income figures should be identified to measure their performance. In total five profit figures have been identified in the above chart. However, the question still remains which one should be used and for what purpose.

Marginal revenue which is being calculated by substracting the variable cost of goods sold from the revenue, cannot be used either for the measurement of managerial efficiency or divisional performance at least for a sufficiently independent division.

9. *Durable liquid assets* are those assets that can be sold with relative ease in an active (Second hand) market. Examples are vehicles, Land, Share etc.

The difference in the market value of the assets between the beginning and the end of the period should be debited (credited) to the user of the assets, as depreciation (appreciation). Note that the market price at the end of the period takes into account any increase in maintainance or obsolescence of the asset during accounting period and also the price level changes.

Durable non liquid Assets—most of the individual assets are not liquid. This is because an active market for the used, specialized facilities does not exist. In this case relevant index number may be used. In absence of relevant index number "appraisal" values may be used.

The annual charges for the assets service consist of the diference in the values at the beignning and at the end of period.

"Appraise" means to determine the value of a durable non-liquid assets depends on a systematic procedure that includes techical examination (by accountant) of the assets potential to render service compared to a new asset.

The most conventional method of calculating depreciation i.e. straight line or accelerated method has several disadvantages so far as measurement and control of divisional performance is concerned, for detail discussion (See Management Control System, Text and cases by R.N. Anthony and John Dearden, Richard D. Irwin, 1977, P.O. 335-344). Moreover the historical cost method does not help to find out the current cost of services received from a durable non liquid asset for a semi-independent period. That's why the appraised value has been chosen, and which we think is more objective than the historical method.

10. For a detailed discussion see 'Yaqoov goldschmidt, "information For Management Decision" Cornell University, 1970, pp. 199-207.

In a quasi-independent division, the divisional manager has the right to exercise substantial influence on the scale of division's operations. It implies the right to determine the optimum scale of operations, and he is to be provided with the necessary capital so long the cost of capital can be met. So a profit figure to be used for the purpose of evaluation of managerial efficiency, must consider the cost of using controllable investment.

After marginal revenue next profit figure identified in the chart is the controllable operating profit, which is the excess of the value of output sold and transferred over the resources used in producing and selling that output at the current cost. So, it seems controllable operating profit is a better yard stick to measure the efficiency of the manager, which considers not only variable cost but also the cost of using controllable investment. This is also not a perfect yardstick to measure the efficiency of the performance of a manager, though, it indicates to a very important factor, that is whether the current proceeds from the sale of a product are sufficient to cover the current cost.

In a sufficiently independent division having substantial control over the investment and composition of assets and inventories, realized cost savings must be considered to evaluate the efficiency of a manager. Realized cost savings is the excess of the current cost over historic cost in producing output sold. In the chart it has been shown by adding A and B. Controllable operating profit which is arising from operation plus Realized cost savings gives the total of *Realized Profit*. From this realized profit Int. on controllable investment is deducted to find out the *controllable residual income* before tax, and this figure can be used for appraising the performance of divisional management. It is to be noted that in appraising the performance of divisional management, no account has been taken of the factors which are beyond the control of division.

On the other hand *net residual income* which is being calculated after taking into consideration both controllable and non-controllable expenses i.e. total expenditure of the division, can be considered by the top management in its decision relating to a division, say new investment or withdrawal of funds from the division etc.

Conclusion

In this article each division is viewed as a quasi-independent subsystem and an attempt is made to develop an accounting procedure to measure the performance of such a division for a semi-independent period. We think this idea of developing an accounting procedure for a quasi-independent subsystem for a semi-independent period will be able to supply relevant information for :—

(1) Decision making, (2) Measurement of the performance of a divisional manager (3) To appraise the performance of the division as a whole.

Productivity
1984, XXIV, 4, 493-498

Salesmen Routing Problem—A Case Study

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This is a case study of application of integar linear programming.

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Introduction

Ganesh Electronics[1] Markets electrical motors, starters switchgears and panels all over India through its four regional offices, each headed by a Regional Sales Manager (RSM). The sales engineers, employed in each region, are assigned territories, which they are required to visit at regular intervals and thereafter submit a report to their respective RSMs.

The Northern India Sales Office of the Company is located in Delhi and is responsible for the sales and service of motors, starters, panels etc., in Delhi, Punjab, Haryana, Uttar Pradesh and Himachal Pradesh. The list of cities, a sales engineer is expected to visit is as follows:

City Number	*Name*
1.	Delhi (Starting and ending city of the tour)
2.	Amritsar
3.	Jullundur
4.	Hoshiarpur
5.	Ferozepur
6.	Ludhiana
7.	Phagwara
8.	Khanna
9.	Patiala
10.	Ambala

1. The name of the Company has been disguised.

$$\sum_{j} R_{1jk} = 1$$

$$\sum_{i} R_{i1n} = 1 \qquad \text{... (a)}$$

It must also be true that from any given city i, there is only one leg of the trip which begins at i, and terminates in some other city. Thus

$$\sum_{j,k} R_{ijk} = 1, \quad i = 2,.....n, \qquad \text{... (b)}$$

where in carrying out the summation we require that if $j = 1$, then $k = n$, and vice versa. The restriction for $i = 1$ is contained in (a). Similarly, it must be true that only one leg of the trip ends at city j. Consequently,

$$\sum_{i,k} R_{ijk} = 1, \quad j = 2,.....n, \qquad \text{... (c)}$$

where we require that if $i = 1$, then $k = 1$, and vice versa. The case of $j = 1$, is contained in (a). Finally, it must be true that if leg k ends in city j, then leg $k + 1$ must begin in city j. This implies that

$$\sum_{i} R_{ijk} = \sum_{j} R_{jj} : k + 1; \quad j = 2.....n; \quad k = 2,.....n-1,$$

$$R_{1j1} = \sum_{j} R_{jj} 2, \qquad \text{... (d)}$$

$$\sum_{i} R_{ij,\,n-1} = R_{j1n}.$$

The constraints (d) eliminate the possibility of disconnected trips such as that illustrated in Figure 1, for the case of seven cites.

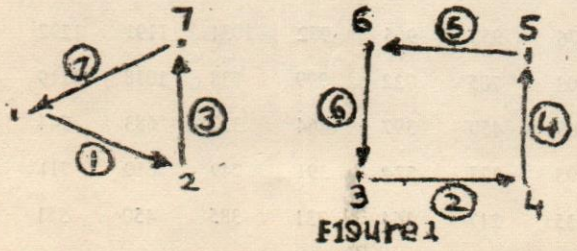

Fig. 1

We now have formulated all the constraints in the problem. It is unnecessary to include constraints $R_{ijk} \leqslant 1$, since (a) through (d) automatically ensures that no $R_{ijk} > 1$. We then wish to determine non-negative integers R_{ijk} satisfying (a) through (d) which minimize

$$Z = \sum_{i,j,k} d_{ij} R_{ijk}$$

where d_{ij} is the distance from city i to city j. The above formulation does not necessarily require that $d_{ij} = d_{ji}$.

Solution

The solution of the integer linear programming Model using the Branch—and-Bound Algorithm[3] gives the following optimal journey cycle.

From Delhi to Meerut to Agra Cant to Kanpur to Lucknow to Faizabad to Varanasi to Allahabad to Aligarh to Bareilly to Moradabad to Hardwar to Saharanpur to Simla to Chandgarh to Karnal to Ambala to Patiala to Khanna to Ludhiana to Phagwara to Jullundur to Hoshiarpur to Jammu Tawi to Pathankot to Amritsar to Ferozepur to Bhatinda to Hissar to Bhiwani to Delhi.

The total distance associated with the above cycle is 4608 kilometers.

Conclusion

The integer linear programming solution for the the above salesmen routing problem by using Branch and Bound algorithm ensures that the total distance travelled by a salesman is minimum. This is approximately 25% less as compared to the total distance associated with the journey cycles followed by the sales engineers and the RSM based on their experience and judgement.

In this problem the objective was to minimize the total distance travelled. However, one could encounter situations in which the objective may be to minimize total time and in that case same methodology could be followed by replacing the distance parameters with time parameters.

3. For details on the Branch-and-Bound Algorithms see reference Number 5.

ANNEX

Distances Between Various

From City No. ↓	To City 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	∝	447	368	412	386	311	347	269	251	198	255	123	484	585	166
2	447	∝	179	123	197	136	100	178	302	249	316	324	107	208	407
3	368	79	∝	43	118	57	21	99	219	166	233	245	116	217	328
4	412	123	43	∝	161	100	64	142	262	209	276	288	159	260	371
5	386	197	118	161	∝	125	161	167	237	238	305	313	234	335	305
6	311	136	57	100	125	∝	36	42	166	113	180	188	173	274	271
7	347	100	21	64	161	36	∝	78	202	149	216	224	137	238	307
8	269	178	99	142	167	42	78	∝	124	71	138	146	215	316	313
9	251	302	219	362	237	166	202	124	∝	53	120	128	339	340	366
10	198	249	166	209	238	113	149	71	53	∝	67	75	286	387	364
11	255	316	233	276	305	180	216	138	120	67	∝	142	353	454	331
12	123	324	245	288	313	188	224	146	128	75	142	∝	361	462	289
13	484	107	116	159	234	173	137	215	339	286	353	361	∝	101	444
14	585	208	217	260	335	274	238	316	340	387	454	462	101	∝	545
15	166	407	328	371	305	271	307	313	366	364	331	289	444	545	∝
16	226	347	268	311	245	211	247	253	317	324	391	349	384	485	60
17	298	451	368	411	88	311	347	353	149	202	269	277	484	585	217
18	590	641	558	601	626	505	537	459	445	392	125	467	674	775	756
19	72	437	358	401	426	301	337	259	241	188	245	195	474	574	238
20	181	324	245	288	313	188	224	146	128	75	142	150	361	462	347
21	161	525	446	489	314	189	225	147	321	276	343	284	562	663	327
22	252	615	536	579	604	479	515	437	419	366	433	375	652	753	418
23	487	853	774	817	842	717	753	675	657	604	671	610	890	991	653
24	432	925	846	889	914	789	825	747	729	676	743	555	962	1063	598
25	625	1117	1038	1081	1106	981	1017	939	921	868	935	748	1154	1255	791
26	788	1154	1075	1118	1143	1018	1064	976	958	965	972	1034	1191	1292	954
27	615	981	902	945	970	845	881	803	785	732	799	738	1018	1119	781
28	199	646	567	610	635	510	546	468	450	397	464	322	683	744	365
29	126	573	494	537	562	437	473	395	377	324	391	249	610	711	292
30	262	413	334	377	402	277	313	235	217	164	231	385	450	551	428

URE

Cities (in Kilometers)

No.														
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
226	298	590	72	181	161	252	487	432	625	788	615	199	126	262
347	451	641	437	324	525	615	853	925	117	1154	981	646	573	413
268	368	558	358	245	446	536	774	846	1038	1075	902	567	494	334
311	411	601	401	288	489	579	817	889	1081	1118	945	610	537	372
245	88	626	426	313	314	604	842	914	1106	1143	970	635	562	40
211	311	505	301	188	189	479	717	789	891	1018	845	510	437	277
247	347	537	337	224	225	515	753	825	1017	1064	881	546	473	313
253	353	459	259	146	147	437	675	747	939	976	803	468	395	235
317	149	445	241	128	329	419	757	729	921	958	785	450	377	217
324	202	392	188	75	276	366	604	676	868	905	732	397	324	164
391	269	125	245	142	343	433	671	743	935	972	799	464	391	231
349	277	467	195	150	284	375	610	555	748	1034	738	322	249	385
384	484	674	474	361	562	652	890	962	1154	1191	1018	683	610	450
485	585	775	574	462	663	753	991	1063	1255	1292	1119	774	711	551
60	217	756	238	347	327	418	653	598	791	954	781	365	292	428
∞	157	816	298	407	387	478	713	658	851	1014	841	425	352	488
157	∝	594	372	277	461	551	787	732	925	1088	915	499	426	562
816	594	∝	574	467	668	758	999	1068	1260	1297	1124	789	716	556
298	372	574	∝	114	193	283	519	464	657	720	647	271	158	208
407	277	467	114	∝	194	284	519	591	783	820	647	380	267	94
387	461	668	193	194	∝	90	325	397	589	626	453	360	247	168
478	552	758	283	284	90	∝	235	307	499	436	363	451	137	378
713	787	996	519	519	325	235	∝	72	364	301	128	486	381	541
658	732	1068	464	591	397	307	72	∝	192	373	200	415	309	613
851	925	1260	657	783	589	499	364	192	∝	170	157	608	501	805
1014	1088	1297	720	820	626	436	301	373	170	∝	166	589	582	842
841	915	1124	647	647	453	363	128	200	157	196	∝	614	509	669
425	499	789	271	380	360	451	486	415	608	589	614	∝	325	461
352	426	716	158	267	247	167	381	309	501	582	509	325	∝	361
488	562	556	208	94	168	378	541	613	805	842	669	461	361	∝

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Productivity
1984, XXIV, 4, 499-503

Design of Storage System for Rural Areas

B.K. ARORA

Storage and post harvest care is an important component of agricultural production system. The function is performed by farmers, traders and several government and quasi-governmental agencies. The paper focusses on the emerging scenario of the storage system for rural areas.

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Introduction

Storage and post harvest care is an important component of agricultural production system. The function is performed by farmers, traders and several government and quasi-governmental agencies. Farmers store foodgrains and other agricultural commodities produced by them partly to meet their years' consumption requirements in the household including the payment in kind, to meet requirements of seeds for the next crop, and partly to hold back some of their marketable surplus of produce in the hope of getting better prices in the lean period. During the harvest period also, when a part of the produce has been harvested, threshed and cleaned, and the farmer is busy in completing these operations on the rest of the crop, he requires temporary storage till he can carry the entire marketable surplus of produce in one lot for sale in the market. Apart from this, farmer may need to store fertilizers for certain periods to ensure that this is available with him at the time when it to be applied to the crop.

Storage Needs

The storage requirements of an individual farmer for various purposes may vary with the size of operational holding, tenure on land, size of his family, the capacity to hold back his produce and extent of reliability he can place on the nearest fertilizer sale point for getting the requisite type of fertilizer at right time etc. etc. It is very difficult to give the

influence of each of these factors individually or jointly on the storage capacity with the farmers. It is, however, generally observed that small and marginal farmers, of whom, a large number may be share croppers, have very little to dispose during lean periods and thereby take advantage of off-season prices. Their storage requirements are limited to the foodgrains needed for household consumption or seeds for the next crop season. Sometimes, even these requirements may not be met from the stored stocks as many of them are perpetually in debt with the village shopkeepers, landlords, commission agents in the nearby markets etc., who realise their loans mainly at harvests by pre-empting bulk of the produce of borrowers immediately after harvest. Even if there is some marketable surplus available with such individuals, they have very little retention power and usually sell their marketable surplus immediately after harvest to meet their household and crop needs. They also have no liquid funds of their own for purchasing fertilizers in advance and thus may not need storage space for same. Thus, the storage needs of the small and marginal farmers are limited to the requirements for storing their produce to meet the family needs and seeds for sowing the next crop.

Even in case of large and well-to-do farmers, retention of produce largely depends on the differences between the peak and lean season prices of market arrivals. The farmers shall have the tendency to store if they speculate a rise in prices more than the cost they will have to incur on storage of their produce and losses in storage. The immediate monetary needs of the farmers also affect the quantum of storage with them. The stabilisation of farm production and procurement of farm produce at a fixed price by public agencies has substantially reduced the fluctuation in the prices of major foodgrains. This has tempted even the medium and large farmers to sell their marketable surplus immediately after harvest. In the absence of data based on scientific studies, it is very difficult to identify the storage needs of different categories of farmers for the foodgrains stored for the purpose of off-season sales. However, it is known that on aggregate level, 70—75 per cent of the produce harvested is retained in the village and stored for the purpose of household consumption, lean season sales send to meet the seed requirements for the next crop.

Rural Storage Structures

For the storage of foodgrains and other agricultural commodities of household and farm consumption, the farmers, since generations, have built up and used various types of storage structures. In past, these structures were built using local materials and stored produce preserved with the help of herbs and other plant materials. The structures were built both underground and above-ground depending upon the climate, materials of construction and length of storage. Of late, metallic drums and bins of different sizes and capacities have also come into use. These bins are certainly safer than the traditional structures as these are moisture proof, insect-proof and rodent proof. Besides, various insecticides and fumigants are used for prevention and control of insect pests of stored grains. In certain states, subsidies are also being given for purchase of these metallic bins. But these structures have not become very popular in rural areas because of high initial cost.

Farmers in rural areas store their surplus grains and other materials in the part of their residential buildings. Often a part of the room, or verandah, is used for storing grains in bags or bulk and the remaining part serves as living space for the family, Due to limitation of space, fertilizers and other farm inventories are also stored in the same room. In case of well-to-do farmers, sometimes a separate room is earmarked for storage of agricultural commodities. These structures are rarely moisture proof, insect-free or rat-proof. These are difficult to seal and may prove to be health hazard if adequate precautions are not taken after fumigation. Proper storage therefore, requires a separate room which can be adequately sealed after fumigation. Besides, the facility has to be made leak-proof and grains inaccessible to rodents. Unless, these measures are taken, the returns from the retention of produce, may even be lower than the same from sale at the harvest time.

Need For a New System

Although large number of innovations have been

made to introduce improvements in storage at farmer's level, there is not much response from the farmers to adopt these. Scope for improvements by farmers themselves seems to be rather limited owing to economic constraints. Small farmers do not have land and funds to own independent scientific storage facilities. They have little surplus for disposal in the lean season. In many cases they are dependent upon the local traders for disposal of their surplus which leaves them with hardly any incentive for storage. They are so pressed for liquid cash that, in many cases, they have to resort to distress sale of their produce. Therefore, there is need for an agency at the national level which can provide institutional credit facilities to increase the holding capacity of the farmers as well as provide scientific storage facilities to the farmers.

With a view to provide above facilities and avoid distress sales, the need for licensed warehousing was realised as early as 1928 by Royal Commission on Agriculture. Specific recommendations in this regard were made in 1945 by Agricultural Finance Sub-Committee (Gadgil Committee). In 1951, the Reserve Bank of India took up a detailed survey on Rural Credit Structure in the country. The All India Rural Credit Survey Committee fully endorsed the views of Gadgil Committee and made important observations and recommendations in its report dated 28.12 1954. The recommendations of the committee paved the way for enactment of Agricultural Produce (Development & Warehousing) Corporations Act, 1956 (since replaced by Warehousing Corporations Act, 1962) and establishing of Central and State Warehousing Corporations.

Warehousing—Fast Perspective

Warehousing envisaged a three tier system. Under the scheme, centres of All India Importance are served by Central Warehousing Corporations, centres of secondary markets and district levels are to be served by the State Warehousing Corporations, while the village and community levels are to be looked after by the cooperatives. The broad objectives for public warehousing have been derived from the Rural Credit Survey Committee Report 1954. These objectives as given in the Public Undertaking Committee Report 1967-68 are :

(i) Creation of negotiable paper to provide an instrument for expansion of credit through Commercial Banks for the benefit of producers, dealers and others.

(ii) Adding to the nation's real income by reducing wastage and losses in storage; and promoting and developing warehousing for scientific storage facilities.

(iii) Assistance in orderly marketing by introduction of standard grade specifications and the Warehouse Receipt.

(iv) Training of personnel to manage and run modern warehouses ; and

(v) Assistance to Government and Government sponsored organisations in their scheme of price support and price control.

To achieve the broad objectives, functions as were identified in the warehousing corporations Act 1962 are :

(i) To acquire and build warehouses at such suitable places in India as it thinks fit.

(ii) To run warehouses for storage of agricultural produce, seeds, manures, fertilizers, agricultural implements and notified commodities offered by individuals, cooperative societies and other institutions.

(iii) To arrange facilities for the transport of agricultural produce, seeds, manures, fertilizers, agricultural implements and other notified commodities to and from the warehouses.

(iv) To subscribe to the share capital of State Warehousing Corporations.

(v) To act as an agent of the Government for the purpose of purchase, sale, and distribution of agricultural produce, seeds, manures, fertilizers, agricultural and notified commodities.

(vi) To undertake disinfestation service at its discretion and at the request of the parties outside owned warehouses in respect of agricultural and notified commodities ; and

(vii) To carry such other functions as may be prescribed.

During the two and half decade of its working Central Warehousing Corporation has made a remarkable progress. It has already built up storage capacity 3,692 thousand metric tonnes spread over 317 warehouses as on 30.4.1981. It has also set up 16 State Warehousing Corporations which own 1035 warehouses with a storage capacity 4,883 thousand m. tonnes as on 30.4.1981. Thus CWC and SWC have a combined storage capacity of 8.6 million tonnes at 1352 centres. The warehouses are manned by trained and qualified persons. The storage facilities are scientific and ensure minimum loss of foodgrains and other materials.

However, the above facilities have been of little assistance to the farmers as far as storage of their surplus produce is concerned. The number of warehouse is very small and distances, in many cases, are so large from the village that the producers do not have induction to deposit their goods in the warehouses. These warehouses are mainly used by the government, public agencies, private traders and cooperatives. The warehousing chain in the country has greatly assisted the procurement, storage and distribution of agricultural commodities and fertilizers but it has been of little assistance in mitigating the storage problems of the farming household. The farming community has still to hold its surplus in the household premises where losses are very high and he cannot get any loan against the materials held by him.

Emerging Scenraio

One of the solutions to the above problems could have been the establishment of third tier storage at the village and cooperative level. The primary agricultural credit societies in the villages can construct modern godowns capable of offering scientific storage to cater the needs of its member farmers for stocking their marketable surplus far as long as they desire. The village societies can also take up distribution of fertilizers as well as other essential commodities needed by the village community. These can also advance short term loans against the pledge of stock kept by them. Arrangements for marketing can also be made by societies without moving the stocks from godowns with the prior consent or on request from the farmers. In fact, the village societies are already engaged in these functions.

Realising the role that these cooperatives have essentially to play in improving the lot of village communities in general and the agricultural economy in particular, a lot of stress has recently been laid in reorganising and strengthening the village societies. They have been provided managerial subsidy to enable them to engage trained and competent managers. They have been provided state participation in share capital to strengthen their capital base. This has helped a large number of societies to take up new activities. The rural godowns have been set up with the loan assistance from state government. Even international funds are being made available to cooperatives for construction of godowns in the rural areas. So wherever, the cooperatives have been strengthened and are performing satisfactory, the role of building and operating rural warehouses can be entrusted to them. This will help in linking credit with marketing and storage ; so necessary for the development of rural areas and success of any rural storage programme.

Some Alternatives

Where cooperatives have not taken firm roots, the role of rural storage agency can be given to the Regional Rural Banks. These banks can be provided a storage godown alongwith their office building. The farmers can pledge their grains with the bank and get the loan against this. The maintenance of stocks in the bank godowns should be entrusted to a trained persons so that stocks kept in its custody do not deteriorate. A nominal charge can be levied to the farmers against the services provided by the bank in storing his grains. This will not only help in linking credit with storage and marketing, but will also make both rural banks and rural storage together viable which if operated independently may not be viable due to their small size of operations. The combination of the functions can be helpful both for the rural banks in expanding their credit base as well as godowns in widening their network.

In the alternate scheme of operation, the small godowns or steel storage bins can be constructed/ fabricated and kept with the farmers themselves. The loans can be advanced by rural or scheduled banks against the stocks kept in these bins, pledged to the bank. A schedule of periodic inspection and disinfestation may be adopted for maintaining the quality of stocks. Loans and subsidy may be provided for building up these storage structures on farmers premises. Only the stocks kept in specific types of structure should be accepted for pledging by the banks. The bank person should be present whenever the stock are to be fumigated and he should periodically satisfy himself with the quality of the grains. In this arrangement, while the responsibility of storage lies with the farmer, he can continuously guided by the visiting bank expert and maintenance and marketing of holds stocks. The disadvantage with the system will be high investments on construction for storage by individual farm household. The farmer may require separate construction for the stocks to be pledged to the bank and the stocks kept under his own custody. However, the system has the potential to mutually benefit rural bankers and the farmers.

The facilities for collective storage can also be built up with the other village agencies such as Gram Panchayat or a Voluntary Agency operating in the rural areas. A part of the storage facility should be pledged to the bank whereas the other part should be held free by the storage agency. To make the facility viable at the level of its operation, it should combine the functions of distribution of farm inputs and essential commodities, the collection and forwarding of farm produce such as milk, vegetable, processing of agricultural raw materials such as atta chakki etc. etc. The pilot storage godowns may have to be set up initially to establish the feasibility of such multipurpose rural commercial complexes.

Design of System

Whatever may be agency for construction and management of rural godowns, the system must meet the following requirements :

(i) The storage structure must conform to the scientific designs. It should use the local materials, as far as possible, for its construction and maintenance.

(ii) It should not be far off from the rural settlement and, as far as possible, controlled by the local people.

(iii) It should be operated and maintained or supervised by well trained and qualified staff.

(iv) Facilities for loan should be available to the depositors against the stocks kept by them.

(v) The activities of the rural storage complex should be commercially viable. The services should be available at reasonable charges to the users.

Besides the implementing agency, which has to necessarily enjoy the confidence of the rural people, there are many other details which have to be worked out for designing a viable system. The location, size and capacity, design (materials, methods of construction and structural arrangement) of the godown financing of construction, training of personnel etc., have to be given serious consideration for designing a viable rural storage system. Vast information and infrastructure is available in the country to meet these requirements. However, the crucial question remains—who should take up the responsibility and provide the much needed facility in the rural areas ? Single agency may not deliver goods in all regions of the country. Innovations will have to be made and applied to design an appropriate storage system which can fit best in the existing agro-economic structure of the area.

Productivity
1984, XXIV, 4, 505-510

PERT Based Penality/Incentive Clause in Civil Construction Contracts

K. P. SINHA

In civil Engineering contracts, the compensation for delay is being fixed arbitrarily, mostly based upon the past practices of the individual organisation. In many of the cases there is no provision in the agreement for incentive or bonus clause. In this paper an attempt has been made to develop an penality incentive clause based on the net work analysis of construction projects. Calculations of compensation for delay and incentive have been derived and illustrated by analysing two projects executed in Central Coalfields Limited, Ranchi.

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Introduction

It is customary to penalise contractors for delaying projects. In fact penality clause has been incorporated in contacts just to act as deterrent to the contractors so that they should try to complete project in estimated time. The compensation for delay or liquidated damage or penalty for delay, is the compensation paid by the contractor, if he fails to maintain the required progress as specified or complete the work before the contractural date of completion, on account of such breach of contract. The compensation amount will be as stipulated in the agreement and agreed upon by both the parties. The prevalent practice for the calculation of compensation and as recommended by the Bureau of Public Enterprises is as follows :

Completion period (As originally) stipulated)	*Compensation in terms of contact value per week*	*Maximum amount of the compensation in terms of the contract value*
(a) Not exceeding 6 months	@ 1% per weak	10 %
(b) Exceeding 6 months and not exceeding 2 years	@ $\frac{1}{2}$% per weak	$7\frac{1}{2}$ %
(c) Exceeding 2 years	@ $\frac{1}{4}$% per week	5 %

In fact the amount charged as penalty is always much less than the actual loss incurred by the management due to delay in completion of the project. This loss broadly consists of opportunity loss and cost of supervision for increased number of days. Some times the project cost might increase due to increase in prices of resources which is normally taken care of by the escalation clause of the contract. Thus instead of this negative approach if some sort of incentive clause is incorporated in the contract, that may prove to be more motivating to the contractors. This may result in lot of saving to the management by getting the projects completed early, if not then at least in estimated time.

Time Standard

The main pre-requisites for implementing any sort of compensation for delay-*cum*-incentive clause is the establishment of time standard and the development of time standard for a project is a problem to Industrial Engineers because of different complexities involved in any project. From its inception, work measurement centered mainly on repetitive work, which were seemingly easy to measure and control. This paper presents a new approach based on PERT to develop time standards for projects. Now a days as it has become common practice to prepare project reports based on PERT, the method suggested would not be difficult to use.

PERT Network and Time Analysis

To start with the three time estimates is the optimistic time estimate t_o, the pessimistic time estimate t_p and the most likely time estimate t_1 are made for individual activities. As per the 'beta distribution' the average time t_E (mean expected time) for the activities are given by

$$t_E = \frac{t_o + 4t_1 + t_p}{6}$$

and the standard deviation σ is given by

$$\sigma = \frac{(t_p - t_o)}{6}.$$

The average time indicates that there is a fifty-fifty chance of getting the activity completed within that time. Based on the average time (mean expected time) t_E for the individual activities, the net work for the whole project is drawn and critical path and the time for critical path is found out. The standard deviation σ for the project is found by summing up the variances (σ^2) of the activities along the critical path and taking the square root of the sum.

Theory

In general a project consisting of several activities will have a normal distribution, that is for the project as a whole, the distribution curve will be a normal curve and the probability of completing the project in time equal to the mean value of the normal curve T_E is 50%. In all fairness, the average time T_E is to be considered as the normal time and the earliest project completion time should be $T_E - 3\sigma$ and latest project completion time should be $T_E + 3\sigma$ as shown in Figure 1. It is logical from the distribution that no penalty should be charged unless and until the project completion time exceeds the latest completion time ($T_E + 3\sigma$). Similarly no incentive should be paid unless and until the project completion time is less than earliest completion time ($T_E - 3\sigma$). However for computing the amount of delay the delay should be counted from T_E and the amount of early finish should be counted from $T_E + 3\sigma$ so that even if the contractor keeps up the standard performance he gets

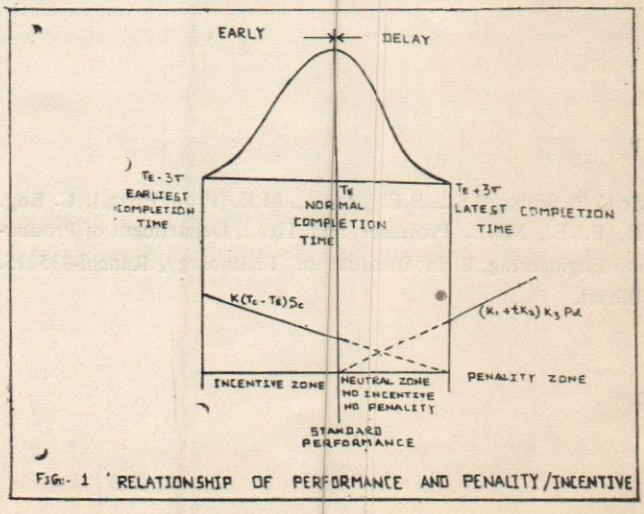

Fig. 1 RELATIONSHIP OF PERFORMANCE AND PENALITY/INCENTIVE

some benefit. Neither Incentive to be paid nor penalty to be charged, if the project completion time falls in neutral zone.

Penality Clause

No penalty should be charged from the contractor till the completion time (T_c) is less than or equal to $T_E + 3\sigma$, as shown in figure 1. Incase the completion time is more than $T + 3\sigma$ then suitable penalty proportional to the percentage delay

$$P_d = \frac{T_C - T_E}{T_E}$$

be made. Where T_c is the actual completion time and T_E is expected completion time as per the PERT network.

The net penalty to be charged on the contractor should be a function of the percentage delay (P_d), Earnest money deposit (K_1), Equal instalment amount of balance security deposited deducted from the running account bills (K_2) and a constant to control the total percentage delay with in which the full penalty is to be recovered (K_3).

Thus the net penalty $= (K_1 + tk_2)\, K_3\, P_d$ (1)

As per the departmental procedure, the EMD is received during the tendering of the work and it is converted into security deposit. The balance security deposit is recovered in 4 equal instalments in the running bills. So, in the formulae,

K_1 = Earnest money deposit

K_2 = Equal instalment amount of balance security deposit deducted from the running on Account bills.

t = 1, 2, 3, 4 which represents the number of bills paid at the time of consideration.

P_d = Percentage of delay.

k_3 = A constant watch can be assigned any value depending upon the total percentage of delay within which the full penalty is to be recovered. $K_3 = 1$, indicates that at 100 per cent of delay of the project the penalty will be recovered in full and for the percentage of delay less than 100 per cent, the penalty will be proportionate. $K_3 = 2$ indicates that at 50 percent of delay of the project the penalty will be recovered in full and for the percentage of delay less than 50 per cent of the penalty will be proportionate. That is for 30 per cent of delay the penalty will be 60 per cent of the total penalty.

In the formulae suggested, if the contractor fails to take up the work, the penalty will be equal to EMD. That is the EMD will be for-feited. After doing some work, if the contractor abandons the work, then the penalty will be the EMD plus the instalments of the security deposit so far deducted from the running bills. That is the security deposit on hand will be for-feited. The percentage of delay in this case will be taken as 100% as it is uncertain to say when the project will be taken up further, after fixing up another agency.

Illustrations

To illustrate the formulae suggested, the following project has been analysed.

This project deals with the construction of a shed for office accommodation, costing amount Rs. 1 lakh. The contract was on item rate contract and the completion period was 3 months. Even though in the initial stages the progress was very good, in the finishing stage the progress was delayed very much and the percentage of delay was 125 per cent. A token penalty of Rs. 200/- was imposed in this case.

The various activities involved in the project, the three time estimates the expected time and the standard deviation of the activities etc. are given in Table 1 and the PERT Net work shown in Figure 2. The security deposit which was 10 per cent of the value of the work is Rs. 9,736/-. k_3 has been assumed as 1. The delay in completion of the project was 115 days. On this work, there was a direct delay of 55 days on the part of the department in the issue of materials, A.C. sheets, cutting of the trees which was on the site etc. So, the delay on the part of contractor was 60 days and the percentage of delay is 70 per cent.

Table 1

Activity Details and Time Analysis

Sl.	Activity Code	Activity Details	Three Time Estimates			Expected Time	σ
1.	A	Receiving approved Drawings & Setting the site office	4	6	8	6	0.67
2.	B	Earth work, concrete Brick Work upto Plinth	12	15	24	16	2.00
3.	C	Refilling the Foundation and Plinth	4	7	10	7	1.0
4.	D	Providing Damp Proof Course	1	2	3	2	0.33
5.	E	Brick Work upto Lintel Level	6	10	20	11	2.33
6.	F	Lintels, Sunshade	4	6	8	6	0.67
7.	G	Brick work above Lintel Level, bed blocks and Holding down bolts	14	18	30	18	2.67
8.	H	Manufacturing doors and windows	14	25	30	24	2.67
9.	I	Fixing doors and windows	5	7	12	7.5	1.17
10.	J	Plastering and Skirting	6	8	13	8.5	1.17
1.	K	Manufacturing tubular Trusses	20	30	40	30	3.33
12.	L	Erection of tubular Trusses and Painting	5	7	12	7.5	1.17
13.	M	Supplying A.C. Sheets	15	21	33	32	3.00
14.	N	Laying of A.C. Sheets	4	6	8	6	0.67
15.	O	Flooring	8	10	15	10.5	1.17
16.	P	White washing & colour washing	4	6	8	6	0.67
17.	Q	Procurement of w/s sanitary and Electrification Materials	20	25	30	25	1.67
18.	R	Fixing w/s Sanitary & Electrification Fittings	8	15	22	15	2.33
19.	S	Procuring Materials for False Ceiling	15	21	33	22	3.0
20.	T	Fixing False Ceilinig	5	8	14	8.5	1.5
21.	U	Plinth protection, Drains Finishing & site clearance	7	12	22	12.83	2.5
		Critical Path				88	3.0

So the net penalty

$= (K_1 + t\,K_2)\,K_3\,P_d$

$= 9736 \times 1 \times 0.7 =$ Rs. 6815.5

Whereas the penalty imposed was only Rs. 200/-.

Incentive Clause

It is logical that when the contractor is expected to pay the penalty for delay he should be given bonus or incentive for early completion of the project and the incentive clause should also be on the similar lines that of penalty clause.

The total time saved due to early completion of the project is equal to (Latest allowable time—Actual time) and if the average cost incurred per day by the management in terms of supervision and opportunity cost over the total span of project execution than the total saving by early completion of the project can be calculated as follows :

Total saving = (Latest allowable − Actual time) × (Average cost per day). If the incentive to be paid as K per cent of the total saving than Incentive to be

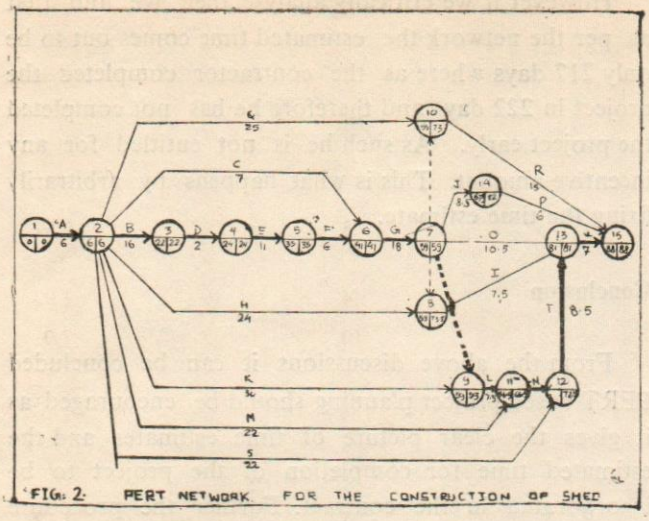

FIG. 2. PERT NETWORK FOR THE CONSTRUCTION OF SHED

paid = K (Latest allowable time − Actual time) × (Average cost − per day)

$$= K (T_E + 3\sigma) - Tc \times (\text{Average cost per day})$$

As it is practically not possible to complete the project in less than $(T_E - 3\sigma)$ days thus the maximum incentive is limited to K × 3 σ × Average cost per day (Fig. 1) and incentive for standard performance will be K × 3σ × Average cost per day.

Illustration

To illustrate the use of formula suggested above, the following project has been analysed.

This project relates to construction of a water tank and was a lump sum contract for Rs. 1.30 lakhs. The contract was inclusive of the contractors own design and the estimated completion time of the project was 270 days. The project was completed in all respects within 222 days. The various activities involved in the project, the three time estimates, the expected time and the standard deviations of the activities etc. are given in Table 2 and the PERT network shown in Figure 3. From the network the critical path time (Normal time)

Table 2

Activity Details and Time Analysis

Sl.	Activity Code	Activity Details	Three Time Estimates			Exp. Time	σ
1.	A	Getting the Drgs. APPD.	5	10	21	11	2.67
2.	B	Setting site office	4	9	20	10	2.67
3.	C	Foundation R.C.C. upto G.L.	25	45	65	45	6.67
4.	D	R.C.C. Shaft	24	45	54	43	6.33
5.	E	Bottom dome slant wall Bottom Ring Beam	10	24	38	24	4.67
6.	F	Wall and Top Ring Beam	20	40	60	40	6.67
7.	G	Top Domes & Ventilation	9	14	25	15	2.67
8.	H	Providing M.S. Ladder & Manhole Collars	10	18	32	19	3.67
9.	I	Supplying C.I. Pipes	6	10	14	10	1.25
10.	J	Supplying C.I. Specials	6	10	14	10	1.25
11.	K	Fixing C.I. Specials & Pipes	10	12	14	12	0.67
12.	L	Supplying Sluice Valves	6	10	14	10	1.25
13.	M	Fixing Sluice Valve and Chamber	1	2	3	2	0.33
14.	N	Providing & Fixing Lightening Arresters	6	8	16	9	1.67
15.	O	Supplying Water Level Indicator	10	15	20	15	1.67
16.	P	Fixing Water Level Indicator	1	2	3	2	0.33
17.	Q	Site Clearance, Testing, Finishing	12	18	36	20	4.00
		Critical Path				217	14.00

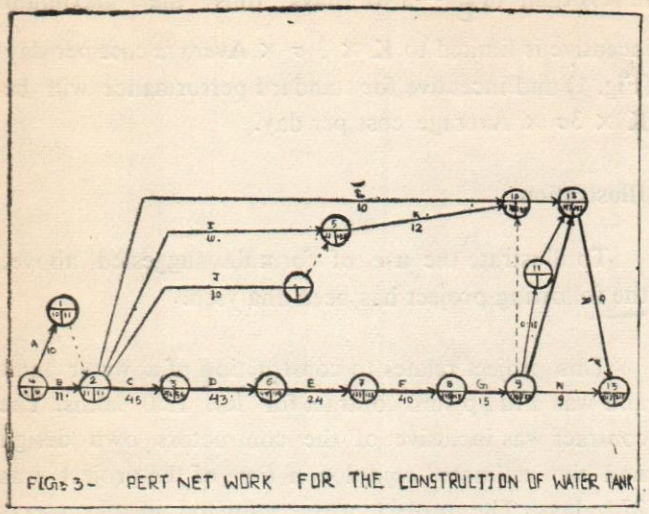

FIG: 3- PERT NET WORK FOR THE CONSTRUCTION OF WATER TANK

comes out to be 217 days and the latest allowable $(T_E + 3\sigma)$ becomes equal $(217 + 3 \times 14) = 259$ days. The average expenses per day incurred by the management in terms of supervision over the span of project duration was estimated to be Rs. 100/- per day. Assuming the value of $K = \frac{1}{2}$ the Incentive can be calculated as follows :—

$$\text{Incentive} = \tfrac{1}{2} \text{ (Latest allowable time} - \text{Actual time)} \times \text{(Average Expenses—per day)}$$

$$= \tfrac{1}{2} (259 - 222) (100)$$

$$= \text{Rs. } 1850$$

No incentive was paid to the contractor where as he should have been paid Rs. 1850/- as per the estimated time given in the contract.

However if we critically analyse then we find that as per the network the estimated time comes out to be only 217 days where as the contractor completed the project in 222 days and therefore he has not completed the project early. As such he is not entitled for any incentive amount. This is what happens by arbitrarily fixing the time estimate.

Conclusion

From the above discussions it can be concluded PERT based project planning should be encouraged as it gives the clear picture of time estimates and the estimated time for completion of the project to be incorporated in the contract. Further the procedure and the formula suggested for the calculation of penalty and incentive may greatly help in rationalising the various procedures presently adopted.

Acknowledgement

The author gratefully acknowledges the advice given by Dr. V.L. Srivastava, Dean of Commerce and Business Management, Ranchi University.

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A Van Scheduling Problem

A.D. GUPTA & B.K. GUPTA

In this paper, an attempt has been made to present a case study which was conducted in Eastern Railways to determine the minimum time consuming van routes for distribution of the items stocked at a depot to various demand centres engaged in the maintenance of the rolling stock. The shortest route model suggested by Hillier and Liebermann has been used, which fans out from the origin successively identifying the shortest routes in terms of time taken to each of the nodes of the network in the ascending order of their (shortest) distances until the destination is reached. The paper presents the design of one of the van routes.

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Introduction

The problem aims at finding out the minimum time consuming van routes for the distribution of items stocked at a depot in a large public sector transport undertaking. This depot caters to the demands of various consumers at different locations engaged in the maintenance and operation of rolling stock.

The depot despatches the items by delivery vans attached with available goods or passenger trains. The vans are detached at stations where the train terminates or where the items demanded are so many that waiting of the whole train for unloading may be economical. The vans after issuing all the materials return to the parent depot.

At present, delay arises due to improper planning of the schedule of despatches and routes adopted. The other factors contributing towards delay are nonavailability of trains, bottlenecks in the marshalling yards, etc. The queuing of vans occurs at the depot awaiting loading due to restriction of manpower and other facilities available.

Mathematically, the problem can be stated as :—

Let $P_1, P_2, P_3 \ldots\ldots, P_m$ be the delivery points (set of consumers) with $Q_1, Q_2, Q_3 \ldots\ldots Q_m$ as the demands. All the interpair shortest timings are represented by t_{ij} $(i, j = 1, 2, \ldots\ldots m)$ and the available capacity by C_i $(i = 1, 2, \ldots\ldots, n)$. $X_{ij} = X_{ji} = 1$ means that the points P_i and P_j are adjacent and $X_{ij} = X_{ji} = 0$ means that the points are not adjacent in any tour.

The problem is to find out those values of X_{ij} which make total time

$$T = \sum_{i,j=1}^{m} t_{ij} X_{ij}$$

a minimum subject to conditions and constraints specified below :

$$\text{Max } C_i \ (i=1, n) \leq \sum_{j=1}^{m} Q_j$$

$$\sum_{i=1}^{n} C_i > \sum_{j=1}^{m} Q_j, \text{ Po being the terminal point.}$$

Model formulation

Shortest route problem by Hillier and Liebermann [1] fans out from the origin successively identifying the shortest route in terms of time to each of the nodes of the network in the ascending order of their (shortest) distances until the destination is reached.

The given points P_j (j = 1, 2, 3, 4, ... , m) are divided into N groups. Further subgrouping has been done depending upon the number of indentors served and the deliveries to be made at a point. Time taken between two stations of a subgroup is found out as shown in Fig. 1.

Let,

T = Cumulative time

X = Starting station

Y = Next station of subgroup

T_d = Departure Time of train from Station X

T_j = Journey time from Station X to Station Y

T_s = Sorting Time at Station Y

T_a = Arrival Time at Station Z

T_r = Time at which Van is ready for despatch to next station.

It should be our effort to reach the starting station of a group in a shortest possible time. Upto starting station of a group, the van need not be stopped

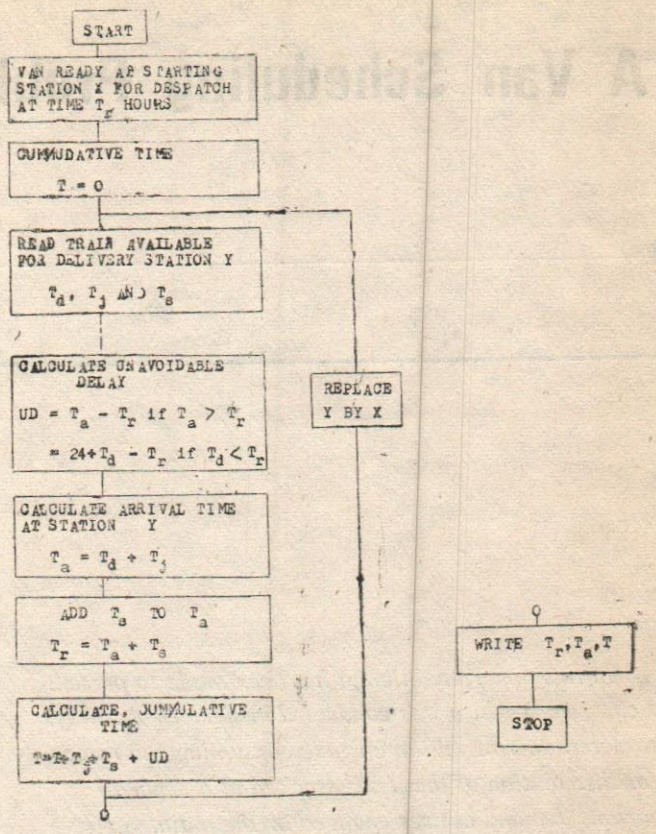

Fig. 1

or detached since it will not deliver material to any station from source to starting point of a group. But due to termination of a train before reaching the starting station of a group, the van has to be detached in the yard and has to be stored out for despatch. Therefore we find a number of alternatives available for reaching the starting station of a Group. Following example will clarify the method of finding out the shortest route (Fig. 2).

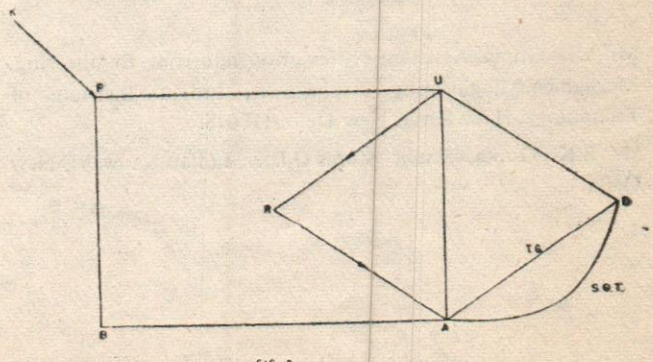

FIG 2

(i) A, B, D, K, P, R, U are the different stations.

(ii) Arrow indicates that the train is available only for that direction.

(iii) T.G. means Through Goods Train which stops only at terminal station.

(iv) S.Q.T. means Small Quick Transit Train which stops at road side stations to load/unload the items for those stations.

Determination of the Shortest Route

The shortest route for reaching from Station K to Station D can be found out as under :—

3.1 *STEP = 1*

T = 0

T_r = 1000

K	P	B	U	R	A	D
t_d = 1000	0400	0845	0820	1030	0600	
T = 39,15	PU-96,30	BP-40,30	UR-24,00	RA-52,20	AD_s-39,30	
T_r = 0115	0430	0115	0820	1450	2130	
		—	—		—	
	1910	—	—		—	
	PB-68,30	BA-79,05	UA-76,50		AD_t-41,20	
	1540	—	—		—	
			1000		—	
			UP-42,30		AB-85,15	
			0430		—	

Solution for Shortest Route

3.2 *STEP = 2*

T = 0 39, 15

t_r = 1000, 0115

K^x	P	B	U	R	A	D
t_d = 1000	0400	0845	0820	1030	0600	
KP-T = 39,15	PU-99,15	BP-40,30	UR-24,00	RA-52,20	AD_s-63,30	
T_r = 0115	0430	0115	0820	1450	2130	
	1910	—	—		—	
—	PB-86,25	BA-79,05	UA-76,50		AD_T -41,20	
	1540	—	—	—	—	
			1000		—	
			UP-42,30		AB-85,15	
			0430		—	

PU = 39, 15 + 99, 15 = 138, 30

PB = 39, 15 + 86, 25 = 125, 40 (Selected)

Solution for Shortest Route

3.3 *STEP : 3*

T = 0 39,15 125,40
t_r = 1000 0115 1540

K	P	B	U	R	A	D
t_d = 100	0400	0845	0820	1030	0600	
KP-T = 39,15	PU-39,15	BP-40,30	UR-24,00	RA-52,20	AD_S-39,30	
t_r = 0115	0430	0115	0820	1450	0430	
	1910	—	—		—	
	PB-86,25	BA-79,05	UA-76,50		AD_T-41,20	
	15,40	—	—		—	
			1000		—	
			UP-42,30		AB-85,15	
			0430		—	

Solution for Shortest Route

3.4 *STEP : 4*

T = 0 39,15 125,40 138,30
t_r = 1000 0115 1540 04,30

K^x	P^x	B	U	R	A	D
1000	0400	0845	0820	1030		
KP-39,15	PU-99,15	BP-40, 30	UR-27,50	RA-52, 20		
0115	0430	0115	0820	1450		
	1910	—	—	—	—	
	PB-86,25	BA-78,05	UA-76,50		AD_T-41,20	
	1540	—	—	—	—	
			1000		—	
			UP-42,30		AB-85,15	
			0430		—	
					0600	
					AD_S-39,30	
					2130	

Solution for Shortest Route

3.5 *STEP* : *5*

T = 0	39,15	125,40	138,30	166,20
t_T = 1000	0115	1540	0430	0820

X^x	P^x	B	U	R	A	D
1000	0400	4845	0820	1030		
KP-39,15	PU-99,15	BP-40,30	UR-22,50	RA-54,30		
0115	0430	0115	0820	1450		
	1910	—	—		0600	
	PB-86,25	BA-79,05	UA-76,50		AD_B-33,30	
	1540	—	—		21,30	
			1000		—	
			UP-42,30		AD_T-41,20	
			0430		—	
					AB-85,15	

BA = 204, 45 (Chosen)
UA = 215, 20
RA = 220, 50

Solution for Shortest Route

3.6 *STEP* : *6*

T = 0	39,15	125,40	138,30	166,20	204,45
t_T = 1000	0115	1540	0430	0820	2245

K^x	P^x	B^x	U^x	R^x	A	D
1000	0400	0845	0820	1030	0600	
KP-39,15	PU-99,15	BP-40,30	UR-27,50	RA-54,30	AD_B-46,55	
0115	0430	0115	0820	1450	2130	
	1910	—	—		—	
	PB-86,25	BA-79,05	UA-76,50		AD_T-41,20	
	1540	—	—		—	
			1000		—	
			UP-42,30		AB-85,15	
			0430		—	

Shortest Route D_T – A – B – P – K
Tracing Backwards K – P – B – A – D_T

T = 246,05
T_T = 1605

ANNEXURE I

Oil Van Route No. 1

Route : KAN UDL IRH ASN DHN

Time : 1247 Hour 45 Minutes

Station	ARR/DEP.	Train No.	Time hrs.	Day	Cum. Time Hrs. Mins.
1	2	3	4	5	6
Working Stations :					
KAN	D	DGR Pilot	1000	1st	—
PAN	A	-do-	1245	1st	2-45
	D	IOC Pilot	0400	5th	90-00
UDL	A	-do-	1000	5th	96-00
	D	Jamuria Pt.	1230	19th	434-30
IRH	A	-do-	1700	19th	440-00
	D	Tapsi Pt.	1900	20th	465-00
UDL	A	-do-	2330	20th	469-00
	D	RNJ-Pilot	0820	25th	574-20
RNJ	A	-do-	0920	25th	575-20
	D	RNJ-Pilot	0815	28th	646-15
ASN	A	-do-	0940	28th	647-40
	D	1165 UP	0600	40th	932-00
BRR	A	-do-	0800	40th	934-00
	D	1165 UP	0840	43th	1006-40
DHN	A	-do-	1540	43th	1013-40
	D	365 DN Pgr.	0507	50th	1171-07
Return Journey :					
BWN	A	-do-	0828	50th	1174-28
	D	DGR Pilot	0845	53th	1246-45
KAN	A	-do-	0945	53th	1247-45

Now the various routes formed are merged together with the feeding groups with the help of an algorithm shown in Fig. 3.

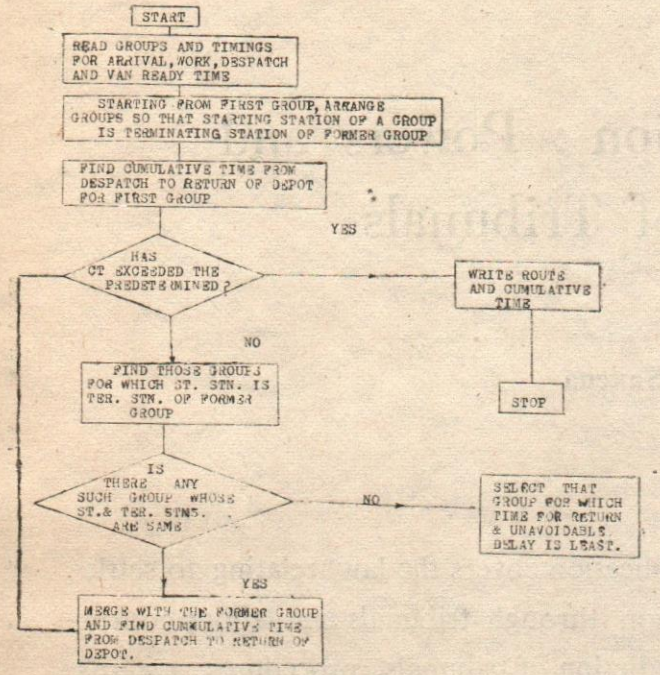

FIG. 3

ALGORITHM FOR MERGING OF ROUTES

Results

40 Groups and 129 subgroups have been formed. The delivery and travelling times have been calculated. Then the Groups have been merged to find out the routes till the arranged list of all the feasible groups exhausts. No van is allowed to remain out of depot for more than 60 days. 11 optimum routes have thus been formed. The various routes and total time taken from and to the Depot, for delivering the items to consumers along the routes, have been formed [2]. One of such routes is shown in Annexure—I.

Drawbacks and Limitations

The model is based upon the availability of trains and their timings of arrival and departure. In case some train is cancelled due to unforeseen reason or its timings are changed, the routes will be affected. Thus the route may have to be redesigned. A huge amount of computational effort is required to find out the combination of trains to reach the starting station of a group and to return from the terminal station of the group. Though the efforts are made to minimize the total time for deliveries, the routes formed may not be optimum. However, the model at present applied to the distribution of various types of oils can be extended to other items as well with certain mdifications.

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Praductivity
1984, XXIV, 4, 519-526

Impact of Mixed Farming on Productivity

RACHHPAL SINGH & J.L. KAUL

An attempt has been made in this paper :

(i) *to work out the economics of different alternatives of mixed farming in Punjab Agriculture ;*

(ii) *to study the impact of mixed farming on human labour employment ; and*

(iii) *to estimate the credit needs at dlfferent levels of mixed farming on these farms.*

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The economy of Punjab is heavily dependent upon agriculture. Besides providing employment to about 80% of its population, it contributes more than 50 per cent towards the gross state domestic product. Thus to run the economy of state on sound lines an overall development in the field of agriculture is a must. Punjab agriculture is currently faced with a problem of adjusting to changing conditions of technology. Production practices, market demand and other factors are continually changing,

The Green Revolution

The green revolution has resulted into a sharp increase in the area under plough and production of cereals. The area under pulses, oilseeds and other crops has experienced a significant decline. Table below shows the index of production of various crops for 1978-79.

Crop	Index for 1978-79 (Triemium ending 1961-62=100)
Wheat	452.3
Paddy	1331.6
Cereals	487.9
Pulses	42.3
Oilseeds	158.2

The table provides enough evidence to suggest that the green revolution favoured the production of cereals in general and paddy-wheat combination in particular. No other crop but vegetable could compete with "paddy-wheat" rotation at current level of prices and technology. Increase in the area under vegetables will bring prices down to an unprofitable level. As a result, the Punjab farmers have specialised in "paddy-wheat" rotation.

Specialization involves a high degree of risk and uncertainty. The flow of income is also uneven. As such the need to adopt mixed farming in agriculture is necessitated for many reasons. Firstly for a smooth functioning of the farm, regular flow of income is required throughout the year. Secondly, the uncertainty attached with specialization is reduced. Thirdly, any addition in income is likely to be spent towards improving the quality of food rather than quantity. This is so because income elasticity of demand for food-grains in Punjab is very low. Consequently, the demand for milk, meat and eggs is expected to increase manifold. By introducing mixed farming we can make an effort to meet the increased demand of these product.

The degree and extent of mixed farming depends upon the financial position of the farmer, and his degree of risk aversion. It is also affected by the availability of credit facilities. The marketing becomes a major bottleneck in the adoption of poultry, dairy and vegetable farming. In view of the lack of transport, cold storage facilities and incompetetive rates of existing cold storages the situation seems to be worse. A well planned and timely action in this direction is required so that the farmers are not caught unaware.

An attempt has, therefore, been made in this paper—

(i) to work out the economics of different alternatives of mixed farming in Punjab Agriculture ;

(ii) to study the impact of mixed farming on human labour employment ; and

(iii) to estimate the credit needs at different levels of mixed farming on these farms.

Methodology

Sultanpur Lodhi Block of Kapurthala District was selected purposively for this study. In this area most of the farmers follow "paddy-wheat" rotation. This block serves as a model for typical situation, as paddy and wheat crops cover most of the area during *kharif* and *rabi* seasons, respectively. Out of total villages in the block, eight villages were randomly selected. A complete list of all operational holdings of farmers of selected villages was prepared with the help of village *patwaries* and other village leaders. The farm holdings were then arranged in ascending order of their operational size. Cumulative cube root method of stratification was used to stratify the holdings into three groups. The range of operational farm size of these groups was as follows :

Group- I	Upto 7.52 acres
Group- II	7.52 to 15.04 acres
Group-III	Above 15.04 acres.

From these groups, 150 farmers were randomly selected, fifty from each group. The average operational size of the holding was worked out to be 5.81, 11.02 and 21.65 acres for groups-I, II and III respectively (Here after called small, medium and large). The data regarding fixed farm resources, and land use capabilities for the year 1980-81 for all the 150 farm holdings was collected through a specially structured schedule.

Model Used

The profit maximizing model of linear programming as stated below was used to obtain normative plans which would maximize returns to fixed farm resources :

$$\text{Maximize : } Z = \sum_{j=1}^{n} C_j X_j \; (j = 1, 2, \ldots\ldots, n)$$

$$\text{Subject to : } \sum_{j=i}^{n} a_{ij} X_j \leqslant b_i \; (i = 1, \ldots n)$$

$$b_i \geqslant 0; \; X_j \geqslant 0 \; \forall \; j \text{ and } i$$

Where,

- a_{ij} are input-out coefficients
- C_j return over variable costs
- X_j real activities, and
- b_i resource restrictions

Constraints used

Land: Land and capital are the most limiting resources in farm production. There are certain periods in the year, when the family labour becomes inadequate to cope with the farm operations. Therefore, the supply of family labour during critical periods was also considered as restriction. Again, some land is invariably set apart by the farmers for raising fodders for meeting the requirements of livestock maintained on their farms. The requirement of land per animal for *kharif* and *rabi* fodders was restricted to 0.30 and 0.20 acres respectively and this was considered as fixed activity. Though sugarcane is a highly profitable crop, the area under this crop was restricted to 0.50, 1.00 and 1.50 acres on small, medium and large farms respectively, depending upon the limited crushing capacity at the farm as there is no sugar mill in the area.

Human labour: The human labour resource restrictions were examined by assessing the available permanent labour resource comprising of family labour and permanent hired labour on these farms. The labour required for fixed farm activities such as tending of livestock and for production of fixed farm activities was deducted from total available man hours to arrive at the net man hours available for farm operations for the important labour peak periods during an agricultural year. This was done under the assumption that each worker contributed his labour for eight hours a day.

The following peak periods were included as constraints in the analysis.

	Period	*Important operations*
1	Mid-April to end of May	Wheat harvesting and threshing, nursery raising for paddy and sugarcane hoeing
2	7th June to end of July	Maize and Arhar sowing, paddy transplanting, maize, Arhar and sugarcane hoeing
3	10th October to end of October	Maize harvesting and threshing
4	Beginning of November to end of December	Paddy harvesting and threshing, wheat sowing, Arhar harvesting
5	Beginning of January to end of January	Sugarcane crushing and wheat hoeing

The work load being lighter in remaining periods, there was no shortage of labour during this period of the year.

Capital: Capital availability is one of the major bottlenecks in Indian agriculture. Capital was, therefore, introduced as a constraint for both *kharif* and *rabi* periods separately. The existing working capital was estimated by including the capital inputs used as working expenses during both the seasons in existing plans, and was taken as capital availability for the two respective periods.

Credit requirements: Short term credit requirements were worked out by deducting the cash expenses in the optional plans from cash expenses in the existing plan. The long term credit requirements, however, depended upon the additional costs incurred on implements, buildings, etc.

Input-output Coefficients

Input-output coefficients were developed for each crop per unit of area for different enterprises under different situations. These coefficients at the improved level of technology were based on the recommendations of various subject matter specialists of Punjab Agricultural University, Ludhiana. The input-output coefficients regarding dairy, poultry and piggery were

developed with the help of respective experts. These coefficients were reduced to one year period, so that these could be compared with crop enterprises for the purpose of analysis. As labour hiring activity was introduced as a separate activity, so the co-efficients developed for various enterprises did not include the expenses on labour.

Activities Used

The activities used for the present study are mentioned as under :

Real activities : These include production activities at the sample farms and the hiring in activities for scarce resources. Individual crop was taken as a separate activity.

Labour hiring activity : It was used for peak periods as described earlier. The capital requirement for wages per unit of hired labour were taken care of. The cost of hiring labour was assumed as Rs. 1.25 per man hour.

Capital borrowing activity : The capital borrowing activities for both *kharif* and *rabi* seasons were used to supply additional capital as working expenses. Interest plus principal was charged as cost of borrowing.

Results and Discussion

Annual total labour availability on the small, medium and large farms was 517.89, 291.56 and 241.70 manhour per acre respectively. This shows that small farms are labour intensive. But the permanently hired labour on small farm was much less as compared to the medium and large farms (Table 1). Bullocks were the main source of power on small and medium farms. Even on large farms bullocks were kept as a second line of defence. The average bullock units available on small, medium and large farms were 2.00, 2.00 and 1.00 respectively. Buffalos are the most popular milch animals kept for milk consumption by the farmers.

Impact of Improved Technology on Farm Income

An analysis of the existing resource use pattern

TABLE 1

Availability of different resources, minimum and maximum constraints on different farm situations

Particulars	Small	medium	Large
Draft power (bullock units)	2.00	2.00	1.00
Crop maximum (acres)			
sugarcane	0.50	1.00	1.50
Farm size (acres)	5.81	11.02	21.65
Labour availability (Man hours)			
Family	496.19	208.62	130.53
Hired	21.70	82.94	111.17
Total	517.89	291.56	241.70
Livestock minimum (at existing prices)			
Dairy (Cross-bred cows)	3	5	10
Piggery (rows)	1	2	5
Poultry (birds)	100	100	500

in the existing plans revealed that yield level of the crops were below the potential. In order to know the extent to which the farmers were operating below potential, the existing plans with improved technology were developed. It was found that the farm incomes could be increased considerably if recommended level of fertilizers, proper time of sowing and adequate plant protection measures were adopted. The use of recommended farm practices increased the returns to fixed farms resources by 19.19, 15.96 and 11.67 per cent over the existing farm situation on small, medium and large, farms respectively (Table 2). The analysis indicated that small farmers had a fairly good scope for increasing farm income and productivity by adopting improved technology compared to medium and large farmers.

Impact of Mixed Farming on Farm Income

At the existing level of prices the cropping pattern of the farm did not change. This indicated that the "paddy-wheat" rotation was most paying at the existing level of technology, except for sugarcane, which can not be cultivated commercially.

With milk sale price at Rs. 1.60 per litre, dairy

TABLE 2

Per acre return to fixed farm resources on small, medium and large farms, Sultanpur Lodhi (Kapurthala) (Rupees)

Plan	Small	Medium	Large
1. Existing plan	2586.95	2915.00	3044.36
2. Existing plan with improved technology	3083.53 (19.19)	3380.37 (15.96)	3399.92 (11.67)
3. Existing plan with improved technology and 0.50 acres of sugarcane	3430.94 (32.62)	3692.74 (26.68)	3568.08 (17.20)
4. Optimal plan with dairy milk @ Rs. 2.20 per litre	3447.10 (33.24)	3708.76 (27.23)	—
5. Optimal plan with dairy milk @ Rs. 2.40 per litre	4568.84 (76.61)	4913.13 (68.54)	—
6. Optimal plan with dairy milk @ Rs. 2.60 per litre with minimum restrictions	5807.45 (124.49)	6544.65 (124.51)	6399.69 (110.21)
7. Dairy (3,5, and 10 cows) on S. M. and L. farm	2566.84 (−0.77)	2846.14 (−2.36)	2716.00 (−10.78)
8. Poultry (100,200 and 500 evids on S.,M., and L. farm)	2566.88 (−0.77)	2751.13 (−5.62)	2386.76 (−21.60)
9. Piggery (1,2, and 5 sous. on S.M. and L. farm)	2736.45 (5.77)	2425.43 (−16.79)	2703.18 (−11.20)

Figures in the parentheses indicate the percentage increase over the existing plan.

enterprise did not enter the optimal plan in any of the three farm situations. The price variable programming was adopted to find a price at which the dairy would find a place in the cropping pattern. It was only at the milk sale price at Rs. 2.20 per litre that three dairy cows entered on each of the small, medium and large farms respectively. The net farm income per acre increased by 33.24 and 27.23 per cent in the respective situation. With a further increase in the sale price of milk to Rs. 2.40 and Rs. 2.60 per litre, 12 cows entered the optimal plan of small farms. The increase experienced in net farm income was 76.61 and 124.49 per cent for the respective prices. Twenty-nine dairy cows entered the optimal plan of medium farms for the milk prices mentioned earlier. The increase in net farm income was calculated at 68.54 and 124.51 per cent. The number of dairy animals on the small and medium farms did not change with change in prices from Rs. 2.40 to Rs. 2.60 per litre because land acted as a constraint, since whole of the available area in kharif season came under fodders. One of the peculiar features of the study was that even at milk sale price of Rs. 2.40 per litre dairy enterprise did not find a place in the optimal plans of large farms. This can be explained from the fact that the large farmers were at a higher place on the production curve and even at a higher price of milk, dairy did not favour their plans. But when the sale price of milk was increased to Rs. 2.60 per litre, 58 dairy heads entered the optional plan increasing the net farm income by 110.02 per cent (Table 2).

Piggery and poultry enterprise were also included in the programme matrix as activities. But even a large increase in the prices of their products could not make them enter the optimal plans of the farmers.

The above explanation clearly suggests that apart from increasing the prices of these products a lot needs to be done to increase the productivity of these products so that they can find a place in the farm plans.

Impact on Working Capital and Credit Requirements

There is a marked increase in working capital as well as credit requirements when improved level of technology and livestock entered the optimal plans of all the categories of the farms. A perusal of Table 3 and 4 together shows that per acre working capital requirements increased by 8.97, 13.69 and 17.60 per cent over the existing plan on small, medium and large farms respectively when improved technology was introduced. The per acre short term credit requirements associated with this situation were Rs. 161.41, Rs. 284.96 and Rs. 354.58. The entry of 0.5, 1.00 and 1.5 acres of sugarcane increased the per acre working capital by 14.14, 17.75 and 17.87 per cent on the above mentioned situations. The short term credit requirements associated with this were calculated at Rs. 254.49, Rs. 347.82 and Rs. 423.36 respectively. The working capital as well as credit requirements increased when the dairy enterprise entered the optimal plans as a result of increase in sale price of milk. Table shows that when piggery

TABLE 3

Per acre working capital requirements on small, medium and large farms, Sultanpur Lodhi (Kapurthala) (Rupees)

	Small	Medium	Large
1. Existing plan	1799.34	1958.91	2010.36
2. Existing plan with improved technology	1960.75 (8.97)	2227.25 (13.69)	2364.95 (17.63)
3. Existing plan with improved technology and 0.50, 1.00 and 1.50 acres of sugarcane on small, medium and large farm repectively	2053.94 (14.14)	2306.78 (17.75)	2369.79 (17.87)
4. Optimal plan with dairy milk @ Rs. 2.20 per litre	3324.63 (84.76)	2510.32 (28.14)	—
5. Optimal plan with dairy milk @ Rs. 2.40 per litre	7385.38 (310.44)	9068.04 (362.91)	—
6. Optimal plan with dairy milk @ Rs. 2.60 per litre	7385.38 (310.44)	10432.05 (432.54)	9312.87 (363.24)
With minimum constraints			
7. Dairy (3, 5, and 10 cross-breed cows on small, medium and large farms respectively)	3373.70 (87.49)	3441.89 (75.70)	3538.18 (75.79)
8. Poultry (100, 200 and 500 birds on small, medium and large farms)	3125.13 (73.68)	3419.68 (74.57)	3788.34 (88.44)
9. Piggery (1,2, and 5 sous on small, medium and large farms)	3949.90 (119.51)	3737.80 (90.81)	3579.58 (78.05)

Figures in the parentheses indicate the percentage increase in working capital requirements.

and poultry entered the plans by setting minimum restrictions, the working capital and credit requirements on all the farm situations increased sharply. This shows that livestock is highly capital intensive and requires outside source of finance.

Impact of Mixed Farming on Employment

One of the objectives of the study was to examine the impact of various levels of mixed farming on labour use on different farm situations. This aspect of the study is analysed and is presented in Table 5. An addition of 0.50, 1.00 and 1.50 acres of sugarcane increased the per acre labour use by 4.50, 20.37 and 24.73 per cent on small, medium and large farms respectively. The labour use went up by 23.33 and 31.52 per cent on small and medium farms when 3 dairy cows entered the optimal plan as a result of sale price increase of milk to Rs. 2.20 per litre. When the price of milk was further raised beyond Rs. 2.40 per litre, the number of dairy animals on

TABLE 4

Credit requirements per acre on small, medium and large farms, Sultanpur Lodhi (Kapurthala) (Rupees)

	Small	Medium	Large
1. Existing plan	—	—	—
2. Existing plan with improved technology	161.41	284.96	354.58
3. Existing plan with improved technology and sugarcane (0.50, 1.00 and 1.50 acres on small, medium and large farms)	254.49	347.82	423.36
4. Optimal plan with dairy milk @ Rs. 2.20 per litre	1539.66 (420.82)	549.80 (221.80)	—
5. Optimal plan with dairy milk @ Rs. 2.40 per litre	5556.86 (1680.30)	7083.74 (2144.73)	—
6. Optimal plan with dairy milk @ Rs. 2.60 per litre	5556.86 (1680.30)	7083.84 (2144.73)	7276.35 (2183.37)
With minimum restrictions			
7. Dairy (3,5,10 cows on small, medium and large farms respectively)	1574.35 (420.82)	1482.93 (369.70)	1527.81 (376.44)
8. Poultry (100, 200 and 500 birds on small, medium and large farms respectively)	1325.63 (1035.75)	1460.70 (1110.07)	1777.97 (1412.50)
9. Piggery (1, 2, and 5 sous on small medium & large farms respectively)	1164.45 (464.71)	17778.83 (490.01)	1569.22 (623.55)

Figures in the brackets represent long run credit and without brackets represent short term credit requirements.

TABLE 5

Per acre labour use on small, medium and large farms, Sultanpur Lodhi (Kapurthala), Man-hours

	Small	Medium	Large
1. Existing plan	423.30	354.80	355.69
2. Existing plan with improved technology	423.20	354.80	355.69
3. Existing plan improved (with 0.50, 1.00 and 1.50 acres of sugarcane on small, medium and large farms)	442.24 (4.50)	427.08 (20.37)	443.67 (24.73)
4. Optimal plan with milk @ Rs. 2.20 per litre	591.92 (23.33)	466.62 (31.52)	—
5. Optimal plan with milk @ Rs. 2.40 per litre	790.30 (86.74)	994.16 (180.20)	—
6. Optimal plan with milk @ Rs. 2.60 per litre	790.30 (56.74)	994.16 (180.20)	241.71 (4.88)
With minimum restrictions			
7. Dairy (3, 5, 10 cows on small, medium and large farms)	526.66 (24.45)	518.50 (46.14)	231.58 (7.19)
8. Poultry (100, 200 and 500 birds on small, medium and large farm)	450.48 (6.45)	465.31 (31.15)	231.58 (7.19)
9. Piggery (1. 2, and 5 sous on small, medium and large farms)	439.75 (3.91)	447.67 (26.17)	218.00 (0.91)

Figures in parentheses indicate percentage increase in labour requirement over existing plan.

the small and medium farms remained at 12 and 29 heads for the respective situations. The increase in labour employment experienced was 86.74 and 180.20 per cent respectively. When sale price of milk was raised to Rs. 2.60, 50 dairy cows entered the optimal plan of the large farms. The labour use went up by 183.27 per cent as a result of inclusion of livestock.

Further Dairy cows, poultry and piggery were included in the plan by setting up minimum constraints at the existing level of prices (Table 5). It was observed that labour use went up on all the three farm situations for all the livestock enterprises. This was a clear indication that livestock can provide gainful employment, provided it finds a place in the production plan of the farmer.

Conclusion

At present one is caught in peculiar situation. On the one hand large quantities of foodgrains are imported to meet the home demand. On the other hand the consumption of milk and milk products, meat and vegetables by an average Indian is far below the requirement. This necessitates that along with foodgrains production, the production of milk and milk products, meat, vegetables and fruits should be stepped up. This testifies the urgency in adoption of mixed farming. Because of limited scope of increasing area under the plough, the only alternative left is by increasing the yield potentials of all the agricultural enterprises.

There is much scope for increasing the farm productivity and income when improved technology is adopted by the farmers. The working capital increased significantly when livestock entered the optimal plans of the farms. The mixed farming can also increase the labour employment on all the farms. However, large amount of credit is required for the adoption of mixed farming. It can be concluded that at the existing level of prices and technology the adoption of livestock on the farms is not economic. Similar studies should be carried out in other parts of the state from time to time so as to help the farmers, financial institutions and policy makers.

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Productivity
1984, XXIV, 4, 527-529

EXECUTIVE READINGS

Small Farmers Development Programme

S.M. Pandey

J.S. Sodhi

Shri Ram Centre for Industrial Relations and Human Resources New Delhi, 1981

Reviewed by

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Dy. Director, National Productivity Council

The study carried out by Shri Ram Centre for Industrial Relations and Human Resources is an economic analysis of the Small Farmers' Development Programme in Budaun, Fatehpur and Rae Bareli districts of Uttar Pradesh. It examines the pattern of assistances utilisation by the participants of the scheme and its impact upon their economic status. The authors have made a comparative analysis of the participants and non-participants in terms of income, employment, expenditure pattern and debt position. The study has also highlighted the deficiencies in the working of the programme.

The observations made by the authors are pertinent to any rural development programme. The practices of setting high targets without ensuring infrastructure and funds, evaluation of the programme on the basis of fund utilisation rather than physical achievements, modifications in the activities and targets to match the achievements are some of the usual facets of these programmes. The book also highlights the field level problems and malpractices that engulf these programmes. The vested interests, lack of motivation for field staff, lack of facilities and proper guidelines, inadequate training, all combine to dilute the spirit of the programme.

But whatever may be the bottlenecks, the study signifies the change that has taken place among the weaker sections of the rural people. The participants of the programme were found to be economically better than the non-participants.

The authors have also made suggestions for improving the implementation of the Small Farmers Development Programme. Although, the programme is no more in existence, the suggestions made are equally true for the implementation of Integrated Rural Development Programme. Significant policy decisions and guidelines can be framed on the basis of the observations made by the authors.

Besides all above, the book provides a simple and interesting reading for all.

Emerging Profile of Finance Function

The Nature and Scope of the Finance Function—Past, Present and Future

G. Murthy

Published by : Lalalajpatrai Research Centre
Price : Not mentioned
PP : 29

Reviewed by: Dr. Badar Alam Iqbal, Lecturer, Faculty of Commerce, A.M.U., Aligarh

It has been rightly said by an eminent classical economist that 'finance is the oil of the wheels, the

marrow of the bones, the blood in the veins and spirit of all trade, commerce and industry'. As a result, finance function has become a vital aspect of modern management and the success of an enterprise depends upon the efficiency with which the funds are managed. Although funds management is the joint responsibility of all the business managers, the financial manager has to play a cardinal role in performing the most difficult tasks of modern management in effective and efficient manner.

The present small monograph captioned 'The Nature and Scope of the Finance Function' is a comprehensive and analytical study providing a systematic and balanced treatment of theory and practice. The monograph takes off, from historical perspective of the subject and goes ahead with the discussion on past, present and future roles of finance manager in a business organisation.

At the very out set, the author has rightly opined that 'a redeeming feature of the 20th century corporate scene is the emergence of financial management, as a distinct discipline at the level of the individual enterprise. In the past, financial management of business was considered as a part of the wider discipline of the economics. As a result, it was very difficult to identify an independent function of and scope for finance in business'. But with passage of time this notion has gone a radical change and became one of the most important tasks of modern management.

After highlighting the functions of the finance manager in the past (traditional functions) and the present (managerial functions), the author goes further and points out the emerging profile of the finance manager. According to him, the changing functions of the finance manager, in the past, have been influenced by the pressures of the external environment like past of technological advancement, squeeze on profits margins, greater opportunities for enterpreneurial activities and the growing size of the modern corporations. Therefore, there has been a shift of emphasis in the finance function which in turn has contributed to a change in the role of the finance manager. The discussion on the emerging role of finance manager is worth reading and provides a basis for further research.

The monograph is written in simple and lucid style, avoids unnecessary mathematics. It is a welcome addition to the existing literature and will provide a deep insight to all those who are concerned with the subject.

Promod K. Batra

Think . . .

There must be a better way

Pub. by : Promod K. Batra

C-28, Nizammuddin West, New Delhi-110 013 India

Ed : August, 1982

Price : 100/US $ 15

PP : 46 plus exhibits

Reviewed by : Shri M.S. Rao
NAVS & SIGS School, Begumpet
Secunderabad

"Thinking is the hardest work that is, which is the probable reason, why so few engage in it".—Henry Ford. This is an action research report, that focusses on the thinking that is needed, for office-cost reduction and paper work simplification.

Batra is right, when he says 'Ideas are rupee a dozen.' "And therefore while flipping the pages of this report, you may feel that some of the ideas are very ordinary—what we may at times call common sense," Just the same, Batra deserves to be congratulated for he has taken care to compile several ideas together and who knows what good effects this book might have in the various offices, this book reaches."

The most important thing about this book is that it is inspiring. It is bound to generate ideas. The book, in eighteen chapters discusses, as to how to do a job in a better way—the Miser way *M* erge it with other works, *I* mprove it, *S* implify it, *E* liminate it and *R* educe it., whether it be concerned with the Mail room, correspondence, Telephone, Telex, records management, business and government forms, stationary, accounting, insurance claims, stores, packing, order processing or any office pracedure. Some ideas, that the book mentions—

—prepunching of forms at the printing stage itself,

--pre addressed envelopes,

—depending upon the value, bill rounded off to nearest Rs. 10/- or Rs. 100/- to facilitate cash handling,

—packing charges not based on packing case size, but charged as a percentage of value of goods,

—elimination of mail receipt and despatch registers. The franking machine becomes a record of monies spent on mailing,

—reduction of typing strokes—side address consists of name and station only. Rs. 25000/- only is written as Rs. 25,000 and so on (window envelopes eliminate typing address on envelope, Mr. Batra !)

Mr. Batra is very right when he says "Germination takes place when the earth is loose enough and there is moisture and the right temperature. An idea is like a seed. Once you have prepared your field and the seed is planted, you are on the track to increased productivity. This write up, is to help prepare the "field'."

Illustrations by Roma Chakravarthy make the reading attractive and easy. A must for all executives. More so in government organisations This can certainly enhance our national productivity.

Industrial Organisation & Management

Awate D.G. Chunawala S.A.
Patel D.R. Bhandarkar B.G.

Vrinda Publications, 1982
Jalgaon
pp : 451
Rs. 40

Reviewed by :
Dr. (Ms.) Mani K. Madala
Dy. Director, National Productivity Council

Study of industrial organisation and its various facets is an imperative for anyone who enters industry, be it a person from engineering, costing, management or commerce. The present book is an attempt to facilitate such study. Planned in four parts, the book covers a wide ground, starting from how to start an enterprise to how to keep the people in the organisation motivated. The first part deals with nature and forms of business, building of a factory and the plant lay out of a factory. The second part titled as production and materials management presents an elementary treatment of manucturing process, production planning and control and maintenance of the plant and also a comprehensive treatment of marketing management, product promotion, methods of distribution, advertising, sales promotion, management of salesmen and market research in that order. One wonders what is the logic of that order.

The third part is devoted to human resource management. It is a fairly comprehensive treatment and also includes a brief note on legislative framework, focussing on important Acts, with their latest amendments.

While the whole book is fairly unorganised, the fourth part presening the various management techniques is most stunningly unorganised. Performance appraisal preceeds job analysis, Linear programming (p. 129-136) is followed by Break even analysis, EDP etc. then by queing theory (p.247-252) and then followed by capital budgeting, SQC, Industrial productivity (Is productivity a technique ?) which in turn is followed by assignment movement (p. 289-297). There is tremendous scope for improvement organisation. While the material by itself was well prepared, with illustrations, the presentation leave smuch to be desired. Typographical errors are one too many. In a book meant for students, care about the language is a must. (e.g. complexibilities p. 23 manyfold p. 37). There is a lot of mispaging. Quality of paper needs improvement. Fairly priced.

Form IV

Statement about Ownership and other Particulars about Newspapers Productivity (as per Rule 8)

1. Place of Publication	:	New Delhi
2. Periodicity	:	Quarterly
3. Printer & Publisher	:	A.C. BHUTANI
4. Whether Citizen of India Address	:	Yes National Productivity Council 'Productivity House' Lodi Road, New Delhi-110003
5. Editor Whether citizen of India Address	:	D.P. UPADHYAY Yes National Productivity Council 'Productivity House' Lodi Road, New Delhi-110003
6. Name and Address of individuals who own the Newspaper and partners or shareholders holding more than one per cent of the total capital	:	National Productivity Council 'Productivity House', Lodi Road, New Delhi-110003

I, A.C. BHUTANI, hereby declare that the particulars given above are true to the best of my knowledge and belief.

Date : 28-2-1984

A.C. BHUTANI
Signature of Publisher

Productivity
1984 XXIV, 4, 531-541

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The following is the detailed list of the articles, book reviews and select bibliographies.

ARTICLES

BOOK REVIEWS

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12. Pareek, Udai	Role Stress Scales Manual and Organisational Role Navin Publications, Ahmedabad	Reviewed by : Dr. J.P. Singh,	Oct.-Dec. '83	pp. 403
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2. Vig. S.N.	Workers' Participation in Management	April-June '83	pp. 97
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