

January—March 1986

# PRODUCTIVITY



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# National Productivity Council

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# Developing Professionalism

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MARGARET VAUGHAN

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## A Heritage of Definitions

In this review of ideas, the notion of professionalism may not be dissociated from the notion of "keeping ethical traditions;" the professional is described as a person who develops values, especially in the role of educator (whether doctor, lawyer, merchant or chief). There is an underlying theme of the power residing in professional status, the power to mould a society by naming and maintaining standards of behaviour.

Eighty years ago, Max Weber gave academicians and practitioners of the Western world a highly-developed theory of professional development that persists in modern thinking and work.<sup>1</sup> Creel documents a similar publication of principles from Shenpu Hai for Eastern thinkers, dating from several hundred years B.C.<sup>2</sup> Both of these works tell us that professionals are the rulers of society. And as one reads through the current General Catalogue of the professional schools of any major university, where it is explained why their graduates do what they do, it is unmistakable that part of the preparation is to teach that line of thinking: the leaders of tomorrow are today's pre-professional registrants. There will be a style, or bearing, which will come through for them. Examining the subsequent pages of course descriptions, one can not find just how this professional bearing is identified.

Other works give general answers. Some say technical expertise must be taught through an intensive

*This is a review of former and current concepts of professionalism concluding with a new model prescribing serial careers and serial career preparation: this mixes integrative studies, the learning of cognitive skills and special studies for highly differentiated (so-called "technical" skills over a longer time than indicated in presently standardized programmes.*

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and well-orchestrated series of prerequisites, and also integrative skills.<sup>3</sup> Weisstein and Huxley prescribe what we require for scientific excellence, defined as imagination, ingenuity, curiosity, and keen perception.<sup>4</sup> Turning to the dictionary, we find a narrow definition of professionalism: the word derives from taking vows, receiving a formal education, and working continuously for living performing activities that others (amateurs) do for pleasure.<sup>5</sup> These ideas seem to stop short of what is meant in common parlance, when one speaks of the "professional outlook" or when one criticizes "non-professional behaviour." It is necessary to search further.

In his writings, Weber set down principles for *officialdom* ("Verband" or "Beamtentum," the bureaucratic or patrimonial versions, respectively). These give more precise ideas:

1. Official tasks are continuous, regulated, and functionally specific, with attendant authority and sanctions.
2. Rights of control and complaint within each sphere are unified and hierarchic. Trained men administer these rules, which are technical or legal in nature.
3. Resources, office (position), and records are managed impersonally, according to skill and not person, as are duties, salary grade, and evaluations by seniority or by merit.<sup>6</sup>

Under Point 2, the connotation of Unity of Command is what appears to distinguish professionals from guild members. (See Henri Fayol, *General and Industrial Management*. D. Storr [Trans]. Sir Isaac Pitman, London, 1963. This distinction was made very early by Edward Hazen, in *The Panorama of Professions and Trades; or Everyman's Book*. Uriah Hunt, Philadelphia, PA, 1836),

These are principles or conditions for a group of skilled persons, to cluster around rules, hierarchy, and impersonal control over the use of their special skills. In short, Weber meant to reproduce a scheme that he had observed, by which people exercised grouped social control, a containment of society that perpetrated excellence in various social functions.<sup>7</sup>

Both he and his near-contemporary, Georg Simmel, saw this group process as the means by which persons find significance in their individuality. These German authors placed it in the abstract realm of a person's way of distinguishing one's self.<sup>8</sup>

Two well-quoted American teachers and authors have refined the idea of the true professional. Zaleznik observes that the true professional is one who keeps an enduring goal and has the will to enlist others to pursue it as a group.<sup>9</sup> Levinson observes that the true professional is one who formulates a consistent ego-ideal (sense of "best self") and copes well, at the same time, with a sense of loss in inevitable aging; the true professional understands the weaknesses as well as the strengths of proteges, eventually serving as their mentor to aid them in developing a strong ego-ideal and good coping ability.<sup>10</sup>

It is important to add that to distinguish one's self is a general aim of members of groups working against society's welfare, not for it. Mosca noted in 1884 that the difference between "racketeers" and "leaders of social forces" lay in the professional group's essential mechanism of representative voting to elect a member to a position in the profession.<sup>11</sup> Meanwhile, this has been contradicted soundly by Couch and Hintz; showing that the representation by democratic mechanisms in terrorist groups is exemplary.<sup>12</sup> The great moralist, Bacon, did not find the difference in mechanism but in personal value. He wrote that he believed love of humankind was the difference between the false and true professional. In discussing social "instauration" (renewal), he admonished professionals to seek knowledge with *true* ends, these being:

"... not either for pleasure or mind, or for contention, or for superiority to others, or for profit, or fame, or power, or any of these inferior things; but for the benefit and use of life, and that they perfect and govern it in charity."<sup>13</sup>

#### Summary of Definitions of Professionalism

With this review one sees that professionalism includes power, ethics, authority, skill-building, impersonal rules, and hierarchy. By way of summary, the

word is used to mean four activities of a group of experts :

1. the pursuit in specialized work of increased expertise, perfected standard-setting and standard-keeping of the expert group's values and their specialized knowledge;
2. the imparting of results of their expertise to the larger society in its own interests rather than in their private interest;
3. the identification of successors and assisting them by participating in their education and training in the same line of expertise ;
4. the judging of the progress of their successors and of each other.

#### Modern Controversies

Professionalism and its measurement, carried on by the teaching and research work done in professional schools, have spawned four modern controversies. These are identified here for perspective, in order to explain why one among them is the key which must be resolved first, before there can be answers to the other three. Issues thought to be resolved by the early thinkers reviewed above, may be recognized as surfacing in each controversy. They are stated here as lemmas :

1. Professionals should be judged for promotion on the basis of *merit*, not seniority. The concept of tenure is no longer useful.
2. The professional must face trade-offs between two opposing development emphases : differentiation into a speciality in one's preparatory work, and *integrative* studies that tie specialities together.
3. Professional education must include *social responsibility* and social studies, in addition to technical subjects.
4. Classroom experience for professionals must include more applied "*experiential*" work (training) along with theoretical conceptual studies (education).

These controversial ideas have strong implications

for the roles of business educators. First, seniority is earned and provides comfort. The forces which keep educators devoted primarily to academic work, leaving consulting with industry as a secondary interest, are at least partly due to the assurance derived from tenure protection. The protection is supposed to derive; in turn, from a standard of excellence that is met. Once having that award, they (the more senior members of our profession) are freed to engage in less narrow inquiry, to "take more risks" with ideas and with the conduct of inquiry into the knowledge base. Alternatively, it is thought to enable them to sit back and relax, perhaps grow stale without penalty. Merit award, by contrast, casts an indifferent glance on past evaluations and, like zero-based budgeting, makes current assessments of the value of performance of professionals vis-a-vis the budget and the criteria of updated standards. It is a method which is thought to accommodate recent change, and not traditions.<sup>14</sup>

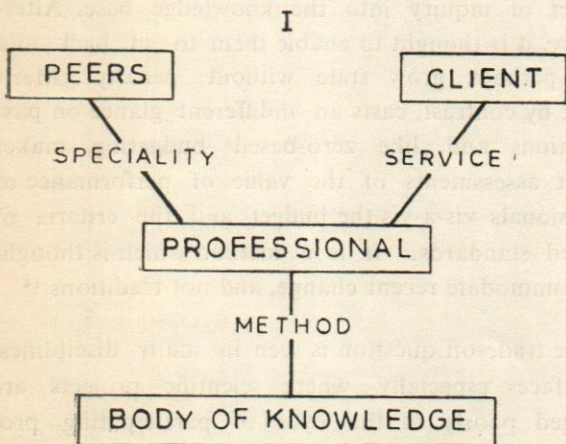
The trade-off question is seen in many disciplines. It surfaces especially where scientific projects are managed poorly in the eyes of participating professionals, who identify the failure as an absence of integrative insight among allegedly over-specialized managers of those failing projects.<sup>13</sup>

Teaching social responsibility (the attention to community) has found its way into business texts, showing the pre-professional the larger social environment and changes occurring there outside the academy or business domain. This demands of the reader a willingness to give formal focus (in lectures, papers, chosen readings, research, interaction used in study) to the larger community. The professional should be imbued with a keen awareness of the impact of one's work on the community that lies outside the body of professional peers, the professional person's clientele, and the body of knowledge used in the work.<sup>16</sup> There are examples of professionals leaving their line of work altogether, in protest against ignorance of community impact.<sup>17</sup> These are echoes of Bacon's thesis.

Finally, the push to add more "learning by doing" in professional development has come around into the specialised schools. They offer several means for enlarging the practical-application options and broadening the professional's social insights, concurrent with

the development of specialized skills. The thesis began with Dewey's *How we Think*.<sup>18</sup> we are acquainted with it the modern examples, through the Harvard case method<sup>19</sup> and specific programmes of applied study or internship programmes near our own campuses.<sup>20</sup>

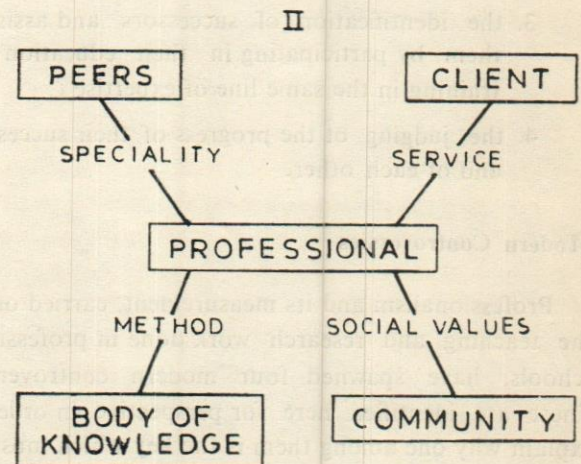
These controversies may be summarized with a picture of an enlarged set of constituencies, showing the main links to each :



The community and values shared are to be incorporated and fully reflected. The system of the profession, as with other system of work, is admonished by its own members to grow more open, less closed. The view held is that one can not turn technology backwards, that the impact of specialized groups is growing greater and spreads wider. So professionals need to *understand* more, and know how to stop themselves when their work is counter-productive somewhere in the system, or be able to change their course when they have chosen poorly because of ignorance of the larger domain. If they continue to reward with standards that are past (seniority), or refuse to examine practical realities (over-theorize), or are ignorant of their responsibility to the large community (lack social responsibility), than the cure for these ills is to start right away including integrative studies and skills in professional training, education, and standards of excellence. This solution to blend both kinds of studies, appears to be prerequisite to acting on the other three points.

### Differentiated Study VS Integrated Study

Differentiation means to specialize, to make distinctions, or to develop one branch of knowledge and skills intensively, exclusive of others. In an organization the result of this process, person by person, task by task, is departmentation of work group hierarchies distinguished clearly by function.



There is a tendency, as groups and organizations enlarge, for this to occur and for it to cause ambiguity and conflict to increase.<sup>21</sup> Integration, on the other hand, is the process by which different, separate things or persons are reunited on common grounds: it is to build linkages and to recognize or create inter dependencies. In organizational interfaces, the role that accomplishes these things specifically is referred to as "boundary spanning," or Huxley's "pontifex:" bridge-builder.<sup>22</sup> Three authoritative sources identify the loss of productivity that is hard to measure yet large, from departmentation without integration.<sup>23</sup>

### Separate Skills for Integrative Roles.

A examination of the jobs of manager or executive is made by dividing the role-set of these jobs into separate roles (expected behaviours at work), that are either differentiating kinds of roles, or integrating kinds of roles. Next to these are the skills said to be emphasized in each one :<sup>24</sup>

<i>Differentiating Roles :</i>	<i>Skills :</i>
Disturbance handler	directiveness; logical proces
Resource allocator	directiveness; quantitative thinking
Leader	directiveness; inspiration
Entrepreneur	inventiveness; design
<i>Integrating Roles :</i>	<i>Skills :</i>
Liaison	listening; compromise; empathy
Spokesman	representation; public presentation
Monitor	looking; listening; cognition
Negotiator	listening; persuasion; "vision"

This allows curriculum designers to see some of the prescriptions for improving the programmes of development for pre-professionals in business-related fields. Still this examination has not answered : Should we change the mix in our curricula ? If so, in what direction ?

Many educators bemoan parallel expectations in American schooling for pre-professionals, that it should give both broad skills and specialized instruction within a reasonable period of time. Becker and Thurow have written of these two from their view as economists. They refer to them as types of investment in human capital, chart the returns from each, and suggest reasons why firms prefer to pay for the second when it is firm-specific, leaving the first to be afforded by the individual or society at large.<sup>25</sup> Thurow has examined the theory also with regard to social acceptability of the persons involved, introducing the cost of discrimination into the analysis. The results of these studies show that pre-professional development conducted in public institutions of higher learning or in multiple-firm associations, should fill the needs of society for general education and integrative skills first and foremost, without discrimination; the rational decisions of firms will tend to rule out payment for any such generally—applicable professional skills. They will rule in favour of training for highly specialized development.

Weber, whose ideas are clearly still revered, stated the trade-off in terms that are those of the sociology

profession. Here is a quote from his views, which are not contrary to those of the economists, from his text :

Specialized and expert schooling attempts to *train* the pupil for practical usefulness for administrative purposes—in the organization of public authorities, business offices, workshops, scientific or industrial laboratories, disciplined armies. In principle, this can be accomplished with anybody, though to varying extent.

The pedagogy of cultivation, finally, attempts to *educate* a cultivated type of man (sic), whose nature depends on the decisive stratum's respective ideal of cultivation. And this means to educate a man for a certain internal and external department in life. In principle this can be done with everybody, only the goal differs. If a separate stratum of warriors from the decisive status group—as in Japan—education will aim at making the pupil a stylized knight and courtier, who despises the pen-pushers as the Japanese Samurai have despised them.<sup>26</sup>

In our time, the internal situation, in contrast to the organization of science as a vocation, is first of all conditioned by the facts that science has entered a phase of specialization previously unknown and that this will forever remain the case. Not only externally, but inwardly, matters stand at a point where the individual can acquire the sure consciousness of achieving something truly perfect in the field of science only in case he is a strict specialist.

All work that overlaps neighbouring fields, such as we occasionally undertake and which the sociologists must necessarily undertake again and again, is burdened with the resigned realization that at best one provides the specialist with useful questions upon which he would not so easily hit from his own specialized point of view. One's own work must inevitably remain highly imperfect. Only by strict specialization can the scientific worker become fully conscious, for once and perhaps never again in his lifetime, that he has achieved something that will endure. A really definitive and good accomplishment is today always a specialized accomplishment. And whoever lacks the capacity to put on blinders, so to speak, and

to come up to the idea that the fate of his soul depends upon whether or not he makes the correct conjecture at this passage of this manuscript may as well stay away from science.<sup>27</sup>

Having identified potent ideas here, the question remaining is whether or not a good education must include forays into the territories of other specialties (such as the natural sciences, the arts, the social sciences), as well as a "core" of broad exposure to the functional subdisciplines within the professional school itself.

The more technology bumps up against the investment time for a pre-professional to remain out of the work force and sit in classrooms or libraries, the more the educator faces a quandary: what to shave off the individual's curriculum to make room for new material. Many faculty decisions conclude by cramming more bits and pieces into a single course, fragmenting the delivery and reducing the intensity. Students complain that the coverage is superficial and that professors are rewarded for covering material, not for teaching it.

Since enrollments have grown, educators may dally with an elitist idea; shall they increase their efforts at early identification of "good students," and track these chosen few as if their very technologically-gear'd lives depended on it? Should they generate, then, a fast track in the pre-professional stage of development which could carry one strategy and funding, different from those used for the "proletarian" student groups? Leavitt says not to do that.<sup>28</sup> He says we don't know enough yet to be sure which ones are which. We must leave alone the prospect of tightening the reins we already use on early identification, since there is so much agreement that Leavitt is right. A better avenue of approach to find our answers may be to inquire into the strengths already found in our professional schools of business and management. For a long time in foreign circles these have been touted as a very successful set of institutions, which spent their dollars and ingenuity wisely, and have the special virtue of clairvoyant self-criticism<sup>29</sup>.

The problem is to find a model that permits enlargement without compromising excellence. For reasons that have been closely tied to the public view of skill-

development programmes made public by widespread or even ponderous coverage in houses of publication and in the press), the business schools' accrediting body has moved in particular directions. One may compare those directions with the definitions of what it is to be professional and next with the roles which are on the one hand differentiating, and on the other hand, integrating. One may arrive at a model by a method of deduction from this comparison. It will help to preface that comparison with a reference to the general "renaissance" in the fields of science and education that professionals believe they are creating.

### A Renaissance In America's Professions

In an effort to identify and correct past errors, educators and their critics are telling each other that Americans suffer a "rising tide of mediocrity" in their schools, which must be reformed by professionals, for professionals, to guarantee good and sufficient succession. From the report of the National Commission on Excellence in Education, released in April 1983, *Nation at Risk*, to the recently released book, *In Search of Excellence*, we are reading that we need to return to an accumulation of those skills permitting us to become better basic learners and to engage in constant, purposive experimentation in our organizations.<sup>30</sup> (It should be noted that the notion of "rebirth" is not the only meaning of "renaissance," but it may be joined with the historians' usage: namely, that the natural human being shall become a legitimate point of departure for studying life's meaning).

Many institutions must be agreeing with the books and reports, as they recoil from an imposed "renaissance" of professional outlook inside their own domains. This takes several forms. They require planned organizational change, and the skills to conduct it.<sup>31</sup> There is profit in providing and studying new texts and courses in strategic planning and the derivation of organizational policy. While quantitative methods are the province of many nations' professionals who travel around the world finding their specialties substitutable, the concepts and skills for strategy and policy are culturally-tied, as shown in recent studies in comparative management.<sup>32</sup>

Networks of professionals may be categorized as



belonging to : Administrative Sciences, Computational Sciences, Earth/Space Exploration, Economics and Finance, Education, Engineering, Fine Arts, Health Sciences, Law, Politics, The Press (Publications and Archives), Religion, and Welfare; Those engaged predominantly in formal schooling differ from *entrepreneurial* service-deliverers, in that their work is publicized and relatively free to be shared. They may or may not enjoy a further distinction : that their inquiry is at their own discretion and not controlled by users who are their "paymasters."<sup>33</sup> These networks are the objects of the effort at hand.

One effort to achieve this "renaissance" in the Administrative Sciences network is expressed in the words of the President of the American Assembly of Collegiate Schools of Business (AACSB) :

Approximately ten years ago a concerted effort was begun to internationalize the accreditation curriculum standards. One of the more telling pieces of evidence revealing the parochial, geocentric nature of U.S. business schools was the initial resistance to the idea of modifying the standards to include a specific reference to an international component. It took several years of perennial importuning before the AACSB changed the standards (in 1974) to require that the curriculum reflect the "world-wide" as well as the domestic dimensions of business. Incidentally, Lee Nehrt, during his tenure on the International Affairs Committee (as president of the Academy of International Business) had a great deal to do with influencing the change. But getting something introduced into the standards and having it operationalized are two different things; it will take many years, I believe, before the International dimension is recognized by the majority of those engaged in the accreditation process as having a level of importance equal to the more traditional areas of business.

To help implement the "world-wide" standard, the AACSB launched (with major support from General Electric), in 1978, a series of workshops and seminars to introduce non-international business faculty to the global aspects of their functional fields. Response to these seminars—the market test—has been very favourable; in the

summer of 1983 there will once again be two workshops, one on the West Coast (Pacific Lutheran) and one on the East (Wharton). It seems clear these annual seminars and workshops are having an impact; however with more than 20 accredited schools and many more unaccredited schools in the system it seems safe to say we have a long way to go before parochialism is erased entirely.

I believe the greatest impact has been made in the functional areas of Finance, Marketing, and Accounting. We might well do more, however, in some areas of particular interest to the Academy of Management, especially Organizational Behaviour, and the human side of production management.

This year a new venture is being launched. Trading on the skills and experience of the Assembly, AACSB is developing an "out-reach" programme which will provide assessment/consultation services to schools and centers abroad. In somewhat similar fashion to the domestic accreditation visit—but emphatically with no accreditation objectives or overtones—three-person teams will spend several days with overseas institutions. In response to an initial letter outlining the proposal, 93 institutions have indicated interest.<sup>34</sup>

Some writers have become vehement. We must stop teaching the pursuit of "pseudo-professionalism,"<sup>35</sup> which is indentified as the development of specialists with finely-drawn lines of differentiation, leading them to become strategists with narrow vision. We must stop teaching "pig-professionalism,"<sup>36</sup> which is competitiveness, elitism, and careerism. And we must avoid the tendency to prepare more and better gamesmen :

The emotional and spiritual of underdevelopment of corporate executives is a problem not only for the individual careerist, but also for society as a whole. Acting through the market, managers serve society's material needs out of their own greedy self-interest... The trouble is that, in rising to the top, they sacrifice the capacity to develop values that go beyond winning the game. And the larger society, of which business is but a subsystem, depends for its greatness not only on the head but on the heart—the qualities of courage, compassion,

generosity, idealism. (Interview with Michael Maccoby, author of *The Gamesman*.)<sup>37</sup>

These objections are met with controversy, as outlined above, and by decisions and their implications, which are discussed next.

### The AACSB Renaissance

Business schools are often in the process of restructuring their curricula. The past ten years of rising enrolments in business disciplines have found them free to shift courses in order to accommodate growth, a freedom few disciplines can enjoy. The shifts have been rulings for greater emphasis on global relations and on social-science applications to our theoretic underpinnings.

Some professors ask when this will stop. They feel they can't teach everything under the sun! They can't find among themselves the eclectic backgrounds to expand the coverage of their programmes, without sacrificing the expertise of their specialization, which is the strength of locally undervalued professional-school reputations. Will students, finding deliveries more shallow, fragmented, and eclectic, seek their technically specific training in firms' in-house programmes, and neglect to receive from generalized platforms either differentiating or integrating skills? Professors sincerely hope not.

To give context to these questions, here is a summary of the current Curriculum Standards and Guidelines of the AACSB:<sup>38</sup>

1. We should provide a broad education, for imaginative and responsible citizenship and leadership in business and society, domestically and worldwide. This should keep students up to date in economic, behavioural, and quantitative areas. This means *continued development of both new and existing curricula*.
2. Undergraduate four-year programmes should be *general education in arts and sciences and learning skills through the second year*. Business specialities should come in the third and fourth years.

3. We must give the *Common body of knowledge* in our profession. This is composed of concepts processes, and institutions in : production and marketing and finance; economic and legal environments; ethical, political, and social influences of business : accounting, quantitative methods, and management information systems; organizational theory, behaviour, and interpersonal communications; integrating analysis and management-policy determination to address conditions of uncertainty.
4. The MBA degree shall be a further study of the same common body of knowledge, aimed at *general competence for overall management*. Other master's degrees with special emphases should devote to the common body of knowledge fully one-half of the expected academic year of credits for coursework.

As seen from this summary, the business school's own accrediting organization admonishes it to do more, to develop two strands of curricula, and yet abide by the same length of time to accomplish this study as has been expected since the early 1960's. Before that time, some accredited business schools devoted all four years of undergraduate pre-professional preparation to the common body of knowledge. Clearly, compression is the word to describe what is happening.

### Meeting Demands

Our dilemma is that theory and practice together are necessary and sufficient conditions for approved professional development. Theory and practice are, at the same time, inevitably more complex and specialized, and our society (through the willingness of professionals to set and keep standards and guidelines) seeks to retain social control by antidotes to the finding estrangement that results. The antidote is a growing collection of subjects that are integrative in nature : international and comparative management, social psychology applied to the workplace; group process in decision-making and decision-taking; human responses to stress; special problems for management of the arts, health care organizations, non-profit organizations; the

matrix form of organization and its conflict and ambiguity; reciprocal influences of business and other constituents (legal, political, physical-environmental, educational)—the list goes on and on, adding more conditions to the original items of theory and practice.

Educators can no longer obey the 1970 Carnegie Commission dictum for American students : to shorten their preparation period.<sup>39</sup> The antidotes elongate the process or encourage shallow coverage. Professors can not in good faith deny students a fair shot at the common body of knowledge, by skipping through it at breakneck speed. Moreover, they know that the new awareness, their "renaissance" shift enlarging their arena to embrace the community, is not altogether wrong. Attempts to answer all these pressures have been to generate exercises, case studies, and internships, to enlarge the size of classes, offer many sections of basic coursework at the sacrifice of delightful specialty courses in daily routine teaching, to teach at all odd hours of the day and night and weekends, and to staff their organizations with part-time or temporary instructors in order to swing with these demands over the constant upward press of enrolments.

They advise successors in large, impersonal, group counseling sessions, forgoing any impulses to hold up enduring goals and act as mentors. This tends to construe their evaluation duties, as they teach, judge, and advise their successors, into the role-behavior of the gatekeeper, or warden, rather than that of the coach. Many believe that the student/faculty ratio is at the heart of this problem. Business educators, too, feel from all of these a rising tide of mediocrity.

#### Is There a New Model ?

The AACSB rulings and McKibbin's request clearly reflect professional decisions that schools are to increase integrative studies and experimental applications, and that both of these shall compete with the time allocated—whatever it shall be for each individual's case—for one's investment in specialized studies to meet all of the professional standards of the day. There are only two ways this can be done.

One model is to begin right away to divide large business school enrolments into two tracks : for

students with "great promise" and students without it.

The other is for the preparation period to be continuous, no longer separable between pre-professional work (undergraduate or graduate) and professional post-graduate work. Lifelong learning is the expression often used, meaning to elongate the preparation period as an expedient for changing the model.

This new model must give :

1. tacit acceptance of skill decay relative to the state of the profession, and the need for upgrading;
2. serial careers and serial career preparation;
3. an equitable mixture at each period of time : of integrative studies, learning skills, and differentiating specialty studies.

If this model is followed, as with any standard that is set by and for a group of skilled professionals, there will be a basis for continuing the protection of seniority. The model addresses merit by definition. It allows educators to include the social-responsibility studies in their curricula and be themselves socially responsive to the needs of students in managing the schedules of their careers. Educators in professions will incorporate the community into the midst of educational work by virtue of the serial learning periods that alternate with experience of their students in the workforce. And by following this model rather than the other one, they will do all of this without discrimination. Further, they will have retained the highly-touted flexibility for which the business profession is so famous.

#### Is There Room for Charity ?

Bacon's admonishment to the professional, to deliver special services to humankind with charity, is not easy to obey. Many schools are extremely short-funded and can not even find full complements of faculty at prices they are able to offer. Equipment budgets are short, and research budgets are often nonexistent. Even secretarial staffs, which are never expensive budget lines, are drastically reduced among us. There are a number of experiments which can be

tried, to save the model and spend relatively little money.

1. Faculty may participate as lecturers or advisors in firms' training programmes and add degree candidates from the campus classrooms there, in order to increase available credits and material off-campus.
2. Greater articulation between non-accredited business coursework that satisfies some on-campus requirements, can reduce the load.
3. Consortia of visiting lecturers, who will prepare themselves well and cooperatively conduct a course, may be enlisted.
4. The expedient of the internship may be addressed more carefully (to control it for scholarly content) and expanded.
5. Well-prepared (cross-trained) faculty from other disciplines may regularly teach content that is controlled by the accredited business school's faculty.
6. University business schools, some distance apart, may contract for regular transportation and exchange their students for complementary coursework and complementary schedules, to expand the choice, the "exposure," and the schedule of the preparation period for the student.

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response to this peril is rapidly creating a new sort of science: critical science. Instead of isolated individuals sacrificing their leisure and interrupting their regular research for engagement in practical problems, we now see the emergence of scientific schools of...collaborative research...involving the discovery, analysis, and criticism of the different sorts of damage inflicted on man and nature by runaway technology..."

Hayes and Abernathy, *op. cit.* On page 75 they write: "The purpose of good organizational design, of course, is to divide responsibilities in such a way that individuals have relatively easy tasks to perform. But then these differentiated responsibilities must be pulled together by sophisticated, broadly gauged integrators at the top of the managerial pyramid. If these individuals are interested in but one or two aspects of the total competitive picture, if their training includes a very narrow exposure to the range of functional specialties, if—worst of all—they are devoted simplifiers themselves, who will do the necessary integration?"

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# Computerization and Production Planning Process

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*Due to the multiple organizational inputs associated with the production management area, it has historically been difficult to effectively control. It was due to its organizational importance, and inherent planning and control problems, that production management was an early candidate for computerization. The author discusses the problems associated with it.*

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## Historical Change in Business Attitudes-Production Orientation to Consumer Orientation

Until the early years of the twentieth century, while the marketing concept and its importance to the American firm had begun to emerge, the long-standing attitude dominated: production. The 'Production Era' in the U.S. did not reach apex until the early part of this century. Henry Ford exemplified this production attitude in the development of the production line and its ensuing slogan: "They (consumers) can have any colour they want, as long as it is black."<sup>1</sup>

The early twentieth century began seeing consumers with growing personal income, and resultant consumer demand. But it was organizational survival that made customer satisfaction the norm rather than the exception it had been previously.<sup>2</sup>

In the post Depression era this trend toward the marketing concept continued, with the early 1950's marking the first public appearance of statements by major U.S. corporations indicating their commitment to the concept.<sup>3</sup>

As stated by Louis E. Boone and David L. Kurtz in 1974, "It would be difficult to envision business returning to an era where moments of engineering genius prevail at the expense of consumer sovereignty."<sup>4</sup> The manner of doing business supported by the barons-of-

industry (such as Henry Ford) was no longer of paramount importance. Organizations would have to change their operations to reflect this change in orientation.<sup>5</sup>

### Transfer of Reins of Management

During the same time period that the attitudinal change from production orientation to marketing orientation was evolving, the 'captains-of-industry' were aging. Their business operations were increasingly being turned over to non-entrepreneurial managers or family successors.<sup>6</sup> With this change at the helm, a majority of the original "intuitive"<sup>7</sup> managers were lost, being replaced by untrained or text trained managers.

In either case, the managements of large U.S. industries were transferred to "Taylorized" managers who were well versed in the application of formal business methods.<sup>8</sup> When faced with a formidable problem such as that posed by production planning, they were able to develop well-defined formal systems to do the job, as their background would dictate.

### The Production Planning Problem

Historically, the production planning process was under the realm of top management; there was minimal concern for market desires or demand forecasts, but heavy emphasis on producing goods they themselves decided upon at the maximum capacity possible, for a clamoring public to purchase.<sup>9</sup> The production planning process, into machinery operating at its maximum, to produce the greatest amount of finished goods as possible.

The growth of importance of the marketing concept, with the objectives of the production planner moving to those outlined by Wright in 1974: (1) customer service; (2) minimum inventory investment; (3) maximum plant operating efficiency.<sup>10</sup>

In virtually all cases, the planning systems consisted of two subsystems, one formal, the other, informal. The formal was untested, uncontrolled in reality; the informal, having developed within the organization, actually got the work out. This was obviously an inefficient manner of handling the problem.<sup>11</sup> The fact

that it worked should not be overlooked, because a flexible system (such as that provided by the informal system) was necessary to meet the needs of a dynamic process—production planning.<sup>12</sup>

"The job of production and inventory management," according to Wright, "is to generate plan that other people can be held responsible for executing."<sup>13</sup> Such an idea is inherent in any operating system, and was a major failing of the dual system generally found in production management.

Increase in organizational size and complexity, market demands, and the retirement of many of the key people which made up the informal system left them little or no choice. The need for improvement in production planning was evident.<sup>14</sup>

The modern electronic computer, having been relegated to performance of clerical tasks in accounting and other business applications, would now do their thinking for them. Or, so they thought.

### What did Production Managers Expect from Computers?

As indicated, there was a growing awareness of the lack of control in the planning process. The specific areas of concern to the planner: priority planning, and capacity planning.<sup>14</sup>

In early attempts of computerizing the production process, it was assumed that the computer could be, and would be, the solution to the problem. By computerizing their systems, the production planner could expect: efficiency in ordering and scheduling; a validated production plan; reduced, more efficient, inventory levels, for materials and finished goods; and most importantly, that ability to meet customer demands through a system responsive to changes in input and output. Certain organizations during the period from 1959 to 1964 reaped these benefits and more.<sup>15</sup> Why, then, were there many cases of failure,<sup>16</sup> or situations where benefits fell short of expectations?<sup>17</sup>

### Unrealistic View of the Computer

Early failures upon implementation of computerized production planning systems were typified by an



unrealistic view of the computer and its capabilities. Many regarded the computer as mechanical reproductions of the human mind; instead of a tool to assist them in their problem solving, the computer was viewed as a solution.

The late 1950's crisis in production planning was tied to the inability of management to design a production planning system capable of responding to the dynamics of the situation. The initial computerization was typified by management replicating the formal system electronically. Had this formal system been successful manually, there would have been no real benefit to be gained by computerization.<sup>18</sup> This point was discussed by Dearden in 1965 :

... it appears to us that it is vital to examine the quality of the management information system first and to consider automating it second. Not all management information can be improved by the use of the computer.<sup>19</sup>

Since the underlying cause of the production planning problem was the inability of the existing manual (formal) systems to effectively handle changes,<sup>20</sup> managers should have been trying to create an improved production planning system *using* the computer (if appropriate), rather than replicating an ineffectual system.

As Wright indicated in 1974 :

These early attempts to use computers in production and inventory management failed more often than not . . . .

As a result, there were probably fewer manufacturing people who were optimistic about the potential for computer application in manufacturing in 1968 than there had been in 1958. Like any new technology, there was a real 'learning curve' and consequently a period of disillusionment<sup>21</sup>

Several fundamental lessons were learned from the early failures which were applicable to production systems design as well as management information systems for other functional areas ;

1. Successful design and implementation of a

computerized system in a complex situation such as that posed by production planning provides the greatest potential payoff.<sup>22</sup>

2. Informal systems develop within organizations due to need. Development of a successful computerized system cannot ignore the existence of an informal system, and should draw upon it in systems design.<sup>23</sup>
3. Responsibility for design of an adequate production system rests with management, not with systems designers or programmers.<sup>24</sup>

### The Computer in Production Planning Today

Twenty years after the first attempts to apply computer technology to management problem solving, an evolution had taken place. From a more cautious and pessimistic view of the computer in 1968 to a more acceptable view in 1978, Sanders states :

Generally speaking, the use of computers can have an impact on planning activities by :

1. Causing faster awareness of problems and opportunities;
2. Enabling faster managers to devote more of their time to planning;
3. Permitting managers to give timely consideration to more complex relationships;
4. Assisting in decision implementation . . . .<sup>25</sup>

This description touches upon the very reasons why computers were initially applied to the production planning process. This trend has led to the introduction of MPS (with components MRP and CRP), which could not have been considered under an inflexible manual process. Ramalgam in 1981 :

MPS is a feasible plan allowing priority changes of products to be manufactured and enables the organization to plan and control facilities, equipment, manpower, and material effectively. It is also the commitment of the manufacturing department on the completion time of customer orders.<sup>26</sup>

Ramalingam, in the same article, notes eight benefits :

... . Improvement of customer service ... . Reduction of inventory investment ... . Productivity improvement ... . Reduction in production and inventory control personnel ... . Reasonably accurate order promising ... . Improved performance in material handling ... . Improved performance in capacity planning ... . and ... . Improvement in management decision making process... .<sup>27</sup>

Again, this typifies what was sought in 1958, but evolved over a twenty year period—from initial application of computer technology in planning to the well-defined and refined MPS systems in vogue today.

### The Production Plan/Corporate Plan Relationship

The introduction to this paper stated that :

Production output is, for all organizations, (be they service or products oriented) the visible result of all other organizational efforts. As such, production management is of vital importance to an organization's current health and future prospects.

This statement is the underlying reason for organizational emphasis on today's MPS/MRP/CRP processes. They provide the organization with the ability to react dynamically in a dynamic environment. In 1974, Scheuing discussed this production plan :

Since planning consists of determining objectives and means for future actions, production planning has to secure the availability of required funds, facilities, and personnel at the intended point in time as well as their coordinated and controlled utilization toward the achievement of the set production goals. In doing so, the interdependence of production planning and the other functional area of corporate planning should be stressed... . The production plan thus should not be viewed as an isolated entity, but has to be seen as being interdependent with the planning activities of the other functional areas within the firm ... .<sup>28</sup>

Without the computer, as a tool in the overall

management information system (or within the confines of the production planning system alone), the potential benefits to be found in strategic planning would be severely limited. Strategists can develop plans, but without the ability to control them (which the computer provides) there could be no accountability, and therefore, no validity to the system.

### Summary and Conclusions

Over the twenty-five years that the computer has been a part of the production planning process, several substantial changes in managerial opinion of its usefulness have occurred. The grand optimism of 1958 became 1968's severe pessimism; this has now evolved into today's realism.

Production planning, when handled manually, was and is typified by a dual system, one formal (as designed by management), and the other an informal system (developed to handle and control the formal system's shortcomings). This informal system reflects actual priorities and needs of the organization and its market, and, if only on a crisis-to-crisis basis, will 'get the work out'.

The advent of the computer age was seen by many organizational managers as the 'tonic' for what ailed them. Several major failures, and a multitude of implementation programmes falling short of expectations, deflated management's hope of the computer as a savior for their woes. In retrospect, the problem seems obvious : computerization of a manual do-nothing system merely provided a faster, more costly, do-nothing system. The informal system had to be considered for computer system success, but it was not. Frequently, this was due to management's refusal to recognize the informal system, or failure to understand how it operated.<sup>29</sup>

Through trial and error, and a systematic review of the early failures, a body of knowledge was developed concerning the tactics of system design, which became increasingly important. Earlier, it was the hardware that was viewed as the 'magic-box'—the computer—that everyone blamed for the initial system failures.<sup>30</sup>

With this system design awareness, better techniques were developed to translate what management wanted into a valid working system. Increasingly, other organizational and human relations implications were being reviewed in system design.<sup>31</sup> The movement from hardware to software and human relations considerations, continued, and business organizations had the production planning system failures to thank for the transition.

What has been learned thus far from the application of computers to the production planning process is of significance today due to: the number of organizational managers, who while initially slow to climb aboard the computer band-wagon, are today singing the praises of the computerized management information system, and racing into systems decisions; and the number of managers who eagerly anticipate the arrival of the new wave of technological advancement are on the increase.

The current literature would seem to indicate that neither of the managerial categories referenced above is heeding the lessons learned thus far. Their optimism, and view that existing and forthcoming technology will solve their problems is all too reminiscent of the 1958 view. Whether this is due to the recent emphasis on technology in business education and training, which is like that of the "Taylorized" manager of 1958, is debatable. The issue, however, is whether today's organizational manager has learned anything from the failures of their predecessors in the application and utilization of high technology.

#### FOOTNOTES

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11. Paul Maranka, "Your New Materials Management Systems—Let's Get the System User and the Computer Together", *Production and Inventory Management* Vol. 13, no. 2 (Second Quarter 1972): p. 5.
12. Wayne Rout, "In Praise of the Informal System", *Production and Inventory Management* Vol. 20, no. 4 (Fourth Quarter 1979): pp. 85-90.
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27. P. Ramalingam, "Managing Master Production Scheduling", *Industrial Management* Vol. 23 no. 1 (Jan-Feb. 1981): p. 24.
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31. Henry C. Lucas, Jr., *The Analysis, Design, and Implementation of Management Information System* (New York: McGraw-Hill, 1976) p. 6.
32. Roscoe Davis, "Production System Failures: Bridging the

Gap", *Production and Inventory Management* Vol. 15, no. 4 (Fourth Quarter 1974) : p. 41.

33. John M. Nicholas "Developing Effective Teams for Systems Design and Implementation," *Production and Inventory Management* Vol. 21, no. 3 (Third Quarter, 1980) : p. 37.

#### GLOSSARY OF TERMS

- Capacity Planning** : the task of determining how much output is needed from plant facilities and suppliers, and the control thereof, to maintain an ongoing balance between planned levels and actual output achieved.
- Computer** : any electronic mechanism or system of mechanisms able to store, manipulate, and disseminate data, whether : on-line or off-line; in-house or off-site; owned, or leased.
- CRP** : Capacity Requirements Planning; a component of the MPS.
- Management Information System** : a systematic approach to providing relevant information to decision-makers on a continual basis (manually or electronically).
- Marketing Concept** : a managerial philosophy of consumer orientation, that holds that all planning begins with an analysis of the consumer and all company decisions are based upon profitable satisfaction of consumer wants and needs.
- MPS** : Master Production Schedule; manufacturing's portion of the organization master plan, which portrays a feasible program that will achieve management's objectives on inventory levels, customer service, operating costs, and stability of employment, while considering also, new products and design changes to existing products, new plants and equipment, changes in distribution systems and other significant factors.
- MRP** : Materials Requirements Planning; a component of MPS.
- Priority Planning** : the process of specifying batch quantities and their start and finish dates, for all items where procurement and manufacture are involved, and the control thereof, by maintenance of a balance between master schedule requirements and output rates.
- Production Planning** : all activities concerned with the planning, monitoring, and control of the processes that produce goods or services.
- Taylorized** : immersed in the classical scientific management principles proposed by Frederic Taylor and his followers.
- Validated System** : a system that by its very nature produces reliable output, which can be counted upon by its users, and serve as a basis for performance accountability.

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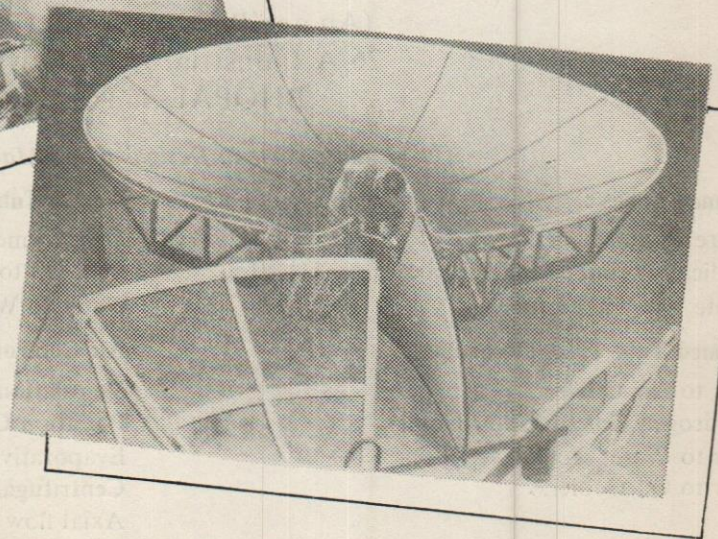
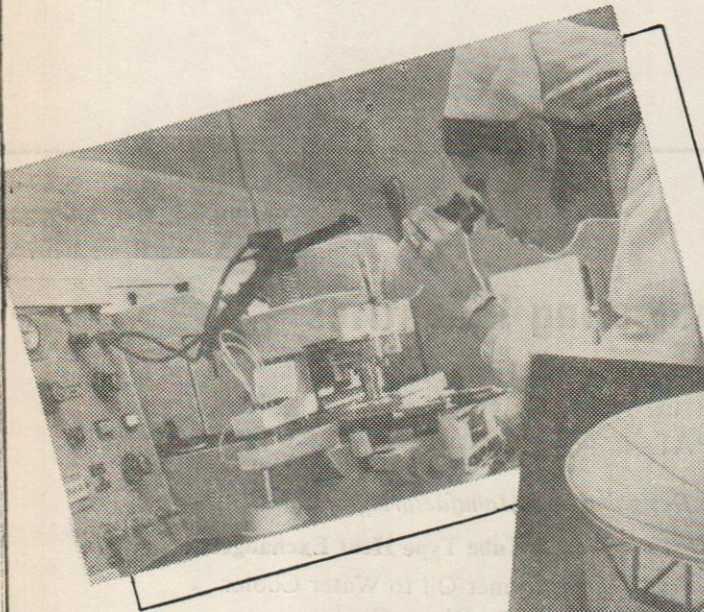
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# Measuring ADO Productivity

R.K. TALUKDAR  
S.N. LAHARIA

*The paper focusses on the need for measuring the Productivity performance of Agricultural Development officers and suggests a methodology for the same.*

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Agricultural Development Officers (ADOs) are the grass-root level extension workers in the Department of Agriculture, Haryana, and thus, play a pivotal role in disseminating the technical knowhow to the farmers and increasing agricultural production. The success of any agricultural development programme to a considerable extent, therefore, depends on the role performance and productivity of ADOs. This suggests a strong need of an objective appraisal of their performance. It would also provide a feedback to the superiors as well as to ADOs to have corrective measures for achieving the desired goals. Clark (1962) observed that performance appraisal plays a significant role in raising the standard of work of employees and also in building more effective work team. Similarly, Pareek and Rao (1981) also reported that performance appraisal is an effective instrument for helping people to grow and develop in the organization. Considering its significance in personnel as well as in organizational development, an attempt has been made to develop suitable measurement criteria of productivity of ADOs in the present study.

## Concept

The dictionary meaning of productivity is "the quality or fact of being productive", while "productive" means "having quality of producing or bringing forth" (Oxford English Dictionary, 1982). According to "International Encyclopaedia of Social Sciences" (1968) productivity refers to a class of empirical out-

put-input ratios that is widely used in economic history, economic analysis and economic policy.

The term productivity has been referred to as "performance" as well as "turn over" (Parumal, 1975). Carrol and Tosi (1978) also defined it as the level of performance relative to some standard. In strict mathematical sense, it is interpreted as profit.

Job performance, according to Rizvi (1967) is "the manner and extent to which different jobs are performed in practical situations" Perumal (1975) operationally defined performance of Agricultural Extension Officers as "carrying out the job in six job areas, namely, education, supply and service, supervision, administration and organization, planning and evaluation".

Thus, productivity of ADOs was operationalized as the extent and manner of job performance by them.

### Methodology

The study was conducted in three randomly selected districts, namely, Hisar, Kurukshetra and Bhiwani of Haryana, representing its three agro-climatic zones. All the ADOs having a minimum of two years experience in the department, of which one year at the present place of posting, constituted the total population of the study. Out of 129 such eligible ADOs, 102 (79%) returned the fully completed questionnaire.

### Measurement of Productivity

To measure productivity in mathematical sense as the difference between returns and costs or output-input ratio or profit-loss ratio is a simple process but it is possible only in financial matters, while, it is difficult in case of workers involved with educational/welfare activities. However, Koontz *et al.* (1980) observed that whether in work or play, in all kinds of group enterprises performance has been evaluated in some way.

In a number of studies done with non extension personnel (Harigopal *et al.* 1969; Ivancevich and Donnelly, 1975; Prakasam, 1976; Minocha, 1977; Laharia, 1978; Krishna, 1980) the productivity has been measured generally by performance rating and/or actual unit of production. In case of extension person-

nel, performance has been mostly measured by superiors and/or self rating, as is evident by the Table-1.

TABLE 1  
Summary of techniques of measurement and categories of extension personnel

Sr. No.	Name of the investigator	Type of extension personnel	Techniques used
1.	Singh <i>et. al</i> , 1967	VLW	Superior rating, self rating and rating by village leaders
2.	Singh, 1970	AEOs	Superior rating
3.	Bhatnagar, 1971	SMS	Superior rating
4.	Kherde and Sahaya, 1972	VLWs	Self rating
5.	Kolte, 1972	AEOs	Superior rating
6.	Choukidar, 1973	VLWs, AEOs etc.	Superior and self rating
7.	Bhatia and Sandhu, 1975	VLWs	Superior rating
8.	Perumal, 1975	AEOs	-do-
9.	Sandhu and Singh, 1977	AEOs	Self rating
10.	Janardhan, 1980	AEOs	Self rating, superior rating and actual performance
11.	Kittrell, 1980	County Extension Agents	Paired comparison by area supervisors
12.	Rao and Sohal, 1982	Vety Extension Officers	Self, superior, subordinate and beneficiaries rating, and physical targets

In some cases, productivity has also been measured in quantitative terms (actual performance, and achievement of physical targets). It was, therefore, felt to measure productivity both in qualitative as well as in quantitative terms.

### A. Qualitative Dimension

#### a. Selection of criteria

First of all, a preliminary list of qualitative criteria



was prepared on the basis of review of literature, discussions with extension personnel of Department of Agriculture, Haryana and an analysis of job charts for Agricultural Inspectors of Haryana (1972) and Agricultural Extension Officers of Tamil Nadu (Perumal, 1975). These criteria were then put to 'judges' rating to find out their importance in measuring the productivity of Agricultural Development Officers. Thirty judges consisting of academicians as well as officials of Department of Agriculture, Haryana, rated the criteria on a 5 point continuum ranging from "Most important" to "Not at all important", through "Very important", "Some what important" and "Not important". The following criteria having the importance score of 2.5 or more were selected as final indicators for qualitative measurement of productivity of ADOs.

- (i) Subject matter knowledge
- (ii) Communication ability/skills (speaking, writing, listening)
- (iii) Ability to conduct demonstrations effectively
- (iv) Reporting (timeliness, accuracy, comprehensiveness)
- (v) Sincerity and devotion to the purpose
- (vi) Overall contribution to the department (utility in the department)

#### b. Judges/rates

The next question was, who should evaluate the ADOs? Obviously, the reply was that they should be evaluated by superiors, peers, subordinates, beneficiaries as well as by themselves. Since, the ADOs were the grass-root functionaries, there was no scope of their evaluation by the subordinates. The evaluation by beneficiaries, though very important, could not be taken up for want of practical problems. The peers' rating was tried on a small sample, but the idea was also given up due to lack of cooperation by the respondents. They, in fact, expressed a feeling of being goody-goody with each other. Similarly, the idea of self evaluation was also dropped after having it tried with a small sample when it was found that almost all the respondents placed themselves on the high echelon. Ultimately, the evaluation was confined only to superior's rating. Rao and Sohal (1982) also reported that

superior rating is quite discriminating.

Circle Agricultural Officers (CAOs), Sub-Divisional Agricultural Officers (SDOs) and Subject Matter Specialists (SMSs) were selected as judges for superior rating of ADOs. District Agricultural Officers (DAOs) and Deputy Director, Agriculture (DDAs) were not included as they did not have very close information about each ADO in their jurisdiction. On an average, each ADO was evaluated by 4-5 judges.

#### c. Administration and Scoring

The data on judges' rating was obtained personally by the investigator on a performance schedule with categories ranging from "outstanding" to "hopeless" through, "very good", "good", "average" "below average", and "poor". The judges rating was got done subdivision wise. They were requested to evaluate the ADOs of their respective sub-division on each of the six criteria separately on the given continuum.

Judges were told about the importance and purpose of the data collection and assured about the secrecy of their rating. They were also requested not to share their judgement with any other person.

The scores assigned to different categories of the performane continuum ranged between 7 for "outstanding" to 1 for "hopeless". Hence, the possible range of score of a respondent on all the six criteria from a single judge was 6 to 42. Since, the ADOs were evaluated by 4-5 judges on all six criteria, the mean score was calculated with the help of the following formula which was considered as an indicator of qualitative productivity of the respondents.

$$P_{q1} = \frac{R_{i1} \dots R_{in} C_{j1} \dots C_{jn}}{R_n \cdot C_n}$$

where,

$P_{q1}$  = Mean productivity score on qualitative criteria

$R_{i1} \dots R_{in} C_{j1} \dots C_{jn}$  = Sum of scores by judges numbering 1 to n, on all the n criteria.

$R_n$  = Total number of judges evaluating an ADO.

$C_n$  = Total number of criteria, i. e. 6.

Thus, the mean qualitative productivity score of each of the respondents ranged from 1 to 7.

## Quantitative Dimension

### Selection of Criteria

A review of literature on performance appraisal of agricultural extension workers revealed the dearth of quantitative criteria, though these have been much used in measuring productivity of factory workers, managers and research scientists (Ivancevich and Donnelly, 1975; Prakasam, 1976; Minocha, 1977; Laharia, 1978). The joint Indo-American Study Team (1970) suggested that ability and productivity of extension workers could be measured by the rate of changes in amount of fertilizers used, areas planted under high yielding varieties and introduction of new technologies etc. On the basis of discussions with extension workers and extension scientists, and review of existing literature, a list of quantitative criteria was prepared. The importance score of these criteria were calculated by following the same procedure as given in selection of qualitative criteria. Initially the following 9 criteria with importance score of 3.5 or more were selected:

- (i) Number of demonstrations conducted
- (ii) Number of field days organized
- (iii) Number of visits by VIPs (agril. ministers/ agriculture commissioners/production commissioners/international scientists and extension personnel/national level scientists and extension personnel/deputy commissioner/scientists and extension officials from other states) in his circle
- (iv) Number of meetings organized
- (v) Number of crop cutting experiments conducted
- (vi) Number of exhibitions, farmers' fairs, film shows, campaigns etc. organized by or actively participated in organizing the same
- (vii) Fertilizer consumption rate (N-P-K-nutrients/ha/ADO's circle)
- (viii) productivity of major crop(kg/ha/ADO's circle)
- (ix) Area under HYVs of major crop per ADO's circle

Out of these 9 criteria the last three were dropped after pretesting as the data on these criteria were not available ADO's circle wise. Hence, only the first six criteria were retained for quantitative measurement of productivity of the ADOs. Duration for these activities was one year.

### C. Administration and scoring

The data on this aspect was also collected through personal interview method with the help of a structured schedule. One point was assigned to each activity done by them. Each respondent was asked to be truthful and objective in his reply. They were also told that they are being evaluated by others also.

The mean quantitative productivity score was worked out by dividing the total score obtained by a respondent by the number of criteria, i.e. 6.

### D. Total Productivity

The qualitative and quantitative productivity scores of each respondent were added after converting them into standard scores, which formed the total productivity score of the ADOs for further analysis.

## Results and Discussion

### A. Productivity on Qualitative Criteria

The mean productivity score on each dimension was calculated separately which are presented in table 2.

TABLE 2  
Mean productivity score on qualitative criteria

Sr. No.	Criteria	Mean	Score range	S.D.	C.V.
1.	Subject matter knowledge	4.88	2-7	0.79	16.19
2.	Communication skill	4.82	2-7	0.77	15.97
3.	Ability to conduct demonstrations	4.56	1-6	0.73	16.01
4.	Reporting	4.73	2-7	1.05	22.20
5.	Sincerity and devotion	4.60	1-7	0.71	15.43
6.	Overall contribution	4.90	2-7	0.79	16.12

The mean scores on all the six criteria did not vary much. Probably, rating on one aspect might have influenced rating on the other aspects. However, "overall contribution" got highest mean score (4.90) and "ability to conduct demonstrations" the lowest mean score (4.58). It is possible that the judges while rating on "overall contribution" might have considered many other aspects hitherto unknown to the investigator. It was also found that "reporting" has the highest discriminating power (c.v.=22.50). However, all these indicators have fair discriminating power in rating the performance of ADOs.

#### Inter-correlation among qualitative criteria

The relationship among the criteria with one another was tested by finding out the inter-correlations among them. The results are presented in table 3.

All the inter-correlations were found positive and significant. The highest correlation was found between "subject-matter knowledge" and "overall contribution" ( $r=0.88$ ). It suggests that all the criteria were interlinked and rating on one dimension influenced rating on another dimension. If a judge rated an ADO high on one dimension, he might have rated him high on other dimensions too.

Tucker *et al.* (1967) also observed high correlation

between superior ratings on "overall work performance" and "skill with people". Superior ratings on "contribution to scientific knowledge" and "contribution to the organization" were also reported to be highly correlated by Laharia (1978) in a study of productivity of agricultural scientists.

The table further reveals high correlation of all the criteria with total qualitative productivity score which suggests that total productivity is also positively associated with the performance appraisal on different qualitative criteria.

#### Inter-judge reliability

An attempt was also made to enquire into the inter-judge agreement on rating of respondents by Kendall's coefficient of concordance (W). The 'W' was further converted to " $\chi^2$ " as 'N' was larger than 7 (Table 4).

It is observed from the table that all the values are significant which indicate high degree of inter-judge agreement in all the sub-divisions. It can, therefore, be concluded that each ADO got more or less same rating by all the judges. Probably, the judges being in close contact with the ADOs had a keen observation of their activities and it might be the major reason of high degree of agreement among them.

TABLE 3  
Inter-correlation matrix among qualitative criteria

Sr. No.	Criteria	A	B	C	D	E	F	TQL
1.	Subject-matter knowledge (A)	—	.72*	.82*	.54*	.77*	.88*	.87*
2.	Communication skill (B)	—	—	.85*	.66*	.75*	.79*	.91*
3.	Ability to conduct demonstrations (C)			—	.66*	.71*	.87*	.83*
4.	Reporting (D)				—	.58*	.59*	.80*
5.	Sincerity and devotion (E)					—	.74*	.85*
6.	Overall contribution (F)						—	.90*
7.	Total (T <sub>QL</sub> )							—

\* Significant at 5 per cent level of significance.

TABLE 4  
Inter-judge reliability sub-division wise

Subdivision	W	x <sup>2</sup>
SDV A	0.68	28.56*
SDV B	0.66	27.72*
SDV C	0.78	21.06*
SDV D	0.79	30.81*
SDV E	0.82	31.98*
SDV F	0.63	22.68*
SDV G	0.72	23.76*
SDV H	0.72	17.28*

\* Significant at 5 per cent level of significance.

### B. Productivity on Quantitative Criteria

The mean scores, standard deviation and coefficient of variations on different quantitative criteria are presented in Table 5.

TABLE 5  
Mean productivity score on quantitative criteria

Sr. No.	Criteria	Mean Score	Range	S.D.	C.V.
1.	No. of demonstration	6.60	1-21	6.73	101.97
2.	No. of field days	3.27	0-20	3.66	111.93
3.	No. of VIPs' visits	0.43	0-4	0.77	179.07
4.	No. of meetings	6.16	0-12	5.74	93.18
5.	No. of crop cutting experiments	3.07	0-10	3.56	115.97
6.	No. of film shows, campaigns, exhibitions, farmers' fairs	0.67	0-7	1.77	264.18

The table reveals that there is a wide variation in the mean scores on different criteria. The highest mean score was observed in case of "demonstrations" closely followed by "meetings". It is, thus, evident that conducting demonstrations and meetings are two

major activities undertaken by all the ADOs. On the other hand, the number of fairs, film shows, exhibitions etc. seems to be small.

The standard deviations and coefficient of variations on all the criteria were very high which suggest that there was a wide heterogeneity in the sample about the performance of these activities. The maximum variation is on the last criterion (c.v.=264.18) and the minimum is in the case of meetings (c.v.=93.18).

### Inter-correlation among Quantitative criteria

Further, to find out the association among the criteria, correlation coefficient (Pearson's r) was calculated. The values are presented in the Table 6.

The table reveals that all the above criteria except "meetings" and "VIPs visits" are significantly and positively correlated with total productivity score. The non-significant correlation between total quantitative productivity score and "VIPs' visits" may be due to the fact that "VIPs' visits" were mainly concentrated in only 25 per cent ADO circles. As many as 75 respondents out of 102 reported that no VIP visited their circle in the last one year. Similarly, there was only one ADO who reported the visits of 3 VIPs in his circle. In rest of the cases, either one or two VIPs visited during this period. This shows that VIPs' visits were confined only to a few circles, which might be on the periphery of the district head-quarter or town as it is convenient to arrange a visit of a VIP to a nearby village rather than to a distant village. Besides work, thus, distance, transport and communication facilities seem to be some other factors which influence the selection of a village for the visit of a VIP.

It is also evident that "field days" is significantly and positively correlated with "demonstrations" and "crop cutting experiments". It means that an ADO who conducted more demonstrations and crop cutting experiments also organized more field days. These activities are thus, inter-related and an extension worker conducting more demonstration can be presumed to be doing better in the other two aspects also and can therefore be considered more reliable quantitative criteria.

TABLE 6  
Inter-correlation matrix among quantitative criteria

Sr. No.	Criteria	A	B	C	D	E	F	T <sub>QN</sub>
1.	No. of demonstrations (A)	—	.201*	.085	.057	.181	.174	.706*
2.	No. of field days (B)		—	.181	.061	.212*	.122	.306*
3.	No. of VIPs visits (C)			—	.068	.023	.017	.188
4.	No. of meetings (D)				—	.051	.137	.159
5.	No. of crop cutting experiments (E)					—	.190	.401*
6.	No. of film shows, campaigns, exhibitions, farmers' fairs (F)						—	.419*
7.	Total (T <sub>QN</sub> )							—

\* Significant at 5 per cent level of significance.

### Relationship between Qualitative and Quantitative Productivity of ADOs

The correlation coefficient between qualitative and quantitative productivity scores of the respondents was positive and highly significant ( $r=0.668$ ). This suggests that the respondents getting high score on qualitative aspects also got high scores on quantitative criteria. It can also be inferred that the rating by the superiors was highly reliable.

### Recapitulation

Six qualitative and also six quantitative criteria were selected on the basis of their importance score to measure the productivity of ADOs. Superiors' rating was obtained on the qualitative dimensions on 5-point continuum. There was high positive inter-correlation among all the qualitative dimensions and also with the total productivity score. Inter judge reliability was also high.

The self reporting on quantitative dimensions was also obtained from the ADOs. It was observed that mean productivity score on demonstration and meetings was very high in comparison to other quantitative dimensions. Demonstrations, field days, and crop cutting experiments were observed as highly inter-related activities.

There was high positive correlation between scores obtained on qualitative and quantitative dimensions. The mean scores on quantitative and qualitative dimensions were converted into Z scores and their summated value formed the total productivity score. The study thus suggests that a combined score obtained through superiors rating on selected qualitative dimensions and self-reporting on some important quantitative aspects by the ADOs can provide a highly reliable and valid index of their productivity.

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# Effective Trainer : Some Personality Correlates

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DR. MADHUKAR SHUKLA

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*This paper attempts at developing a framework within which the personality correlates of an effective trainer may be investigated. The authors identify five major dimensions of personality along which the effective trainers may be distinguished from the ineffective ones. These are : (1) teaching effectiveness; (2) leadership style; (3) interpersonal competence; (4) psychological needs; and (5) ego strength.*

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## Introduction

Within the last few decades, management development training has become one of the most important field of organisational activity all over the world. Trained and experienced managerial personnel are being increasingly accepted as a 'resource', the supply of which is critical to the survival and development of an organisation. In fact certain authorities (e.g., Taylor and Lippitt, 1975) have even asserted that the differences in performance among countries and organisations rest, not so much on their supply of natural resources and technological advancements, as on the ability of their people to utilize the existing technology through efficient and innovative organisations.

As a fast, upcoming and critical field, the area of management development training poses several interesting questions, not the least among which is the question about the type of persons who are actively involved in training others, namely, the trainers. An increasingly large number of persons from various disciplines are being employed as trainers. However, in the absence of any definitive data about the required personality profile of trainers, the judgement on their role effectiveness is, by and large, post priori and is based of arbitrary criteria. This paper aims to explore the personality correlates of an effective trainer in relation to the requirements and demands of the training situation.

### The Training Process

Management development training is a systematic approach to impart managerial skills and techniques to the personnel of an organisation. Apart from giving conceptual and knowledge input through lecture-method, training also relies on such training techniques as group-discussions, role plays, business games, etc., to encourage learning through unstructured group interactions, individual feedback, skill-practice and simulation of real-life situations in the classroom. The aim of these methods is to impart knowledge and skills to trainees through creating, manipulating and analysing their experiences (Howrylyshyn, 1975). Simultaneously, however, these methods tend to make the training process a two-way flow of communication (as contrasted to the unidirectional communication in the conventional lecture-method). Such a situation would necessarily minimise the interpersonal distance between the trainer and trainee, and is likely to place rigorous demands on the interpersonal skills of the trainer.

A related aspect of effective training process is its emphasis on experience-based, as opposed to merely concept-based, learning. Numerous studies have shown that while the semi-structured experiential training methods are as effective as lecture-method in terms of acquisition of knowledge by the trainees (Buxton, 1956; Dietrick, 1960; Hill, 1960; Stovall, 1958; Verner and Dickinson, 1967), they were found to be more effective for inducing attitude change (Butler, 1966; Festinger and Carlsmith, 1959; Harvey and Beverley, 1961; Siliber, 1961; Smith, 1964), for modifying behavioural patterns (Bonde, 1956; Boyd and Ellis, 1968; Levine and Butler, 1952; Lewin, 1958; Underwood, 1965), for developing interpersonal skills (Bolda and Lawsche, 1962; Campbell and Dunette, 1968; Lawsche, Bolda and Brune, 1959; Maier and Hoffman, 1960), and for imparting problem-solving skills (Fox, 1963; Maier and Hoffman, 1960; Parnes and Meadow, 1959; Solem, 1960). By and large, these studies appear to suggest that a flexible and semi-structured style of training is more effective than the rigid and conceptual style. The effective trainer therefore, must strive to maintain, in the group, a precarious balance of spontaneity and ambiguity, on one hand, and control and guidance, on the others.

The ambiguity of the training process is further augmented by the role-requirements of the trainer. Allan and Silver-zwing (1976) have defined the trainer as a catalyst in the process of change. Schein and Bennis (1965) have identified this role as that of a professional but, simultaneously also, as ambiguous, insecure and risky. This is all the more so, because not only the requirements of the training process inhibit the trainer from exercising overt and explicit control over the trainees, but also because many a time the status-difference between the trainer and the trainees is too negligible to do so.

In fact, it is not so rare to find that the participants in a training programme are higher in status, pay, age, etc. than the trainer. This status-incongruity may obstruct the smooth flow of group-functioning and decrease the involvement of trainees with the group-task (Adams, 1953). Since in our country the cultural and organisational milieu is predominantly authoritarian (Carstair, 1956; Gangouli, 1964; Panekar and Savur 1969) the participants are even more likely to perceive and repond to these status-incongruities (Wilkins and de Charms, 1962).

As a change agent, the trainer is also likely to encounter opposition from participants who may find their belief systems and attitudes threatened by the contents and values of training. The clash between trainer's intentions and participants, expectations is not an uncommon occurrence (Lynton and Pareek, 1973). Such situations hold the potential of getting transformed into open or covert conflict and hostility, and would demand from the trainer both diagnostic as well as behavioural skills, to deal with them effectively.

### The Trainer Personality

The above analysis of the training process, though not exhaustive, is sufficient to provide a background against which the personality of an effective may be examined. The following paragraphs discuss a few salient dimensions of personality along which differences between the effective and the ineffective trainers are likely to be found :

#### 1. Teaching Effectiveness

The trainer is first and foremost a teacher, albeit.



with a greater emphasis on the process-aspect of training than is found in the conventional teaching activity. Teaching effectiveness is a much explored area and has been subjected to rigorous empirical and conceptual investigations. Researchers have attempted to seek determinants of effective teaching in such variables as attitudes (Andrew, 1970), creativity (Maslow and Zimmerman, 1955), task-orientation (Sullivan and Skanes, 1974), scholarly publications (Hicks, 1974; McDaniel and Feldhausen, 1970) organisational climate (Anderson, 1969; George and Bishop, 1971; Kumar, 1976), etc. Lynton and Pareek (1973) have noted that enthusiasm for the subject and ability to generate interest are two important characteristics of a good teacher. However, as a group, these studies have failed to yield any conclusive results, and have even been contradictory (Biddle and Elena, 1964; Hanlon, 1973). It seems likely that teaching effectiveness is a complex variable which has to be determined through interaction of a number of factors. Cattell (1976), for example, describes teaching effectiveness as a weighted multiple function of a number of factors, e.g., intelligence, interpersonal warmth, social insight, shrewdness, imaginativeness, ego-strength, lack of tension etc.

## 2. Leadership style

By the very definition of his role, the trainer is thrown into the position of a leader for the group of trainees. It is for him to coordinate the group activities, to set the tone of interactions and to establish goals and tasks for the group. His acceptance by the group as a leader, appears to be a significant determinant of the group's openness and receptivity to his ideas and suggestions (Wurster, Bass and Alcock, 1961). Harley and Force (1973), in fact, found that the participant's judgements of the trainer's effectiveness was significantly related to subsequent assessments of change in the attitudes and behaviour among participants.

The semi-structuredness and fluidity of the training situation appears to indicate the nondirective leadership style as more appropriate for the trainer than the directive leadership style (Shaw and Blum, 1966). Permissiveness and tolerance in managing the group's functioning was also found to be positively related to

effectiveness of the group's leader (Maier and Hoffman, 1965; Ziller, 1963, 1965). Thelen (1965) also noted that a sophisticated teacher, works with, rather than suppresses, the wide range of potentialities existing in the group, and creates situations in which these tendencies may be constructively expressed.

Leadership has also been defined as the creation and "management of meaning" (Smircich and Morgan, 1982). Effective leadership, according to these authors, "depends upon the extent to which the leader's definition of the situation...serves as a basis for action by others. It is in this sense that effective leadership rests heavily on the framing of experience of others, so that action may be guided by common conceptions as to what should occur (Smircich and Morgan, 1982, p. 262)". This focus on providing relevant interpretations to groups' experiences, appears to be an appropriate perspective within which to view the trainer's role. A major task of the trainer is to draw the participants' attention to particular aspects of the ongoing stream of experiences, thereby creating a new awareness of hitherto unknown and unsuspected meaning-structures. This proposition is also supported by the evidence that leaders of the training groups, which under-went a large amount of long-term positive change, were more competent in providing explanations and labels for group or individual behaviour (Lieberman, Yalom, and Miles, 1973).

## 3. Interpersonal Competence

Related to the leadership ability is the ability to competently cope with the numerous interpersonal and group interactions occurring in the training situation.

An important aspect of interpersonal competence is the person's ability to perceive and remain sensitive to the group's needs and feelings. Involved in the intensive interpersonal situation of training, the trainer needs to be shrewd in his judgement, insightful regarding others and himself and empathic to social obligations and reactions of others (Lynton and Pareek, 1973). Bradford (quoted in Lynton and Pareek, 1973) also noted that the permissive atmosphere needed for training can be created only by "sensitive action" on the part of the leader. Cassel (1975)

observed a high positive correlation between social insight and effective leadership.

Since the training process relies heavily on the group-interaction and interpersonal feedback for learning, a large part of trainer's role lies in creating a climate of openness and spontaneity among the participants. Various researchers (e.g. Gordon, 1955; McClelland, 1965; Wischmeier, 1955) have emphasised the warm and friendly group atmosphere, characterised by mutual respect, sense of belonging and lack of self-defensiveness, as essential for effective learning and change. Gibb(1982) also noted that if the trainer fails to generate positive feelings within the group, both for himself and for each other, he is unlikely to promote effective, relevant and retainable learning, in spite of his skill and knowledge of the subject-matter.

#### 4. Psychological Needs

Trainer's active involvement in the training situation is likely to bring forth in his behaviour his personal needs and likings- dislikings (Lynton and Pareek, 1973). Since these needs are a powerful normative influence for the group (Babad and Amir, 1978; Babad and Melnick, 1976) they become an important consideration for judging the trainer's effectiveness.

While not much research evidence exists on this aspect, a few findings and observations do suggest the significance of this variable in predicting the success of trainer's efforts, Lynton and Pareek (1973) observed the need for control and order to be a major factor on which trainers would differ. A trainer with a high need for control, for example, may prefer to use more structured methods of training (e.g. lecture-method) and may inhibit the spontaneity of expression in the group. Similarly, high needs for achievement and affiliation were found to differentiate the effective group discussion leaders from the ineffective leaders (Mussen and Porter, 1959). This finding is consistent with the findings of Bass *et al* (1963) that a high need for affiliation characterised those leaders who placed greater emphasis on the group-processes and interactions in their functioning. The need to nurture and care appears to be another of the trainer's need which produces long-term positive changes in the group's

behaviour and attitudes (Lieberman, Yalom and Miles, 1973).

#### 5. Ego-Strength

Ego-strength denotes a person's emotional maturity, stability and sense of personal adequacy. People with high ego-strength have been found to be suited for occupations requiring flexibility, and they contribute actively in maintaining group morale (Cattell, 1976). They can make quick adjustments to external difficulties and interpersonal conflicts and can competently deal with novel and ambiguous situations (Feirstein, 1977).

Various studies appear to suggest the importance of high ego-strength for trainer's effectiveness. Harrison and Lubin (1965) for example, noted that to induce effective learning, the trainer needs to be flexible in his behaviour ranging from being highly supportive to provoking tension and making confrontations, Similar flexibility in acceptance of deviant situations (e.g., disagreements, interpersonal conflict, differing opinions, etc.) in the group was found to be differentiating characteristic between effective and ineffective group leaders. A related aspect of high ego-strength is the acceptance of oneself and one's feelings. Whitehall and Lewis (1963) noted that denial by the trainer of his own feelings is accompanied by lower effectiveness. Mussen and Porter (1959) also found that effective group-discussion leaders show greater acceptance of oneself and feel adequate in themselves.

#### Conclusions & Implications

This paper aimed at developing a framework within which to view the personality of an effective trainer. The significance of the effort lies in the fact that the trainer through his interactions and behaviour can make or mar an otherwise well-designed and well-attended training programme. Unfortunately, while much work has been done on other areas of training (e.g., designing, methodology, evaluation, etc.), the trainer's personality has eluded the focus of such investigation.

While the results of this theoretical analysis are not very conclusive, they do serve as a stepping-stone

towards a greater conceptual integration. Further conceptual and empirical investigations in this area have two major practical implications. One, such a framework would provide a criterion for selection of effective training staff by organisations, and, secondly it may help in designing more effective training programmes for the personal growth of the trainers.

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## Public Sector—Where does the Problem Lie ?

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DR. ANTHONY LOBO

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*The author in this article dwells on the problems in the Public Sector. He attempts to find the causes of the problems and suggests certain remedies which are worth taking a look at.*

“The Government shall keep as a state monopoly both mining and commerce in minerals, for mines are the source of the treasury and from the treasury comes the power of government.” This was Kautilya over 2000 years ago in his Arthashastra ! After all Public Sector tradition is not new to India.

Talking of the recent past : Discarding the Doctrine of Laissez Faire looked liked a universal phenomenon in the post-Depression era. Even in America, President F.D. Roosevelt, during his first term of Office, 1932-36, was talking of New Deal, a policy that envisaged an extensive programme of Government involvement in corporate and other sectors.

In India, by 1939, a National Planning Committee was appointed by the Indian National Congress with Pandit Jawaharlal Nehru as its Chairman. The Committee could not complete its work because national leaders were detained during the Second World War. After the release of the national leaders, which was followed by the Independence to the country on August 15, 1947, an Economic Programme Committee was appointed by the Delhi Session of the All India Congress Committee on November 1, 1947. Pandit Nehru was the head of this Committee. Its recommendations were approved by the Congress Session at Jaipur in December 1947.

In April 1948, eight months after the Nehru

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Government took over, the Industrial Policy Resolution was announced. The Resolution, though accepted the principle of mixed economy it made the State's role a shade more important in the development of industries by saying : "There can be no doubt that the State must play an active role in the development of industries."

Eight years later, on April 30, 1956, a Second Industrial Policy Resolution was adopted by the Parliament. Meanwhile, the Indian Economic Scene had undergone many changes : The Constitution had been enacted guaranteeing certain Fundamental Rights. Directive Principles of State Policy had been laid down making the State responsible for promoting the welfare of the people by securing social order in which social, economic and political justice would prevail. Since then the growth of Indian Industrial Field has been quite substantial. Today, India is one of the first ten industrialised countries of the world.

A study of the growth of Public Sector in Indian Industrial Field over the years boggles a lay mind which is easily carried away by the enormity of the investment made by the State.

**TABLE 1**  
Growth of Investment in Public Sector  
(Rs. in crores)

Year	No. of Units in Public Sector	Investment
1-4-1951	5	29
1-4-1956	21	81
1-4-1961	48	953
1-4-1966	74	2415
1-4-1969	85	3902
1-4-1974	122	6237
1-4-1979	176	15602
1-4-1980	186	18225
1-4-1981	185	21102
1-4-1982	205	24916
1-4-1983	209	30039
1-4-1984	214	35411

In 1951, there were only two major units producing iron and steel. Today, there are 8 major steel plants with a capacity of 11.4 m. tonnes. So is the story of other industries also. In 1951, there were only five non-departmental public undertakings in the Central Sector, with an investment of Rs 29 crores. In April 1984, they numbered 214 with an investment of Rs 35,410.88 crores.

**TABLE 2**  
Outlay in the Public Sector During  
Different Five Year Plans

Year	Plan Outlay
First Plan Period (1951-56)	1960.0
Second Plan Period (1956-61)	4672.0
Third Plan Period (1961-66)	8576.5
Annual Plans (1966-69)	6625.4
Fourth Plan Period (1969-74)	15778.8
Fifth Plan Period (1974-79)	39426.2*
Annual Plans (1979-80)	12176.5
Sixth Plan : (a) 4 year period (1980-84)	25480.3*
(b) 5 year period (1980-85)	110731.3**
Seventh Plan : 5 year period (1985-90)	180000.00***

Note : \*For the five year period as originally envisaged,  
\*\*Estimates  
\*\*\*Proposed

Table 4 makes it clear that public enterprises have entered almost every field that the present day corporate sector can think of : steel, coal, aluminium, copper, heavy and light engineering products, locomotives, aircraft and ships, and...you name it !

Of all the sectors, steel seems to have attracted the public sector most. This is evident from the fact that nearly 20 per cent of the Public Sector investment has been absorbed by steel industry alone. The lowest of the contribution seems to have gone into the development of the small scale industries. But ironically, the government's highest investment industry has incurred the highest loss also, as is evident from the graphs,

TABLE 3  
Pattern of Investment in PEs

Cognate Group	No. of Enterprises as on 31-3-1984	Investments as on 31-3-1984
Enterprises under construction	6	1747.18
Enterprises producing and selling goods :		
(i) Steel	6	5717.24
(ii) Minerals and Metals	13	2936.79
(iii) Coal	5	4068.82
(iv) Power	2	2510.71
(v) Petroleum	12	3774.21
(vi) Chemicals, Fertilisers, and Pharmaceuticals	25	3992.74
(vii) Heavy Engineering	14	1651.69
(viii) Medium and Light Engg.	20	587.47
(ix) Transportation Equipment	12	1178.84
(x) Consumer goods	14	801.36
(xi) Agro-based	10	36.20
(xii) Textiles	13	860.07
Total	146	28,116.17
Enterprises rendering Services :		
(i) Trading and Marketing services	19	823.17
(ii) Transportation services	9	2194.81
(iii) Contract and construction services	7	265.84
(iv) Industrial Development and Technical Consultancy Services	11	94.19
(v) Development of Small Industries	1	47.86
(vi) Tourist services	2	81.85
(vii) Financial Services	3	1835.75
(viii) Companies registered under Section 25	3	83.06
Total (3)	55	5426.53
Insurance companies	7	121.00
Grand Total	214	35410.88

while on the whole the small scale industries have performed fairly well in India. No wonder Japan has made a commendable progress in its corporate field, for, no less than 99 per cent of its industry is made up of small and medium sized enterprises. Those few giant corporations indulge mostly in assembling the parts supplied by numerous small and medium sized enterprises.

When Rajaji cautioned nearly three decades ago that State monopoly could turn out to be as pernicious as private sector monopoly and perhaps would, in the long run, do greater and lasting damage to economic development, he was only predicting then what is happening today. Out of the 200-odd public sector enterprises in the country, four—Oil & Natural Gas Commission, Oil India Limited, Indian Oil Corporation and Bharat Heavy Electricals Limited—employing a total capital of about Rs 6000 crores made a profit before tax of Rs 2025 crores during 1983-84. The rate of return of these four organisations as profits before tax to capital employed was 30-odd per cent. The remaining enterprises cumulatively among them made a zero profit. This, nearly after decades of "gestation" period!

To deduce 'achievements' of the public Sector Enterprises from the Graphs :

SAIL : First among the Investment Leaders  
Also First among the Loss Leaders

Fert CI : Sixth among the Investment Leaders  
Also Fifth among the Loss Leaders

Kudremukh IOCL : Eighth among the Investment Leaders. Also Seventh among the Loss Leaders

SCI : Tenth among the Investment Leaders  
Also Ninth among the Loss Leaders

To have a similar analysis in the private sector : A study conducted by TC Vishwanathan, NV Venkatarman, and others of the Economic Times Research Bureau, revealed the fact that, of the 101 private sector corporate giants they studied, only 25 had incurred small and marginal losses and the remaining 76 had made good profits (1982-83).

**TABLE 4**  
**Public Sector Contribution in total Industrial Production**

Item	Unit	National Production in 1983-84	PEs' Production in 1983-84	Percentage of PEs' Contribution in Production
<i>Fuel</i>				
Coal	Million Tonnes	138.39	134.20	96.97
Lignite	"	6.60	6.60	100.00
Petroleum-crude	"	26.03	25.03	100.00
<i>Basic Metal Industries</i>				
Steel ingot	"	7.93	5.96	75.11
Saleable steel	"	6.40	4.77	74.53
Non-Ferrous Metal Aluminium	Thousand Tonnes	220.29	61.34	27.85
Copper	"	35.37	35.37	100.00
Lead	"	15.42	15.42	100.00
Zinc	"	60.17	53.70	89.25
<i>Fertilizers</i>				
Nitrogenous	"	3485.00	1660.5	45.65
Phosphatic	"	1048.00	286.5	27.35
<i>Communications Equipment</i>				
Telephones	Lakh Nos.	5.47	5.47	100.00
Teleprinters	"	81.49	81.49	100.00

TISCO : First among the Investment Leaders (807 cr)  
Second among the Profit Leaders (78 cr)

TELCO : Second among the Investment Leaders  
(586 cr)  
First among the Profit Leaders (79 cr)

Reliance Textiles : Third among the Investment  
Leaders (506 cr)  
Fourth among the Profit Leaders (52 cr)

ITC : Fifth among the Investment Leaders (325 cr)  
Third among the Profit Leaders (53 cr)

Today, there is equality between the sectors—they are benefitted or handicapped to the same extent by the government policies. So, if the private sector makes profit and the public sector does not, excuses like social overheads, and such others, no longer provide an adequate explanation. The answer has to be sought elsewhere.

The Public Sector having gone into the Corporate field must have the economic objective as its core objective. Its social objective could be restricted to the extent of making an organisation a progressive and forward looking member of a society, fair to its client group and supportive of its employees. The economic objective should be the creation of surpluses—through efficient production—with which it can grow itself and enable the State to foster economic activity and social welfare.

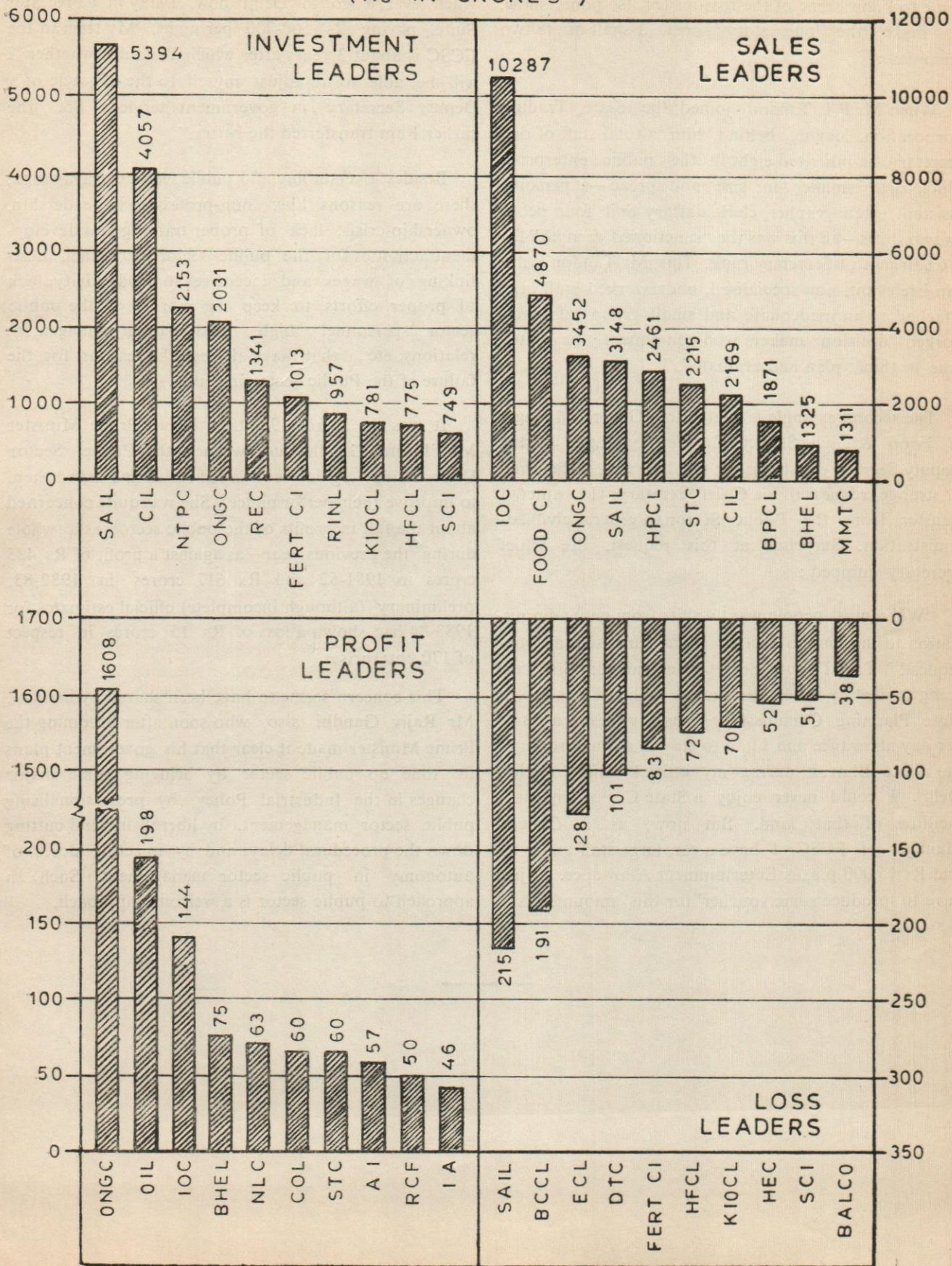
Now the moot point is : With the imported know how, sophisticated machinery and even monopoly benefits given to the public sector in some of the industrial activities (like in power, coal, minerals, air passage and so on), if it is incurring losses, where does the problem lie? Perhaps if we probe into the structure and working of the Public Sector in India, we will



# TOP TEN ENTERPRISES

1983-84

(Rs IN CRORES )



come to know some of the reasons for its poor show. To make the long story short, I shall quote two examples :

When Mr P L Tandon joined the State Trading Corporation, leaving behind him a total staff of one Secretary, he inherited eight in the public enterprise, which was smaller in size and spread—a personal assistant, stenographer, clerk, daftary and four peons on two shifts—all this was the “sanctioned strength” for a Chairman of Secretary rank. This, Mr Tandon calls, “an irrelevant, non specialised, underworked staff tail attached to an inadequate and small group of over-worked decision makers who consequently have little time to think, plan and evaluate”.

The second example is related to a General Manager of Food & Civil Service Corporation Ltd., of the Deputy Secretary Rank in the Civil Service, who had a strange request to his Chief Secretary. He wanted a transfer from the Public Sector to general civil administration. Surprised at this request, the Chief Secretary quipped :

“When most people want a shift from civil administration to the public sector, I am surprised at your request!” The Deputy Secretary explained: “Sir, I am being spoiled by the Public Sector. When I was in the State Planning Commission, I was eligible for a Rs 25 per day allowance and I had to stay in a dingy room of the State Bhavan during my official visits to New Delhi. I could never enjoy a State Car or any other facilities of that kind. But now, as a General Manager of FCSC, I have a car, large staff under me and Rs 15,000 p.a., as Entertainment Allowance. I just have to ‘produce some voucher’ for this amount. And

when ever I go to Delhi now, I stay in a Five Star Suite, paying Rs 500-700 per night. My term in the FCSC is about 3 years after which I doubt whether I will be able to re-adjust myself to the life-style of a Deputy Secretary in government service. So, the earlier I am transferred the better.”

Besides overstaffing and public sector extravaganza, there are reasons like: non-professional leadership, ownership-crisis, lack of proper training and development activities for the public sector personnel, non-linking of wages and incentives to productivity, lack of proper efforts to keep the morale of the public sector personnel high, bad labour-management relations, etc., that have all been the reasons for the failure of the Public Sector in India.

It was in March 1984 that the late Prime Minister Mrs Indira Gandhi had warned the Public Sector Undertakings against continued losses and asked them to improve their performance. She was quite concerned about the fall in profits of the public sector as a whole during the previous year—as against a profit of Rs 485 crores in 1981-82 and Rs 617 crores in 1982-83, preliminary (although incomplete) official estimates for 1983-84 had shown a loss of Rs 15 crores in respect of 170 enterprises.

This concern seems to have been shared by her son, Mr Rajiv Gandhi also, who soon after becoming the Prime Minister made it clear that his government plans to tone up public sector by bringing some major changes in the Industrial Policy, by professionalising public sector management, by liberalising and cutting down the procedural delays and by injecting doses of autonomy in public sector management. Such an approach to public sector is a welcome approach.

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# Developing Construction Industry

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S.K. NARAYANA

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*This paper focuses on the need for educating and training the personnel in the construction industry. The author also places emphasis on the need for increasing research in the industry, which is essential for developing it to suit the changing needs of the society.*

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## The Imperatives

A system of education conceived to train adequate man power competently and hasten modernization can effectively promote productivity. The skilled man power needed for research can be drawn only from science and technology education, while failure to develop indigenous skills may compel a developing nation bow out of a global competition. In the absence of a positive reaction the rapport with the advanced world will be lost. Modern methods of production demand new attitudes. The construction activity is an index to economic and social progress of a country. An imaginative plan should aim at the right type of technological education and link it with national plan—may be a plan on a continuity basis. The appropriate methods and materials of instruction need constant check, with the built in 'servomechanism' of feed back obtainable from the field, and applied in the classroom. The construction activity in the materialization of the strategies developed in the classroom of its technical institutions. The major programmes should include a practical approach to education and training, and achievements of standards comparable in certain aspects to international standards and careful assessment of man power requirements.

## The Needs

For satisfactory design and erection of construction projects there is need for engineers, architects, building physicists, quantity surveyors and others. With the expanding sizes of the projects, communication, within

the building industry assumes an important role. The tasks to be performed are numerous. Technical and administrative liaison is as involved as it is unwieldy unless handled expertly. The skill of handling projects, meeting targets of economy efficiency and time stipulations needs a knowledgeable 'communications' man. He sees that each consultant operates in such a way that decisions do not multiply mutually. Besides he has to watch the interest of a client. Such a person will be trained as a principal consultant. To be able to contain unwieldy bulges in the total make up of the construction activity, it would be necessary to formulate a new educational pattern taking into account current and future changes in the nature, structure and the organisation of the building industry as a whole.

Attention is essential towards the education of the skilled worker, the supervisor and the mid-level technologist for, the use of human material for industrialization of construction demands training and development of skills through technical education. Therefore, it is the task of the planner and the educator to foresee the needs of the industry and to provide appropriate training programmes on an adequate scale at required levels of quality.

### **The Evolution Of Construction**

Over the centuries, the art of building construction has been handed down through generations and it has followed set patterns. Any progress thereof has been one of ad-hoc experimentation in the field. The interaction of science and technology and the induction of cement concrete accelerated the progress beyond straight line proportions and the building activity spurted. Progressively it was realised that the contemporary organisational methods were cumbersome, uneconomic and inefficient. Consequently the contractual system evolved. As the size of the building construction grew, the construction control became complex leading to discrepancies between estimated and final cost causing client dissatisfaction. The quantity surveyor was given due importance and inducted to analyse, draw from past experience and advice the building team and its principal consultant. He developed as a 'Cost Planner' and a 'Cost Controller'.

Inspired by assembly line products, thought has

been bestowed on achieving stream lining in the building industry too. Standardization modular coordination, prefabrication are some innovations in this regard. It is too early to say how industrialisation of the building process would metamorphose the methods, men and materials of construction in the developing country.

### **Vocational Education & Training**

The semi-skilled and skilled workers are so classified by virtue of their continuous exposure to their respective crafts. The more intelligent amongst them get to supervisory positions after a long wait. The development of technical education as it relates to the industry was initiated, through the Apprentice Act 1961. The I.T.I.'s and Technical Schools implement the intentions. But many building workers at lowest levels of literacy can hardly make it to these institutions. There is a large number of untrained workers who surreptitiously manage to fill the bill particularly since the recent building activity boom. Proper training of such workers will obviate, to a large extent substandard craftsmanship. While patterning special courses, the unskilled and the skilled workers should be so educated and trained that he can be directly employed on the job without need for further practical experience. Technical education may be either institution based with training completed in within the industry. Periodic-re-education and retraining to meet changing technology is getting to be mandatory. The present situation with regard to industrial co-operation is disappointing. Notwithstanding the demands of the Apprentice Act, the contractor is rather reluctant to have apprentice on sites. Persuasive measures are required to make him act in the national interest.

In the building industry, the workers are on the move constantly, whereas in other production industries the product moves on assembly lines. The building process is seldom continuous and operations in a given project are carried out at different location in a single site. The contractor has little opportunity to carry out work planning since he enters the picture after the planning is done. Besides, technology is changing rapidly. As the technology advances and enters new ramifications new trades might

have to be identified and appropriate programmes of training devised. Therefore, the training activity falls into the following categories :

- (a) Training programme for new trades emanating from new technological activities.
- (b) Training programme to improve the existing skill.
- (c) Training programme for traditional trades which will continue especially in rural areas.

The following steps would appear appropriate for the skilled and unskilled workers :

1. The education should be terminal in character releasing the trainee for intended employment. However, the brilliant student may be provided opportunities for further study.
2. Reorienting of I.T.I. syllabus is necessary.
3. The industry should be fully involved in planning and development of I.T.I. education.
4. Audio-visual training courses should be organised to train those who are already practicing trades traditionally.
5. To encourage the co-operation of the contractor, incentives such as rebate in income tax linked with compulsory training facilities offered in return by the industry may be investigated and suitable measures taken up.

### Diploma Level Training

The mid-level man power is the back bone of all construction industry. The Junior Engineer is a link between the skilled worker and the planners and clerks of the works. In addition to the numerous areas where he is indispensable, he can help to evolve a coherent system of technical education designed to train artisans. The pace and development of the economy through building activity will largely depend on how supervising problems will be solved.

Each country has evolved courses to suit its contemporary technological advancement. The structure of the courses, their contents, standard and organizational arrangements differ from one country to another. For instance, there are near progressional courses for

those technicians whose work demands a sound theoretical knowledge of Engineering. At the other end of the spectrum, there are near craft courses for those technicians who need to have mastery of practical skills. In between there are courses that have varying proportions of theory and craft content. A variety of organisational arrangements characterise the complexity of the courses. Full time integrated courses that are two or three years' long, sandwich courses in which a student spends stated periods in industry and in a technical institution alternately; block release courses; day release courses; evening courses; and correspondence courses.

### System of Training

Each type of the courses conducted in a particular country represents historical development of technical education in response to industrial needs. For instance, in the U.S.A. the wide spread Technical Institutes' courses grew out of the impact of rapid changes of technological, economic and social development in the beginning of World War II in 1939. To meet the demand, two-year full-time courses were organised for training engineering technicians. To day, these courses have spread so widely that at least one in thirty employed in the U.S.A. is a technical institute graduate. In Britain the well organised sandwich courses are the joint responsibility of the industry and technical institutions. Similarly, part time courses of various types that are offered by a large net work of institutions are typical of the British scene which relies heavily on industry for training of craftsmen and technicians, industry provides practical training for four days a week and the technical institutions provide the education content during one day a week. The system works admirably.

Correspondence courses which are popular in Australia, Newzealand and U.S.S.R. are useful wherever students are widely dispersed and part time and day release courses are not practicable. The German system of training 'Practical Engineering' is unique for that country. Every candidate who joins an engineering school or 'Technicum' to become a practical engineer must have completed at least a two year apprenticeship in industry and German industry is providing excellent facilities for such apprenticeship training. It is, there-

fore, not possible to generalise the structure and the form of technician courses throughout the world. It is vital that a country about to organise or organise its system of technician education and training should adopt these systems (or system) which is best suited to its particular circumstance, and not simply copy another country's system, however well tried and successful that may be. It seems that the sandwich course should become ultimately a general principle for all polytechnic. The building industry must accept its legitimate share of responsibility of training in its own interest. Suitable legislation of the carrot and the-stick type needs to be promulgated.

### Methodology of Training

It is pointed out that the polytechnic education courses are still poor imitation of the country's engineering courses. It is necessary to examine the whole process of polytechnic education, the teaching and learning, processes, the instructional material used, teacher competence, selection procedures of students for admission and so on. The string of responsibilities of a mid-level supervisor is a graded one and in certain specific jobs he may have to replace the engineer at a responsible level. To anticipate such growing, possibilities polytechnics should provide post-diploma courses for those who have acquired experience. They should bear in mind the pattern of employment in major sectors of our engineering activity the need for the mobility of the technician both horizontal and vertical, and the immediate and further employment opportunities available to them.

The teachers placed in charge of the students of the polytechnics should themselves be adept at organising courses most profitably. They should undergo research and training in teaching methods. They should undergo training to acquire special teaching skills.

The building industry must accept, encourage and assist the transfer of experienced staff to part-time and full time teaching work. The flow should be reversed when teachers have to gain experience, sabbaticals should be encouraged.

### The Building Engineering and Manager as a Principal Consultant

The huge programme of construction attendant on

economic plans of the country has to ensure arrival at envisaged time targets, expenditure constraints and the streamlined conduct of each project. At present there are reasons to believe that increasing confusion of responsibilities and instability of pattern in the structure of a building teams have brought dissatisfaction to the client. The work of designing and constructing modern buildings has become a complex job calling for professional skill and specialised training in building and related aspects. High rise constructions for residential and commercial purposes, industrial buildings, power houses, large scale manufacturing units, educational campus buildings, hospital, complexes have all become common place—Asiad buildings are also cases in point—and demand professional skill at each stage of progressing. It has been clear for over a couple of decades now, sophisticated technical advice is mandatory. This requirement is confirmed by large scale consultancy firms too.

A building engineer—manager is called upon—in this context, to perform an array of significant tasks. He acts as a co-ordinator and a principal contestant to whom the building team comprising the Architect, the Engineers, the Quality Surveyors, the Consultants, the Contractors and the client himself look up for disengaging bottlenecks. Being a focus of all enquiries—technical or administrative—he will have to see that the right people are engaged collaboratively at the right time, good communication pattern for both vertical and horizontal dialogue inset, the programme set is acceptable to all specialists and act as a reference to the design teams and as rationaliser to the client.

During the course of a planning activity of any project decision will have to be taken regarding :

- (a) Adequacy of available information;
- (b) Specific tasks to be done to arrive at satisfactory decision;
- (c) Selection of suitable consultants;
- (d) Planning, tasks, target dates and communication details;
- (e) Cost controls and organisational control;
- (f) Execution of the project; and

- (g) Analysis of the feed back to verify initial assumption and deviation from targets.

Engineers and Architects who are competent to handle involved projects can be picked up to train at a post graduate level. This matter has, in fact, already been dealt in depth. The school of Planning and Architecture, New Delhi had found, during a periodical routine enquiry that adequate, appropriate and systematized education at the right level of sophistication is necessary. Before launching a course, the matter was carefully investigated and meticulously analysed with assistance of All India Council of Technical Education and the delegates of a National Seminar called for the purpose. After establishing conclusively that such a need existed, a Board of Studies came out with a good curriculum. The course is now five years old and has been endorsed by organisation of similar pursuits the world over. The Indian Institute of Technology also started a similar post-graduate course and both are doing well. A critical appraisal and methodology of course development of the Master's programme is available at the School of Planning and Architecture, Indraprastha Estate, New Delhi for limited circulation.

The course content has a 25% of instruction devoted to building science, around 33% for systems analysis and the major thrust of 42% is for Project Management. A severe entrance test selects the choicest crop. The Engineers and Architects are qualified to be on the building team, however and their training can be separately looked into. The under graduate courses in Civil Engineering and Architecture must be broad based and contain in the final year electives related to Building Engineer and Management. The academic department of Building Engineering and Management should ensure interaction between teaching, research professional field. Faculty members should be encouraged to engage themselves in consultancy and use examples in class room teaching.

#### The Indian Institute of Building

The objective of this institute is that it should assume the role of a watch dog of technical education and establish a rapport both with the institution and

the industry. It brings under one forum all those engaged in building matters under one forum. The objectives of the Institute could be :

- (a) to formulate suitable plans relating to various aspects of industry;
- (b) to collect statistics through a centralised organisation;
- (c) to collect information and to disseminate it to the industry;
- (d) to maintain building standards;
- (e) to establish rapport between government and industry;
- (f) to assist the government in information of legislation concerning industry;
- (g) to bring building workers under a common forum;
- (h) to encourage research in the industry;
- (i) to maintain exhibitions and libraries for the benefit of the industry;
- (j) to maintain professional conduct.

The heads under which the Institute could deal with building matters are :—

1. Education;
2. Membership;
3. Professional Practice;
4. Research and Extensions;
5. National Builders' Forums;
6. Construction Statistics;
7. Documentation;
8. Activities.

#### Research, Technical

It is noteworthy that technological advancement through research essentially carried out indegenously does more good to a country than merely adopting the results and conclusions arrived at elsewhere abroad. Such a measure of accepting others' conclusions would deny its people all the developmental experience so essential for elevating the technical understanding. Borrowed research may be seldom applicable to conditions obtaining in this country. No ad-hoc adjustment in research parameters will do. Problems

should be studied 'de novo' right from the start. Some noticeable beginning of enquiry into problems of management can be traced to our national laboratories. To achieve synthesis between basic research and its application, the constitution of a strong body to advise Government on policies and priorities of funding is a sound measure. An expert committee made up of knowledgeable persons representing various interests should, under the auspices of the Indian Institute of Building, determine the urgency of different problems and allot them to the several research organisations of the country. This committee should work out meticulously the details of how each project should progress, what would be the scope of anticipated scope of results to be arrived at and what specific questions are to be answered. The committee could comprise profession of technical institutions, builder's representative, export consultants and other competent persons. A second echelon of workers could deal with individual specific problems of, perhaps, short duration and obtain solutions quickly. The post-graduate student theses could be on research oriented field problems.

#### Research Education

Methods of teaching at the grass root level should

orient themselves to obtain motivation. Research has shown that emotions have influence on motivation development of attitudes and habits. At the level of skilled worker it may be worth while to re-think about the present curricula. Meaningful research in the field of planning and selective funding will need a knowledge of sociology and economics of technical education. At the Polytechnic level curriculum development depends on inter linkages amongst the several subjects, training the supervisor towards decision making, and developing his ability to translate his class room knowledge to the field.

Sandwich courses incorporating the technical know-how, skill, and inventive acumen should be formulated to train the under graduate student.

Copious work on live projects which are included in these is the answer for research topics, that the education researchers may like to adopt.

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# Road Construction Productivity

V.K. SOOD & Y.R. PHULL

## Introduction

India has a large network of existing roads, totalling to about 14 lakhs kilometers (1981) including National Highways, State Highways, Major District Roads and Rural Roads. A need based perspective Road Development Plan for 1981-2001 recently prepared by the Indian Road Congress has assessed that Rs. 64,250 crores (at 1983 price levels) are required for road sector including new construction, improvements and maintenance of existing roads. The major portion of the outlay will be consumed by the programme to provide accessibility to all villages by the turn of the century. The Seventh Plan outlay for the roads sector is Rs. 11,000 crores.

As regards quality of roads, the picture on the national scene is not quite encouraging. Taking only the National Highways, it is seen that the system is deficient in many respects, the most important being low riding quality levels, as a result of inadequate thickness, choice of labour-intensive technology and excessive overloading of commercial vehicles. The picture with regard to rural roads, too, is far from satisfactory.

Whereas considerable mechanisation has been introduced in the recent past by some of the road construction agencies in the country, particularly with regard to bituminous work, adopting central hot-mix plants, tipper trucks, and pavers; by and large, the road construction techniques in vogue are quite old.

*This paper presents some considerations for improving Productivity in road construction and maintenance, which is of great relevance to Indian conditions.*

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The machinery, when used is either old and in need of repairs, or of inadequate capacity. The present construction and maintenance practices in use are mostly labour oriented and slow. As regards, the maintenance of existing roads, India is spending about Rs. 400 crores annually but keeping in view the quantum of work involved, these funds are found to be very inadequate. Maintaining the roads in good traffic-worthy condition with the limited available funds poses a great challenge to the engineers on the job. The work involved in the future, for new constructions and improvement of existing roads is also enormous as can be seen from Table 1, showing the road length required, as worked out by different methods, by 2001w. There is great scope for modernisation of road construction and maintenance industry in the country to enhance the quality and productivity of road construction and maintenance operations. In the following sections some of the measures needed for increasing the productivity have been suggested.

TABLE 1

Project Estimated Road Length Requirement of the Country by 2001

S. No.	Method of projection	Estimated road length by 2001, (kn in lakhs)
1.	Road density criteria	26.30
2.	Grid connecting villages & towns	27.66
3.	Regression equation	
	(a) G.N.P.	34.51
	(b) Agricultural production	31.71
	(c) Industrial Production	33.87
	(d) Population	29.00
4.	Time trend analysis	32.99

## 2. Systems Approach for Road Development

A system may be described as a scheme which behaves according to some description to accomplish an operational process. Design of a system for pavement management needs a coordinated set of procedures to detail the use of men, money and materials in the most economical manner. Piecemeal

solutions of different aspects of road development do not lead to the correct solutions. A pavement management system will incorporate various activities like planning, design, construction, maintenance as well as adequate feedback in terms of evaluation. The first major phase in the systems approach is problem recognition, as insight to the problem helps in taking the correct decisions. The whole system being an integrated one, proper planning and solutions increase the productivity of the work. The various aspects which can bring about increase in productivity are as follows :--

- I. Choice of Technology.
- II. Use of new/improved materials.
- III. Equipment management.
- IV. Application of construction management techniques.
- V. Use of appropriate maintenance measures.

## 3. Choice of Technology

The various alternatives available to engineers in India for road construction are :

- (1) Labour Intensive methods, dependent mostly on unskilled labour using nothing more than simple hand tools.
- (2) Intermediate methods, employing certain simple equipment for aiding manual operations.
- (3) Equipment Intensive methods, dependent fully on machines, using human labour only for the operation of equipment.

The guiding factors effecting the choice of Technology are<sup>2</sup> :

- (a) Technology feasibility
- (b) Economic viability
- (c) Social desirability
- (d) Compatibility in working

1. 'Road Development Plan for India (1981-2001)', IRC, New Delhi, 1984.
2. Draft Report of the Working Group on 'Modernisation of Equipment for Construction of Roads and Bridges' Planning Commission, New Delhi, 1984.

India has not enjoyed the benefits of a well-developed and coordinated modern road transport system so far, but it can not afford to neglect this sector because of the popularity it is gaining, and the modern roads will have to be built at an accelerated pace. The 20-year Road Development Plan (1981-2001) envisages the introduction of Expressways as a safer and faster means of inter-urban road travel between selected important urban centres. These roads will have to be made to the most exacting standards and specifications, calling for a high degree of mechanisation and riding quality control.

In recent years, the technology of road construction has gradually changed from purely labour oriented to a judicious blend of men and machines. With a large scale road construction programme ahead in the country, the technology needs to under-go further changes. The shift required is towards mechanisation on arterial routes because of the quantity and quality of work involved, better specifications proposed and the use of new materials. Also at places where manpower available is limited, the induction of equipment is unavoidable. In the case of rural roads, labour intensive techniques may continue for some more time, and their judicious modernisation with simple manual aids manually operated equipment items is called for.

The increasing concern for productivity, quality, human aspects and cost effectiveness calls for increasing use of improved tools and techniques which add a lot to out-put. Thus the choice of construction desirability but also the techno-economic viability, and limiting mechanisation in the interest of generating greater employment potential for unskilled labour is not a prudent policy in the long run. The use of appropriate technology for road construction, keeping in view the difference in acceptable levels of quality for different types of roads is the need of the day in our country.

### 3.1 Increase in Labour Productivity

Following are some of the aspects to make the construction operation more productive, in either case of the technology-labour intensive or intermediate.

(i) Tools given to the labourers should be compa-

tible with the task to be accomplished as better tools make use of better muscle power.

- (ii) Implements such as wheel barrows can enhance productivity over the traditional method of carrying materials by head loads.
- (iii) Supervision and motivation of labour play a great role. Lack of proper planning, organisation and labour management result in poor productivity.
- (iv) An incentive system of wages should be introduced, productivity linked wage structure is desirable.
- (v) Consideration should be given to health and nutrition requirements of labour. A modest investment on these will enhance the productivity remarkably.
- (vi) Proper training should be imparted to the staff, in use of materials and appropriate techniques, which can enhance the productivity considerably.

### 4. Use of New/Improved Material

New materials have been looked for increasing the productivity research has shown the use of these materials can bring about significant changes.

- (i) Cationic Emulsion<sup>4</sup>—This is a material which has been recently introduced in the construction and maintenance of bituminous wearing surfaces in place of conventional bitumen. Emulsion is a cold application binder and in liquid form which can be readily used at any temperature without heating. It can be mixed in a power operated asphalt mixer, or hand operated mixer. Cationic emulsions have been used for path repairs, especially during monsoons.

3. 'A Systems Approach to Road Maintenance' by Prof. C.G. Swaminathan, Dr. N. Bansilal, Ashok Kumar, IRC Seminar on Maintenance and Drainage Aspects of Road Pavements, Theme I, Bangalore, 1982.

4. 'Road Materials and Construction' by Shri R.T. Atre, Papers for Panel Discussion on Trends in Design, Construction and Maintenance of Road. IRC Golden Jubilee Session, Lucknow, 1985.

Results of experimental construction of surface dressing treatment and premix carpet works with use of cationic emulsions have also proved encouraging.

(ii) Geotextiles—In order to overcome the adverse conditions of terrain, drainage and subgrade the use of geo-textiles in road construction has been recently started. Geotextiles contribute towards improved performance of road pavements in more than one way.

(a) by preventing the intrusion of soft subgrade soil into the voids of the unbound aggregate subbase above, while at the same time being permeable to flow of water by functioning as a drainage medium.

(b) by possibly strengthening the subgrade to some extent by virtue of its inherent tensile strength.

The geo-textiles can partly replace the blanket course made of sand/moorum/lime stabilised soil, which has become pre-requisite layer between subbase and soft subgrades. They are easier and faster to lay in road construction.

(iii) Bulk Bitumen—In place of transporting the bitumen in sealed drums, it can be transported to the site in bulk in the tankers. It is economical and also reduces the time component in transportation and utilisation.

(iv) High-type bituminous specifications—The use of asphaltic concrete, bituminous macadam, dense bituminous macadam have brought a revolution in the road construction industry. The specifications are of high standards and the construction is mechanised right from the mixing stage. The use of precoated chips for renewal coats has also brought saving in construction time.

(v) West mix macadam—This is different from the conventional WBM construction which is time-consuming and requires copious use of water which makes attaining the proper quality

control difficult. In the case of wet mix macadam, all the constituent materials are mixed in the mixer and transported to the site for laying and compaction.

(vi) Precast Ribbed Blocks<sup>5</sup>—In the case of areas where conventional construction materials are not readily available and water is in scarcity, the use of precast concrete ribbed block will be very helpful. These blocks can be precast at a base station where materials are available and transported to site for joining them together in forming the pavement. As compared to conventional concrete pavement section, use of precast blocks saves the 28-day curing period in the field and can enable the road to be opened to traffic much faster.

(vii) Optimised Macadam Construction<sup>6</sup> -Research work carried out at CRRI has indicated that the conventional specifications in use for WBM construction need modification. The suggested optimised specifications, such as use of optimum quality and quantity of screenings/filler can enhance not only the maximum density and strength of granular mixes but also productivity. For example, it has been observed that the replacement in quantity of screening to the extent of 50% by non-plastic filler can bring about improved strength, cost economy and better productivity in road construction, vis-a-vis conventional macadam construction.

### Equipment Management

On projects making substantial use of construction equipments, it proper management is necessary in order to achieve economy of construction. The use of machinery to start with was on a small scale especially on jobs like compaction of embankment and subgrade, crushing the stone to yield aggregates of finer sizes, blasting of rocks etc. With the introduction of earth

5. "A New Pavement System for the Sandy Terrains in Desert Areas" by Dr. M.P. Dhir, M.C. Venkatesh and T. Muraleedharan, IRC, vol. 37-3, 1978.

6. 'A Study on the Compositional Aspects of Water Bound Macadam' by Dr. M.P. Dhir, J.K. Jhingan, M.R. Arora, IRC vol. 44-3, 1983.

moving machinery, the use of labour substantially reduced especially on important roads like National Highways where time and quality were essence of the work. The requirement of thick bituminous constructions and new specifications resulted in the use of machines such as mixers, hot mix plants, paver finishers etc. The use of soil-lime and soil-cement stabilised subbases resulted in greater demand on stabilisers. Increasing traffic and consequent need for improved compaction of materials necessitated the use of vibratory rollers.

Although the use of machinery for compaction of earth work, bituminous courses, stabilised layers has increased considerably during the past, there are still many more aspects to be considered for increasing productivity. Proper equipment management can result in higher productivity avoiding the unnecessary idling. More of sophisticated equipment need to be procured and back-up of adequately trained staff and maintenance facilities needs to be provided.

In order to avoid delay in works due to break-down of machinery, facilities for repairs and maintenance of machinery need to be adequately augmented. Mobile workshop units as well as major central workshops should be set-up for the purpose.

#### Application of Construction Management Techniques

The road is represented by a sequence of activities from preparation of subgrade to surface, finishing, which are carried out by labourers and machines. The progress of each process is influenced by factors causing variations in weekly production, interference between labourers and resources used, to which one has to react in order to control construction time and cost. There are a no. of operations research and other techniques available<sup>7 8</sup> for examining the influence on productivity of the interaction between the different operations in construction of road. Using these methods it is possible to simulate the effect on

production rates and progress of changes in labour and plant resources for each of the processes involved. The techniques applicable applied in road construction are :

- (1) Critical Path Method (CPM)
- (2) P.E.R.T.

The use of these techniques in our country has been very limited so far. The extended use of these techniques can bring about increased productivity, through optimal use of resources and cutting down of delays.

#### Appropriate Maintenance Measures

The maintenance aspect though the most important one, is generally most neglected one so far, particularly in developing countries like ours. This happens mainly because it is treated as an independent aspect of road development and not as a part of the whole system. It is extremely important that right from the initial stages of planning and setting forth the investment criteria, the maintenance of roads is assigned its rightful place and needed funds allocated in the very initial stages of development.

In the context of emerging maintenance tasks, there is a need for review of organisational set-up.<sup>9</sup> The aspects of mobility, regular inspections, tarring of field staff, feed-back etc. are some of the important points needing consideration for increasing productivity.

The present system of wholly relying on labour gangs for the maintenance activity has not been found to be an effective way of coping with it. If mobile gangs are formed, which can move about fast in a small truck, having facilities for heating bitumen, mixing patch materials, hand operated light vibratory tampers and rollers etc., the efficiency of maintenance can be vastly improved.

7. 'Road Maintenance in Eighties—Some Pointers' by Dr. M.P. Dhir, M.C. Venkatesha. IRC Seminar on Maintenance and Drainage Aspects of Road Pavements, Theme I, Bangalore, 1982.

8. 'Management Techniques for Civil Engineering Construction' by K. Rowe, Applied Science Publishers, 1975.

9. 'Modern Construction Management' by Frank Harris and Ronald Mc. Caffer. Cross by Lockwood Staples, London, 1977.

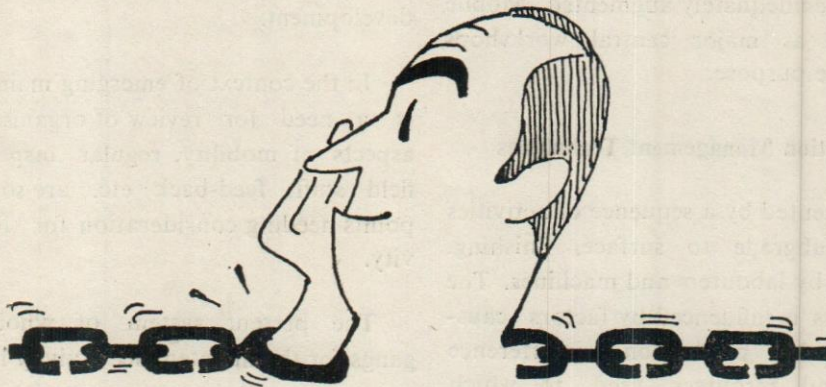
### Concluding Remarks

The road construction and maintenance in India, thus far, has been mostly based on labour intensive techniques. The use of equipment has been to the limited extent for specialised jobs only. A judicious mix of men and machines is necessary keeping in view the quality of work to be obtained and the quantum of work involved for keeping up with the projected road length requirements, including their maintenance and periodic upgrading for better productivity. An appropriate technology for road construction with

more of mechanisation, is the need of the day. The use of new materials developed and application of modern construction equipment and maintenance management techniques can increase the productivity considerably, and needs to be incorporated more and more in the management of our roads.

### Acknowledgement

The authors thank Dr. M.P. Dhir, Director, CRRRI for permission to publish the paper.



**Do you often slave for  
hours to avoid 5 minutes  
of thinking!**

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# Construction Sector Modernisation

S.N. NANDI

## Introduction

Construction Sector dealing with Building Dams, Roads, Production facilities, etc., is an important component in gross capital formation activities in country's economy. It is a productive activity as it results in creation of assets. These assets will be further used for productive purposes. Therefore construction should be regarded as 'Mother Productive Activity'. Its development is inter-linked with that of most of the other sectors in economy.

Though it employs about 5 per cent of non-agricultural work force in India, it is capable of generating comparatively much higher rate of employment in relation to many other sectors like manufacturing, mining etc. In fact, on an average over last 3 decades, employment in total economy has increased by 65%, whereas in construction sector employment has risen by 150%.

Capital deployment in the whole economy has increased by 4.3 times over the last three decades since 1950-51. Even in construction sector, investment in absolute terms has increased by 1.5 times. But its relative share in respect of total investment has surprisingly fallen down from that 2.8 per cent in 1950-51 to 1.4% in 1980-81.

This sector contributes about 4.5 per cent of Net Domestic Product (NDP). Though, its share to contribution in prior seventies has been reasonable but its

*This paper focuses on the modernisation that is needed in the Indian Construction Sector. The author says modernisation should not be viewed as indiscriminated use of foreign technology. He emphasises the need for suitable adaptation.*

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**Suitability of Programme and Projects for Construction by Labour-based Methods at Various Wage Rates  
(1980 prices)**

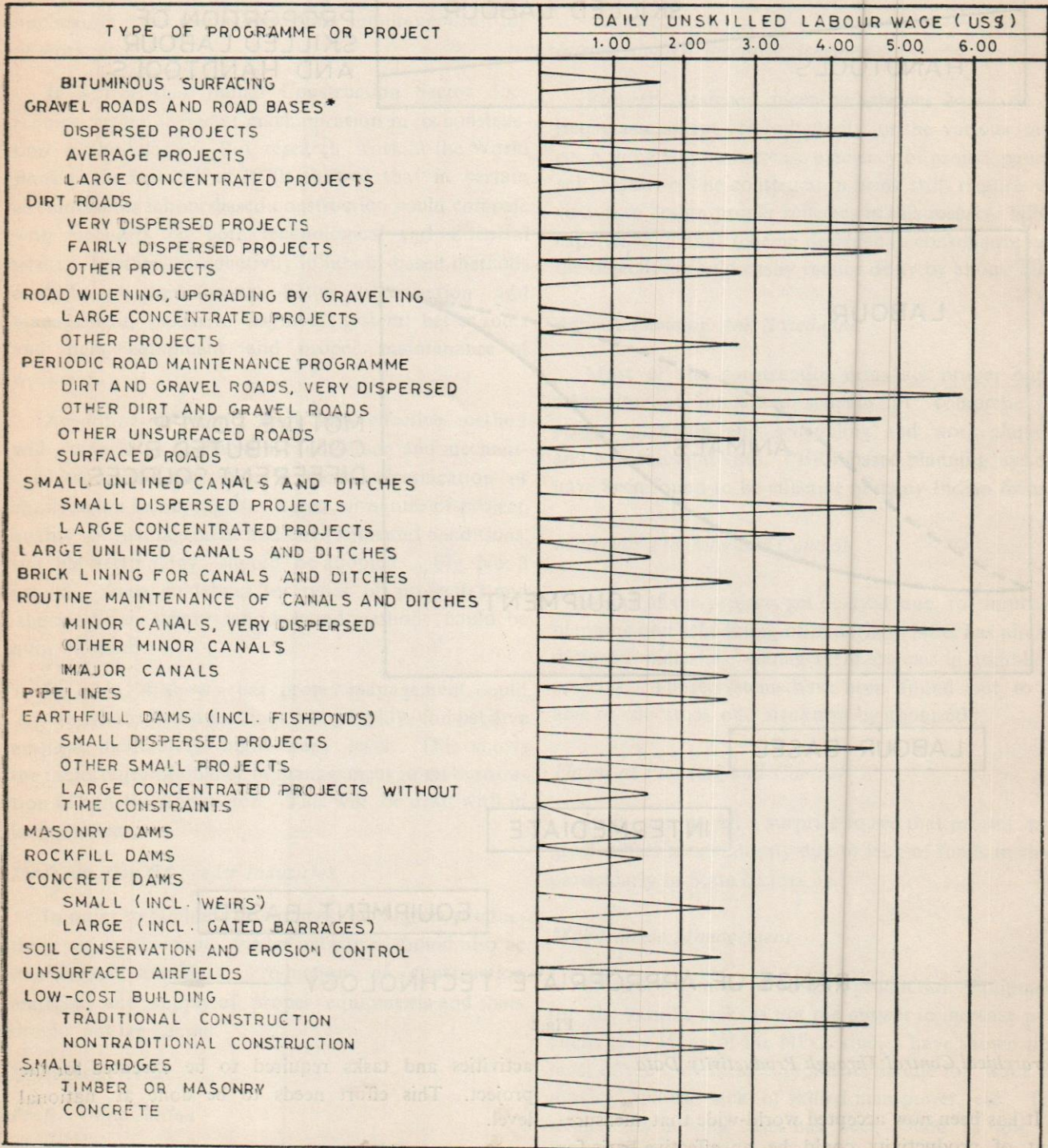


Fig. 3



### Break-even Costs for an Earthworks Task Using Labour or Equipment-based Methods under various Supervisory Conditions

(1976 Prices)

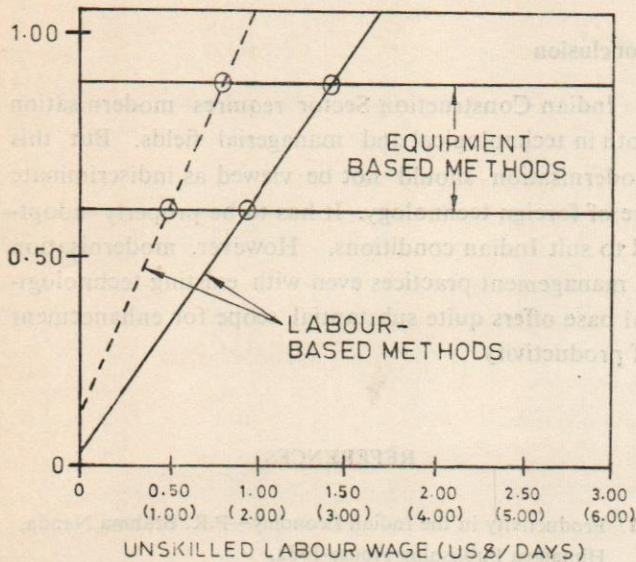


Fig. 4

playing great attention to the idea of total quality control. This concept has been found to be very effective for self-improvement and generating job satisfaction to everybody both at lower and higher levels. Some of the manufacturing firms in India have started introducing QC Circles in their organisations and results have been found to be promising. Therefore, Indian Construction Sector could think of introducing the above Concept to their individual firms. Indian experience of working of Q.C. Circles has shown that this practice can reduce delays by about 25%. It has also been seen to be quite helpful in creating positive environment in the organisation.

#### Computerisation

Many world renowned construction firms use computers for both engineering and managerial application structure within a short time cannot be done manually. Some of the Indian firms have already introduced computers even at sites for effective greater control.

#### Policy Actions Required

Technological Modernisation requires concerted

efforts by all the implementing agencies and substantial investment at the national level. Some of the actions thought in this line are as follows :

- (i) In India, we have already got quite a few number of specialised organisation which are concerned with improvement of designs and adoption of alternate materials. National Building organisation, Central Building Research Institute of India, to mention a few, are doing a good job in this direction in order to transfer know-how from these specialised organisations to project organisations, it is quite necessary that there should be close inter-action between the two. Therefore, there is a need for introduction of extensive promotional services to disseminate technical know-how to the implementing agencies. Even special incentive schemes may be instituted which will encourage agencies to use better technology, cheaper materials, etc.
- (ii) Standardisation of equipment, materials, etc. popularisation of these standards will be quite helpful in this regard.
- (iii) Certain research projects to identify appropriate technology for a few construction programmes may be commissioned by the Government or by apex industry level organisations.
- (iv) Value Engineering has been found to be quite helpful in finalisation of product design in some of the western countries. Even some of the contracts in those countries include provision for use of value engineering to develop more effective designs so as to affect cost and quality of work. In India, this particular productivity technique is still not popular. It requires attention from all the concerned.
- (v) In order to make improvement in the method of working and development of proper tools and fixtures for carrying out tasks, work studies have been found to be very beneficial in western countries and in Indian Manufacturing Industries. Construction Agencies in India should think of large scale use of this above technique. Fortunately, in India, we have enough number of qualified personnel for this.

Financing of construction operations, therefore, becomes fairly high.

9. Time of construction is not considered and value analysis not done in arriving at the total project cost. The quality is often compromised to make up for lost time, for lack of skills.
10. Construction projects during and after execution do not consider aesthetics and effects on environment. Architecture is confined to buildings only.

Some of these ills are the results of long-term neglect and no remedy will be effective immediately. Action taken now may start showing results in 3-5 years time.

### Current Position

The specialised construction know-how for large projects acquired from abroad remains with only a few large construction firms. This has not been spread to a wider base by technology upgradation in medium sized firms. With the result, a handful of firms have far more work than they can handle. This leads to high cost at tender for want of competition.

The bulk of the small scale contractors do not have the resources to bid for large projects. Their inability to get trained manpower restricts choice of builders. With all these factors, delay in construction becomes inevitable.

At the design stage itself, for fear of properties of materials, more materials are specified than required. At detailing stage, again bigger size of structures are indicated for fear of working conditions at site.

At site, wasting of materials even in storage becomes routine. Quality of construction is often neglected for want of knowledge on the part of men-on-the-job. Time overruns become routine and this is not assessed in terms of loss of returns. Construction projects do not pay attention to safety. Efficiency at projects is reduced for want of incentives and motivations.

There is also a feeling with many medium construction agencies that they have built a few projects with

available resources, in the past, and therefore, what lies ahead can also be attained by the same methods employed hitherto. Too much of dependence on human skill for the operations inhibit speed of construction. Such a thinking is sustained because it is not easily understood that all that we have built in the past 25 years, in terms of money, have to be built in the next 5 years. This cannot be achieved by following the old methods.

There is a greater need to upgrade, repair, renovate and maintain many of the facilities built during the past 50 years. This also calls for new approaches in design and construction.

The government, on its part, ought to compare the support that it offers to the sectors of agriculture, oil production, transport and electronics. Agricultural extension, agricultural financing; oil exploration, development and production; transport development and financing; electronics development corporations are all the creation of the state. On the other hand, the construction sector which takes away bulk of the outlays is allowed to struggle on its own without much of the support and necessary promotion from the government.

Even as 'Nuclear Power' is more expensive to generate and coal resources are in abundance, we have set ourselves on a path to generate substantial capacity for nuclear power generation. We know that this is a planned effort to face the future. The same enthusiasm is not seen with the policy makers, planners and even engineers who are responsible for construction policies, to build up the mechanised construction systems and infrastructure in India. The same abundance of unskilled workforce is quoted here for the present, but not for what is to happen in the future.

### Manpower & Training

Manpower is the weakest yet highly contributing factor in the Indian construction industry. In terms of quality, it is an inverted pyramid with plenty of knowledge on what to do. In practice, it is a regular pyramid with very few knowing how to do it. This can be said of personnel at all levels. Construction sector is considered as the absorber of all migrant labour:

force with practically no skills. In terms of technical skills and managerial talents, very little organised efforts are made to improve this. Even as 150,000 seats for technical training in various trades, including some for building trades, exist for training at Industrial Training Institutes, not even 1 percent of this is available to construction industry. There is scope for setting up and promoting skills of about twenty trades, applicable to construction, producing thousands of such tradesmen each year, who will form part of the work force in construction industry. Even as the five year plan estimates an addition of 2.5 million work force in construction in 5 years—a good percentage of this with technical skills—hardly any effort is evident to impart such training.

It is estimated that each one of these trades with a modest out-turn of 20-30 per year from, say, 50 such schools will not meet even a quarter of the demand for such skills. Though belated, urgent action is required to set up such schools for training in construction skills. There is yet another aspect of the personnel policies in construction industry. Providing temporary jobs has its economic advantages to the industry per se. Does that ensure social justice? Construction industry in India is the least unionised. Let us look at the construction wages and cost of materials world over. Manufactured or modified natural materials used in construction cost almost the same or even more in India compared to other countries. The construction workers are the least paid in India. The strength of the industry seems to be the cheap labour force. Wages are lower than in manufacturing industries. So long as labour force is cheap, productivity will be least attended to. But does it match with the national objectives? Also needing attention is the field of safety at construction sites, now almost neglected by law. Motivation for workers, a principle followed in manufacturing industries is also absent in construction sector.

### Research and Development

Research and development in relation to construction process is rather weak. Analysis of this situation is as follows :

The total cost of civil engineering construction can

be sub-divided into the following components :

Materials and semiprocessed articles at site	— 50-65%
Equipment hire cost	— 5-10%
Conversion of materials to structures	— 30-40%

The last item itself can be sub-divided as follows :

Structural Designs knowhow	— 5-10%
* Software development	
* Codes and standards	
* Design and detailing	
* Capability building for future requirements	
Construction knowhow	— 25-30%
* Construction process design	
* Component production/construction	
* Process knowhow construction management	
* Skilled and unskilled labour	
* Quality assurance.	

Almost all R&D efforts in research institutions and universities, concerned with this aspect of conversion/value addition is confined to the design know-how. It is even a matter of dispute as to who should do R&D on construction know-how. Contractors/builders prefer to import know-how just as manufacturing industries; they prefer such tie-ups. A few of the builders, on occasions get the government to accept tie-ups or import of know-how for government projects. Once imported, this know-how remains with them as monopoly user and they seek to perpetuate their superiority and to generate high demand for their products and techniques a high cost. No efforts are made to transfer this know-how to a wider base and thereby to popularise a technique. Constraints thus created can be seen in the use of prestressed concrete, piling systems, manufacture of pipes, slip forming etc.

The state organs are not interested to promote such techniques through a large number of builders because responsibility for 'building' is practically that of contractors. Here again, the state and the industry represented by the private sector should come forward

$d_{L-i}^-$  = Negative deviation from minimum land required for  $i$ -th type of building

$d_{L-i}^+$  = Positive deviation from minimum land required for  $i$ -th type of building

$d_{f-j}^-$  = Negative deviation from lower limit of funds allotted in  $j$ -th year

$d_{f-j}^+$  = Positive deviation from lower limit of funds allotted in the  $j$ -th year

$d_{f-uj}^-$  = Negative deviation from upper limit of funds admissible in  $j$ -th year

$d_{f-uj}^+$  = Positive deviation from upper limit of funds admissible in  $j$ -th year

$d_L^-$  = Negative deviation from total land available

$d_L^+$  = Positive deviation from total land available

### 5.2 Constants

$a_{ij}$  = Number of  $i$ -th type building ideally required to be sanctioned in  $j$ -th year

$f_{ij}$  = Lower limit of funds allotted in  $j$ -th year

In reading these inequalities, it is relevant to note the following. The self-similar inequality constraint both for the lower limit and for the upper limit (i.e. without reading the lower limit constraint with  $\leq$  sign) is merely the mathematical statement of the prevalent departmental practice—according to which  $f_{ij}$  is the nominal budget sanctioned; and if the actual expenditure at the end does not exceed by more than 10% of  $f_{ij}$  (i.e., so long as  $f_{uj} \leq 1.1 f_{ij}$ ), then no revised administrative sanction is called for. In this case,  $f_{ij}$  is the preliminary stipulated lower limit; and  $f_{uj}$  is the inviolable upper limit; it is to be observed that ordinarily  $f_{ij}$  is not exceeded; but in no case should  $f_{uj}$  be exceeded at all. (This percentage excess admissible may vary from organisation to organisation.)

### 5.4 Objective function (with implied priorities)

$$\text{Minimize } z = p_1 (\sum d_{L-i}^- + d_L^-) + p_2 \sum d_{f-uj}^- + p_3 (\sum d_{f-j}^- + \sum d_{f-ij}^+) + p_4 \sum d_{ij}^-$$

The objective of the solution is to minimize deviations from various goals. The highest priority is assigned to the goal of use of land; accordingly, the

highest pre-emptive factor  $p_1$  is associated with the variables that represent deviation from this goal. The availability of upper-limit of funds in each year has been assigned the second priority; so,  $p_2$  is assigned to deviational variables from this goal. The third goal is to minimize the deviations as regards the lower-limit of funds available in each year; for this  $p_3$  is associated with both the deviational variables of this goal. The fourth (and last) goal is the achievement in respect of the required number of the various buildings/utilities to be sanctioned in different years for which  $p_4$  is assigned to the deviational variable from this goal.

The several goals could quite be seemingly incompatible: if any thing, this should be the universal situations, and in fact, the essential criterion for adopting goal programming methodology.

### 6. Preliminary Goals to be Programmed for the Case Study

Let the first attempt be towards the following goals or priority stipulation with the over-riding consideration that all the construction will be single-storeyed.

#### Goal I

- (a) The total allottable 20 hectares of land should not be exceeded;
- (b) Expenditure in each year shall strictly be limited to the upper limit.

#### Goal II

- (a) The year-by-year expenditure should be not far different from lower limit;
- (b) General development (Phase I—Bulk water supply, distribution and electricity supply; Phase-II—Construction of roads, drains, culverts, Horticulture and land-scaping) should be accomplished as pertinent to the ultimate development.

#### Goal III

- (a) Type I Qrs. should be equitably taken up in both phase, i.e., as close as 20 number blocks (each block consisting of 6 dwelling units) in each phase; this is prescribed as a social-welfare obligation.

(b) There is a need that 15 blocks of Type II Qrs. (each block consisting of 6 dwelling units) should be constructed in each phase.

Goal IV

Construction of stores-blocks should be distributed as 2 units in each phase.

Goal V

Construction of office-blocks also should be distributed as 2 units in each phase.

6.1 First Search for Management -Decision:

A first attempt is considered in terms of the said stipulation, namely, single storeyed buildings for all constructions. The relevant set of constraint equations for this would be as under:—

6.1.1 Construction Programme phase—I

- $X_{11} + d^-_{11} - d^+_{11} = 2$  Goal V
- $X_{21} + d^-_{21} - d^+_{21} = 2$  Goal IV
- $X_{31} + d^-_{31} - d^+_{31} = 1$  Goal II B
- $X_{41} + d^-_{41} - d^+_{41} = 20$  Goal III a
- $X_{51} + d^-_{51} - d^+_{51} = 15$  Goal III b

6.1.2 Construction Programme Phase—II

- $X_{12} + d^-_{22} - d^+_{22} = 2$  Goal V
- $X_{22} + d^-_{22} - d^+_{22} = 2$  Goal IV
- $X_{32} + d^-_{32} - d^+_{32} = 1$  Goal II b
- $X_{42} + d^-_{42} - d^+_{42} = 20$  Goal III a
- $X_{52} + d^-_{52} - d^+_{52} = 15$  Goal III b

6.1.3 Land Requirement Constraints

- $1.0X_{11} + 1.0X_{12} - X_{L-1} + d^-_{L-1} - d^+_{L-1} = 0$  Goal Ia
- $1.1X_{21} + 1.1X_{22} - X_{L-2} + d^-_{L-2} - d^+_{L-2} = 0$  Goal Ia
- $0.3X_{41} + 0.3X_{42} - X_{L-4} + d^-_{L-4} - d^+_{L-4} = 0$  Goal Ia
- $0.4X_{51} + 0.4X_{52} - X_{L-5} + d^-_{L-5} - d^+_{L-5} = 0$  Goal Ia
- $X_{L-1} + X_{L-2} + X_{L-3} + X_{L-4} + X_{L-5} + d^-_L - d^+_L = 20.0$  Goal Ia

6.1.4 Requirement of funds : 1st year

$$* 0.2 \times 1.0 (20.0X_{11} + 20.0X_{21} + 60.0X_{31} + 10.0X_{41} + 10.0X_{51}) + d^-_{f-11} - d^+_{f-11} = 98.00 \quad \text{Goal Ib + IIa}$$

2nd year

$$* 0.5 \times 1.1 (20.0X_{11} + 20.0X_{21} + 60.0X_{31} + 10.0X_{41} + 10.0X_{51}) + 0.2 \times 1.1 (20.0X_{12} + 20.0X_{22} + 60.0X_{32} + 10.0X_{42} + 10.0X_{52}) + d^-_{f-12} - d^+_{f-12} = 345.00$$

Goal II a

$$* 0.5 \times 1.1 (20.0X_{11} + 20.0X_{21} + 60.0X_{31} + 10.0X_{41} + 10.0X_{51}) + 0.2 \times 1.1 (20.0X_{12} + 20.0X_{22} + 60.0X_{32} + 10.0X_{42} + 10.0X_{52}) + d^-_{f-u2} - d^+_{f-u2} = 365.00$$

Goal Ib

3rd year

$$* 0.3 \times 1.2 (20.0X_{11} + 20.0X_{21} + 60.0X_{31} + 10.0X_{41} + 10.0X_{51}) + 0.5 \times 1.2 (20.0X_{12} + 20.0X_{22} + 60.0X_{32} + 10.0X_{42} + 10.0X_{52}) + d^-_{f-13} - d^+_{f-13} = 395.00$$

Goal IIa

$$* 0.3 \times 1.2 (20.0X_{11} + 20.0X_{21} + 60.0X_{31} + 10.0X_{41} + 10.0X_{51}) + 0.5 \times 1.2 (20.0X_{12} + 20.0X_{22} + 60.0X_{32} + 10.0X_{42} + 10.0X_{52}) + d^-_{f-u3} - d^+_{f-u3} = 420.00$$

Goal Ib

4th year

$$* 0.3 \times 1.3 (20.0X_{12} + 20.0X_{22} + 60.0X_{32} + 10.0X_{42} + 10.0X_{52}) + d^-_{f-14} - d^+_{f-14} = 150.00$$

Goal IIa

$$* 0.3 \times 1.3 (20.0X_{12} + 20.0X_{22} + 60.0X_{32} + 10.0X_{42} + 10.0X_{52}) + d^-_{f-u4} - d^+_{f-u4} = 167.0$$

Goal Ib

The results of this study (using ICL-2960) showed up the following over, and under-achievements in respect of the above 5 groups of priorities.

6.2 Results of 1st run

Building/Utility	Desired number	Positive slack	Negative slack
(a) Construction programme			
Phase I			
(i) Office block	2	0	0
(ii) Stores block	2	0	0

(iii) General develop- ment	1	0	0
(iv) Type I Quarters	20	0	1
(v) Type II Qrs.	15	0	15
<i>Phase II</i>			
(i) Office block	2	0	0
(ii) Stores block	2	0	0
(iii) General Development	1	0	0
(iv) Type I Quarters	20	0	0
(v) Type II Qrs.	15	0	15
<b>(b) Funds</b>			
1st year			
(i) Lower limit	98.00	0.00	32.66
(ii) Upper limit	98.00	0.00	32.66
2nd Year			
(i) Lower limit	345.00	0.00	90.53
(ii) Upper limit	365.00	0.00	110.53
3rd year			
(i) Lower limit	395.00	0.00	73.39
(ii) Upper limit	420.00	0.00	98.40
4th year			
(i) Lower limit	150.00	0.00	17.40
(ii) Upper limit	167.00	0.00	34.40
(c) Land (in hectares)	20.00	0.00	0.00

The indications in above table can be highlighted as follows:

Positive slack means that the priorities in the order assigned are over-achieved to the quantitative extent indicated; likewise negative-slack indicates under-achievements against the targets within the priorities in the orders assigned.

### 6.3. Reviewing the Achievement of goals

From the results of 1st run it is clear that the 1st goal has been fully achieved as far as requirement of land and upper limit of expenditure are concerned.

The 2nd goal for the objective of keeping the expenditure below the lower limit has been achieved but at the cost of the construction programme. It is possible to execute the general development work of both the phases.

The 3rd goal has not been fully achieved as there will be shortage of 1 block of Type-I (i.e., 6 dwelling units) and of 15 blocks of type-II in phase-I construction programme; and also of 15 blocks of Type II quarters (i.e. 90 dwelling units) in phase-II construction programme. The 4th and 5th goals have been fully achieved.

Since the residential programme of the organisation cannot be executed fully and funds earmarked are also lying unutilized-even as land usable has been exhausted, a second attempt can be made to analyse the possibility of introducing two-storeyed construction with some change in the priority structure as well. This is done in what follows.

### 7. Search to Improve the Management Decision

Realising the large shortages in Type II quarters revision of policy can be made to permit two-storeyed construction for office-blocks and stores retaining, however, single-storeyed construction for residences. Priority stipulations are recast as under:—

- Goal I** Construction programme phase-I; i. e., construction of 2 units office-blocks; 2 units stores-blocks; General development Phase I: construction of 20 blocks of Type I quarters and 15 blocks of Type II quarters.
- Goal II** Construction programme Phase-II, i. e., construction of 2 further units of office-blocks, 2 further units of stores-blocks, General development phase-II, construction of 20 blocks Type I quarters and 15 blocks Type II quarters.
- Goal III** Yearly expenditures in no case should exceed the upper limits.
- Goal IV** The year-by-year expenditures should not be far different from lower limits.
- Goal V** The total allottable 20 hectares of land should not be exceeded.

The relevant constraint equations can be recast as have been done for the first search run. The outcome of having running the programme is as under:—

### 7.1 Results of 2nd run

Buildings/Utility	Desired number	Positive slack	Negative slack
<b>(a) Construction programme</b>			
<i>Phase I</i>			
(i) Office block	2	0	0
(ii) Stores block	2	0	0
(iii) General development	1	0	0
(iv) Type I quarters	20	0	0
(v) Type II quarters	15	0	0
<i>Phase II</i>			
(i) Office block	2	0	0
(ii) Stores block	2	0	0
(iii) General development	1	0	0
(iv) Type I quarters	20	0	13
(v) Type II quarters	15	0	15
<b>(b) Funds</b>			
1st year			
(i) Lower limit	98.00	0	0
(ii) Upper limit	98.00	0	0
2nd year			
(i) Lower limit	345.00	0	30.03
(ii) Upper limit	365.00	0	50.03
3rd year			
(i) Lower limit	395.00	0	94.60
(ii) Upper limit	420.00	0	119.60
4th year			
(i) Lower limit	150.00	0	69.40
(ii) Upper limit	167.00	0	86.40
<b>(c) Land (in hectares)</b>	20.00	0	0.00

### Further Review of the Achievement of Goals

The 1st goal has been fully achieved; the second goal has not been fully achieved in as much as only 7 blocks of Type I quarters in phase-II can be constructed and in other words, it is not possible to under-take construction work of 15 blocks of Type II quarters in phase-II. Goals 3 and 4 are fully met and expenditure is much below the lower limits fixed except for 1st year. Also goal 5 is fully met.

### To Continue the Search in Management Decision

It is evident in previous, i.e., the second trial that in phase-II several of the quarters could not be taken up within the financial constraints if single-storeyed constructions are intended for the residences. Hence admitting two-storeyed construction for the Type I and Type II quarters as well and retaining the priority stipulation as in the second run, a third run is made to ascertain the feasibility of this decision and its consequences as far as the goals are concerned. The results are reproduced below :

### 8.1 Results of 3rd run

Buildings/Utility	Desired number	Positive slack	Negative slack
<b>(a) Construction programme</b>			
<i>Phase I</i>			
(i) Office blocks	2	0	0
(ii) Stores blocks	2	0	0
(iii) General development	1	0	0
(iv) Type I quarters	20	0	0
(v) Type II quarters	15	0	0
<i>Phase II</i>			
(i) Office blocks	2	0	0
(ii) Stores block	2	0	0
(iii) General development	1	0	0
(iv) Type I quarters	20	0	0
(v) Type II quarters	15	0	15
<b>(b) Funds</b>			
1st year			
Lower limit	98.00	0.00	0.00
Upper limit	98.00	0.00	0.00

2nd year			
Lower limit	345.00	0.00	0.00
Upper limit	365.00	0.00	20.70
3rd year			
Lower limit	395.00	0.00	14.60
Upper limit	420.00	0.00	39.60
4th year			
Lower limit	150.00	0.00	17.40
Upper limit	167.00	0.00	34.40
(c) Land (in hectares)	20.00	1.50	0.00

It is seen that the 1st goal is fully met whereas the 2nd goal regarding phase-II construction programme could not be fully achieved as the construction work of phase-II Type-II quarters cannot be taken up at all. Goals 3 and 4 are achieved in years 1 and 2, whereas the expenditure level is much below the lower limits prescribed for the 3rd and 4th years. Goal 5 has also not been achieved as 1.50 hectares of extra land would be required.

The following have been noted particularly as indicators for the next revision of the search (i.e. for the 4th run) for improving on goal satisfaction. Type I and Type II quarters could perhaps be taken up as three-storeyed constructions. The results of such a trial, without any change in priorities among the goals as in the previous run, are listed below :

### 8.2 Results of 4th run

Building/Utility	Desired number	Positive slack	Negative slack
(a) Construction programme			
Phase I			
(i) Office blocks	2	0	0
(ii) Stores blocks	2	0	0
(iii) General development	1	0	0
(iv) Type I quarters	20	0	0
(v) Type II quarters	15	0	0

Phase II			
(i) Office blocks	2	0	0
(ii) Stores blocks	2	0	0
(iii) General development	1	0	0
(iv) Type I quarters	20	0	8
(v) Type II quarters	15	0	0
(b) Funds			
1st year			
Lower limit	98.00	0.00	0.00
Upper limit	98.00	0.00	0.00
2nd year			
Lower limit	345.03	13.82	0.00
Upper limit	365.00	0.00	6.18
3rd year			
Lower limit	395.00	25.00	0.00
Upper limit	420.00	0.00	0.00
4th year			
Lower limit	150.00	8.34	0.00
Upper limit	167.00	0.00	8.66
(c) Land (in hectares)	20.00	0.00	3.60

### Iterative Goals Improvements

By changing from single-storeyed to two-storeyed construction only for office and stores (from the 1st to the 2nd run), the number of quarters that could be constructed has increased within all the parameters of the project though taking up of the total requisite numbers has not been possible. By admitting two-storeyed construction for residences also the 3rd trial improves over the 2nd as far as Type I quarters are concerned but yet it falls short as regards Type II quarters even though more of land is required to be allotted. The fourth trial, by admitting three-storeyed construction for residences, satisfies all the goals and priorities: and, what is more, it leaves more space unutilised for future expansion.

### A Critique on Successive Iterations

The oft-realized problems in the hands of manage-



ment as regards establishment of facilities in colonies can be handled by involving the modifiable priorities even if there are conflicting objective due to the need to satisfy socially desirable goals; a satisfactory solution can be attempted through iterative goal settings with the construction programme modified successively to the absolutely inescapable levels of changes within the options. This is highlighted through this case study wherein increasing the number of storeys in the office buildings and the stores blocks precedes over resorting to increasing the number of storeys for the residences. Quite readily any different order of priorities or comparable changes of options could also be accommodated in these iterative searches and corresponding decisions can be extracted. This could prove equally adoptable for larger problems as well. Incidentally, persistent failure even after several iterative runs to satisfy the several goals may also indicate in-built inadmissibility of the several policy options.

### Conclusions

While defining a methodology for prescribing establishment of colonies and facilities, goal programming techniques, through considering all possible indicators to each construction programmes, can permit develop-

ment of preferable options of alternatives in policies from among which management may choose. The need to reserve land for future development, and the compulsions for phased budget allocation as well as the inevitably progressive cost escalations can also be taken care of in the programmed searches before deciding the actual construction out-lay. The process involved in such interactive decision-making has been demonstrated through a feasible scheme of hypothetical case study.

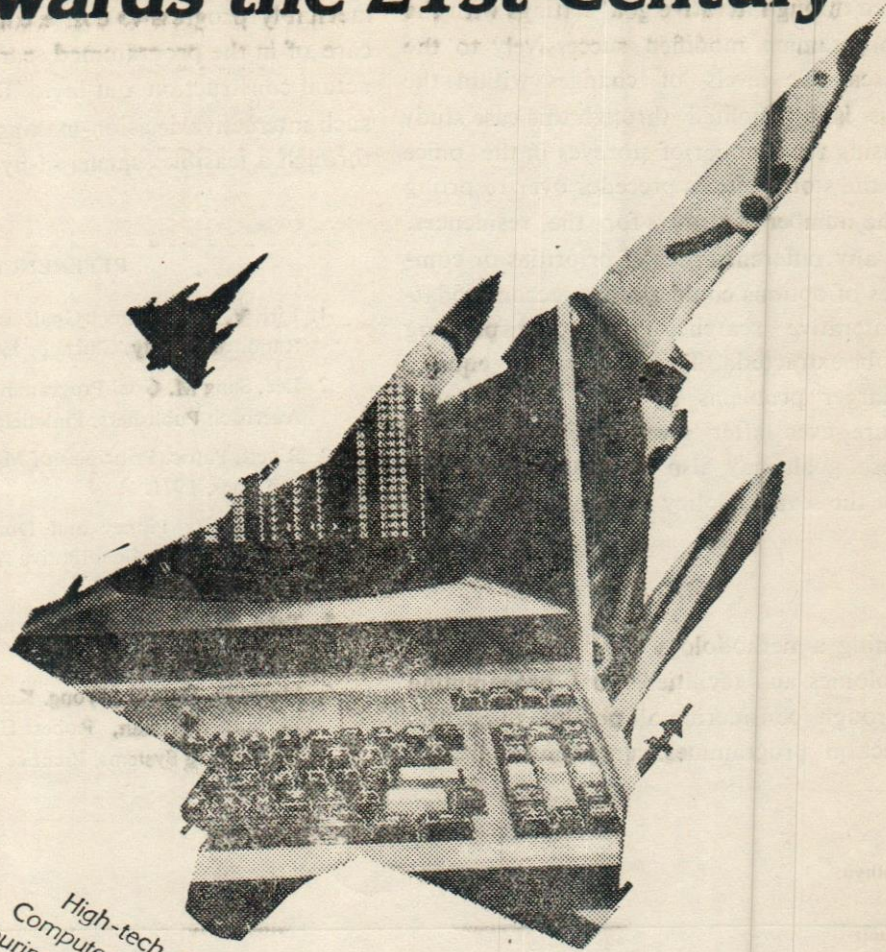
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***If you fear failure, success will  
fear you!***

# Towards the 21st Century



High-tech, Advanced knowledge  
Computerised Controls, Space odysseys—  
Scouring oceanbeds, Searching the Antarctic—  
It's all sea-change that awaits us  
at every turn.  
Prepare we must, right from now  
lest we miss the revolution in the offing  
With Science and Industry overcome we shall  
the problems of poverty

**And forge ahead together**

## EXECUTIVE READINGS

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### **Industrial Relations—Conceptual & Legal Framework**

A.M. Sharma

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Published by :  
Himalaya Publishing House,  
"Ramdoot", Dr. Bhalerao Marg,  
Bombay-40004  
Price : Rs. 35/-  
pp : 408

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Reviewed by :  
Shri D.P. Upadhyay,  
Director,  
National Productivity Council,  
New Delhi

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Industrial Relations is a subject on which only a few good books are available and that too from Indian authors. The title under review is a welcome publication for one main reason that it contains references to a large number of cases to illustrate or substantiate various points discussed in the area of legal framework.

As indicated by the title itself,

the author has divided the book in two parts: Conceptual framework and legal framework. The conceptual framework includes the basic concepts, systems, theories and contributions to the literature of industrial relations besides key areas like grievance handling, discipline, role of the trade unions, wages, collective bargaining, workers participation in management etc.

The legal framework covers such topics as labour and the Constitution, constitutional writs and appeals, disciplinary proceedings, Industrial Disputes Act 1947, Prevention of Unfair Labour Practices Act 1971 etc. The recent amendments in these laws have also been included in the book. In the second part on legal framework, particular emphasis has been given on case law pertaining to legislation on industrial relations.

In the first chapter which deals with philosophy of industrial relations, the author tries to define industrial relations with quotations from acknowledged experts and

mentions that there are four main parties actively involved in any industrial relations system i.e. the workers, the management, the organisation of workers and management and the state. While no one can dispute this statement, the recent thinking is that the society or the community is not any less active a party.

The social set-up and the public opinion also influence the industrial relations system in many ways. The strike of the textile workers of Bombay in recent past has proved beyond doubts the influence of these factors. Both the interest of public in these matters or their apathy have their influence on industrial relations system. The author should have touched this dimension also to make the conceptual framework more comprehensive. There is some reference to environmental factors but this is incidental and without elaboration.

The second chapter deals with the evolution of industrial relations in India and in some other countries particularly USA, UK, Japan &

West Germany. This discussion is more in the nature of providing certain information without any context of the influence of other systems particularly of UK. This would have enhanced the value of this chapter.

Another suggestion which the author may consider for its future edition is about inclusion of a chapter on implementational/operational problems of labour laws in India. The laws so far as their objectives and scope are concerned are quite progressive but several types of distortions take place due to slackness of the implementing agencies. Sound industrial relations cannot be prompted by mere enactment of laws or pious statements but through their proper implementation. Any discussion on industrial relations will be incomplete without adequate discussion about the implementation of these laws.

It is not possible to refer to all the chapters in this review. The author deserves compliments for clear exposition of topics, analytical approach and for providing relevant information rather than compilation of too many details. The focus as such is sharp. The book will certainly be of value and interest to academicians, students and practitioners in the area of industrial relations.

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### **Financial Management of Public Enterprises**

S.S. Sahay

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**Published by :**  
S. Chand & Co. Ltd., New Delhi)  
1985  
Rs. 75/-  
PP 216.

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**Reviewed by :**  
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The public enterprises in Indian economy have come to stay and make a significant contribution in every economic and social activity and study relating to any of their aspects is a welcome contribution to the existing literature on public enterprises. The present study of Financial Management of public Enterprises by S.S. Sahay is a good attempt in that direction, particularly on public enterprise at a state government level. The public enterprises as an instrument of growth, according to the study, are to be regarded as a necessary commitment of economic planning adopted by developing countries, and as the vehicle of economic development and social change.

The study, an abridged and updated version of the author's doctoral thesis, tests and hypothesis that one of the reasons why public enterprises have not proved to be financially viable is their poor financial management and thus analyses in depth the various aspects of financial management to identify the weak spots and to suggest possible remedies.

The study is restricted to six public enterprises of Bihar involving an investment of Rs. 400/-

crore which accounts for about 92 per cent of the total investment of the government in the state enterprises. The study pertains to the years 1970-71 to 1975-76 and is divided into seven chapters. Each chapter is devoted to certain aspects of financial management including organisational structure and operations performance; capitalisation and return on investment; sources of funds; working capital management; budgeting, accounting, financial reporting. Findings of the study are given in the last chapter.

The suitability of public corporation or a company form of organisation structure for public enterprises depends largely on the extent of autonomy and flexibility extended, and that organisational structure and management set up of public enterprises are hardly conducive to their efficient working. The various aspects of financial management affecting performance covered in the study are capitalisation and capital structure; long-term financing; short term financing; budgeting and financial control system.

The study advocates that the principles of financial management applicable to private sector are also applicable to public enterprises which are no longer extension of government functions like post and telegraph, irrigation, electricity, etc. and analyses the performance of public enterprises in view of these principles. The capital structure of most of the public enterprises studied is found to be 'unbalanced and far from satisfactory' and 'the availability of funds rather than the

necessity of an enterprise seems to decide the amount of investment.' No doubt, the public enterprises prepare financial statements like balance sheet and profit and loss account, the accounting system adopted lacks consistency and uniformity, and it is suggested that the account sections be strengthened and named by professional accountants.

However, the six public sector enterprises selected for detailed analysis were originally run as departmental undertakings and were converted into either joint stock companies or statutory corporations and are either a public utility concern or a service organisation. This raises a question: how far these organisations can run more on social considerations than on commercial lines and the principles of financial management prevalent in private sector can be applied to them?

The study, in general is lucid and well drafted but it slaps at a number of places. For example, the statement (on page 85) that poor managerial efficiency and weak financial management are stated to be factors responsible for the poor performance of the enterprise lacks rational explanation and justification. Similarly, the statements (on page 58) if ordinary or equity shares cannot be marketed satisfactorily, preference shares are the next choice, and (on page 7) 'the public enterprises not only did not yield even normal return on their capital investment' are made without looking into the prevalence of preference shares in Indian

Capital Market and without the defining the term 'normal return. Lastly, the well known accounting principles and techniques like performance budgeting and accrual as a basis of accounting, do not find sufficient justification in the study, particularly, when these are the kingpin for any control mechanism.

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**Road Passenger Transport in India**  
Dr. P.G. Patankar

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Published by:  
Central Institute of Road Transport,  
(Training and Research),  
Pune 411 026  
Ed : 1984  
Price :Rs.80.00  
PP : 226

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Reviewed by:  
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It is said that culture grows in the hut of a peasant whereas civilisations prosper and blossom in cities. Problems of road passenger transport which form the backbone of passenger mobility system have been placed in a proper framework in the realm of rural and urban transport. Tracing the reasons for added impetus given to development of Railways at the cost of Road Industry, the author has rightly attributed it primarily to the legacy of the British colonial philosophy. The result has been mushrooming

growth of urban areas at the cost of rural areas. The author has also been equally candid enough to state that the policies adopted by the Government are characterised by lack of appreciation of the role of road transport industry in the developmental process and its tremendous potential for integration. The importance of development of roads in the rural areas has been repeatedly stressed. A case has been developed for self-sufficient communities living close together connected by strong transport links between rural and urban areas.

Equally appealing has been the author's grasp of the communication gap between the management and workers in the transport industry. It has been rightly stated that bossism is not to be practised, aloofness is not the answer, 'Book of Rules' is not the solution; but it is the ability to reach hearts of workers that can achieve productivity.

The operational efficiency and financial performance of State Road Transport corporations has been evaluated on the basis of data furnished by various undertakings and meaningful conclusions have been drawn which can prove quite handy to the management and policy makers. The issue of materials management has been dealt with dexterity.

An overview of various other aspects associated with passenger transport has been presented and the book as such will prove quite useful for students and teachers alike as also for serious readers of transportation studies.

### The Cotton Mill Industry in India

D. U. Sastry

(Institute of Economic Growth Studies in  
Economic Development and Planning: No  
34 General Editor: P.C. Joshi)

Published by  
Oxford University Press, Delhi  
1984  
Price: Rs 75.00  
pp: 134

Reviewed:  
Lt. Col C. C. Bakshi (Retd.)  
Advisor, Management Services,  
Placon Services Private Limited  
New Delhi.

The cotton mill industry has been amongst the most predominant industrial sectors in India, accounting for over 16% of the labour employment. The book could not have been published at a more opportune time when the cotton

textile industry is at cross roads. Demand recession, technological obsolescence and emergence of synthetic and blended fabrics have compelled the industry to have a hardlook at itself, as never before in its relatively long history.

The book has been organised into eight chapters, scanning various aspects like structure and growth, productivity and capacity, utilisation, demand, production function, and a treatise on Governments Textile Policy and its implications. The book examines the problem of capacity and capital estimation and thereby evolves capital surrogates. Productivity has been examined for Maharashtra, Gujarat as one focus, and Tamil Nadu as another.

Amongst the important findings, the author feels that one of the key reasons for demand stagnation and infact decline of per capita cloth consumption has been the slow rate

of agri-output and relatively steep rise in food prices.

The key factors indentified by the author influencing capacity utilisation are insufficient supply of raw cotton and yarn rather than demand. There has been a secular reduction of capacity utilisation for both spinning and weaving. The study ends on an optimistic note. Seen as an important contributor to the economy, productivity is anticipated to increase after the weak and marginal units will cease to function. Even moderete price stability and growth prospects of the economy, it is claimed, could result in growth of the industry.

The book has been written with fairly indepth analysis, taking recourse to quantitative analysis as well as qualitative commentry. Planners and serious researchers would certainly find it a very useful document.

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## on

# Project Management

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S. N. VIG

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| 1. Place of Publication   | : | New Delhi  |
| 2. Periodicity  | : | Quarterly  |
| 3. Printer & Publisher  | : | A.C. BHUTANI   |
| 4. Whether Citizen of India   | : | Yes  |
|   |   | National Productivity Council<br>'Utpadakta Bhavan'<br>Lodi Road, New Delhi-110 003    |
| 5. Editor   | : | D.P. UPADHYAY  |
| Whether citizen of India  |   | Yes  |
| Address   |   | National Productivity Council<br>'Utpadakta Bhavan'<br>Lodi Road, New Delhi-110 003    |
| 6. Name and Address of individuals<br>who own the Newspaper and<br>partners or shareholders holding<br>more than one per cent of the<br>total capital | : | National Productivity Council<br>'Utpadakta Bhavan'<br>Lodi Road,<br>New Delhi-110 003 |

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