

Commitment, Cognitive Appraisal & Occupational Stress

Amitava Chatterjee

With growing complexities in technological and human domains, occupational stress has become a costly problem for both the organizations and individuals. While the list of causes for work-related stress is a long one, stressors are not necessarily 'out there'. Stress involves the operation of several cognitive factors. Perhaps the most central of these is the individual's cognitive appraisal of the situation or potential stressor. Recent evidences suggest that through proper socialization in work settings and work environment, the individual's commitment and self-control can be strengthened as two most important potence for resistance to stress.

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Stress in modern times is an all too common part of everyday life, something which few can avoid. To many persons, stress is an experienced state of emotional nature accompanied by high levels of arousal. However, experts on the subject view it as a response to homeostatic imbalance which may be both physiological or psychological in nature with the predominance of one or the other.

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The evolution of human civilization shows that on the material plane, progress has been achieved at a breathtaking pace in the last few decades. On the cognitive plane, humankind has evolved from a state of natural balance of mind-body components, through a mind dominated period and in the present day there is an attempt to turn back to mind-body unit. With growing knowledge about matter and energy, the balance between mind and body gradually shifted in favour of mind dominance, the products of mind (technology) advanced, often unchecked. Modern human being has almost become the slave of machines. The rapidity of the seemingly endless changes overwhelm us to the point of producing shock reactions to our systems (Toffler, 1970). It has, nonetheless, to be realized that "mind, life and body become merely an instrumentation for increasing the self in the world, instruments not equal in their hierarchy, but equal in their necessity to the whole, so that their complete perfection and harmony and unity as elements of our self-expression become essential to the true aim of our living" (Aurobindo, 1985).

The General Adaptation Syndrome

Growing evidence suggests that high levels of stress affect physical health, psychological well-being and all aspects of human behaviour. According to Selye (1976), the physiological aspects of stress can be conceptualized as a syndrome, that is, stress is more than a response to an adverse stimulus. The same patterns of physiological processes occur in response to a wide variety of stimuli (Frese, 1985). Selye (1976) has described this reaction as a three-stage General Adaptation Syndrome. The three stages are: i) alarm reaction, ii) resistance and iii) exhaustion.

An optimum amount of arousal is accompanied by increased effort in more focussed direction.

When faced with any threat to safety or well-being, the individual experiences an immediate and vigorous alarm reaction. At this stage, arousal rises to high levels and generalized changes that prepare our bodies for strenuous activity take place, but with no specific organ system being affected. This initial reaction is followed by the second stage, that of resistance. Here activation level remains relatively high but is channelised to specific organ system or process most capable of dealing with it or suppressing it. Adaptation energy is limited and if stress persists, the final stage known as exhaustion occurs. At this point, the organ system or the coping process drops to low levels and may cause severe biological damage with continuing stress.

Accepting stress as an inevitable part of everyday life, Hinkle (1973) observes "to be alive is to be under stress", though excessive and persistent stress is harmful, affecting various aspects of human life and behaviour. An optimum amount of arousal is accompanied by increased efforts in more focussed direction. Since stress accelerates arousal, a little amount of stress may be of help to the individual for adaptation to the changing environmental demands (Selye, 1956). Stress at the optimum level has a functional value (Frankenhaeuser & Johnson, 1986; Petonjee, 1987) and motivational source for the employee (Bernard, 1963).

Stress : Some Major Effects

It is now established that stress stems from many sources and it results *quid pro quo*, in important effects on the persons who experience it. According to empirical evidences, stress acts as a 'silent killer'. The built-in physico-chemical systems of the human body, facilitate adaptive reactions to adverse environmental demands. But research evidence has shown that frequent or long-term mobilisation of such adaptive reactions may lead to the development of cardiovascular disease (Karasek, Russell & Theorell, 1982), peptic ulcers and high blood pressure.

The precise mechanism involved in stress-induced effects on human organism is not yet very clear, but a good conceptual understanding is that: any organic disease may have a somatogenic psychosomatic component, depending, of course, on the psychological make-up of the individual (Dubos, 1965). The bodily resources are depleted under stress and physiological homeostasis is lost. Thus stress lowers the body's resistance or immune system. In somatogenic psychosomatic disease, being infected or being otherwise affected is not critical in determining the course of illness; rather it is the body's immune system which defends itself against the degenerative processes in everyday life.

Increment of stress upto an optimum level is energizing and may lead to improved performance. Beyond a certain point, however, continued stress is detrimental and interferes with performance.

From an organizational view point, we have to analyse the deleterious effect of stress on employee performance and health. It is generally assumed that for many tasks the relationship between stress and task performance is functional, so that increment of stress upto an optimum level is energizing and may lead to improved performance. Beyond a certain point, however, continued stress is detrimental and interferes with performance. The relationship between performance and stress as an arousal phenomenon is, thus, curvilinear. While this relationship may hold true under some conditions, growing evidences suggest that stress leads to negative effects on task performance. It is only reasonable to expect that impairments caused by job demands on physical and

psychological well-being will get reflected as stress effects on the behaviour and performance of employees (Cooper & Payne, 1978). The workers on the assembly line, characterized by highly rigorous machine control, displayed more psychosomatic disturbances such as disturbed sleep disorders, gastrointestinal problems and nervous symptoms (Johansson et al, 1978). Stress may result from conflicting or incompatible role expectations of the incumbent. Similarly quantitative or qualitative overload has been found to be strongly related to anxiety, tension and other job-related threats to person's mental health and physical well-being (French & Caplan, 1970; Rizzo et al., 1970).

The findings of field studies on stress and task performance relationship indicate that in real-life situation, performance is reduced even at a lower or moderate level of stress. It may sound contradictory to arousal hypothesis, but there are several reasons behind this. It has been observed that as arousal increases, performance may rise at first, but at some point begins to fall. The precise location of this optimum point depends to a great extent on the complexity of job demands. With the advancement of technology, complexities in job are increasing and greater the complexity the lower the level of arousal at which performance begins the downturn direction. Secondly, technological innovations change work places very quickly. Thus it may be too late before stress research has the chance to lead to a reduction of stressors in respective work places. Prolonged or repeated exposure even to mild stress may be injurious to health and this may interfere with effective performance. Finally relatively mild stress may act as detractor. Individuals experiencing it may develop unpleasant feelings and emotional negativism which interfere with the task at hand.

There are certain exceptions to the general rule of detrimental effect of stress on performance. When faced with a challenging task, individuals who are truly experts in the fields, notwithstanding high stress, seem to turn commendable performances. This may result from the fact that skill developed through training to a suitable degree and type may reduce and perhaps eliminate the adverse effects of stress. Knowledge gives courage and thus even high levels of stress are cognitively appraised by skilled persons as a challenge rather than threat. There is a widely-held commonsense belief that performance in skilled task declines under stress of fear implying that skill gives courage to override stress.

Considering the empirical evidences, the most reasonable conclusion regarding the stress effects on performance is that in many situations, stress interferes with task performance. However, the precise effect depends on other variables like the complexity of the job, performer's previous experience and skill in the job, frequency and time duration of the complexity.

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Antecedents to stress

The contingency approach to stress has primarily focussed on situational correlates of stress. It has been assumed that certain situations are beyond the coping capabilities of the individual facing it and thus stress-inherent. The role-related factors in organization have been identified as sources of stress. In the professional field which is rapidly developing, technologically, economically and socially, career progression is perhaps a stress inducing problem by its nature (Caplan et al, 1975). Lack of participation and its relationship with stress symptoms is also relevant here. French & Caplan (1970) report that those who reported greater participation in decision making were more satisfied with their jobs, had low job-related feeling of threat and had higher self-esteem. Some other antecedent variables identified are : job characteristics (Brief & Aldag, 1976); interpersonal relationships in work situation (Cooper & Marshall, 1978); social support (House, 1981) and so on.

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While work occupies about one-third of daily life to most people it is not the only activity. Most individuals have a non-work life as well. It is not surprising then, that stress generated by non-work life events persists and is carried to work settings and in the same way the work-related

stressors continue as hang-over outside the work place. Some 'Life Change Events' (Holmes & Rahe, 1967) and 'Events of Daily Life' (Lazarus et al., 1985) have been identified as stressors of non-work life situations.

Personality Causes of Stress

Every aspect of human behaviour has some personality components as its important determinants and so is it with stress. Stress is not simply "out there" in the environment, though it may originate there. Stress depends not only on external conditions, but also on the vulnerabilities and the coping style of the individual. Some persons remain at ease in the situation that seems stressful to others.

Individual differences in proneness to stress are more reflected in patterns of behaviour. Type A behaviour is characterised by high levels of achievement motivation, competitiveness, hostility, time urgency and polyphasic behaviour (Friedman & Rosenman, 1974). Persons who demonstrate Type A behaviour pattern seem to respond more strongly than others to various forms of stress. Research findings indicate that Type As pay a high price for their hard-driving, over-estimated life style in the form of a compromise with the integrity of the cardiovascular system.

Nearly everyone experiences some degree of tension and anxiety at one time or the other—this is a basic fact of life in modern society. However individuals differ to a great extent in terms of how they handle such feelings. Some people seem capable of being relieved as they move away from the anxiety generating situations, like the work place or in short as the stressor is removed. In contrast, others carry the heavy load of tension or anxiety, if once aroused, for quite long even after the stressor is gone. Obviously the latter group suffers from harmful effects of stress. Many individuals may suffer from hallucinatory experiences worse effects of the stressor event than what it really is. This personality type is highly prone to psychosomatic disorders. Anxious reaction reduction rate then is, indeed, an important personality determinant of stress in present day complex systems.

Cognitive Appraisal

Whether and to what extent a given situation induces stress among individuals depends upon their cognitive appraisals. Most of the stress experiences of the individual is a function of perception, the meanings and interpretations given to life situation. Not a mere perception of a

situation, stress depends upon how that is *cognised*. McGrath (1976) has suggested that the perception of objective environment is combined with the subject's 'interpretative-evaluative' process in significantly altering the stress level. The manner in which a life event is defined and interpreted is determined by "..... the psychological environment, which is, in turn, mediated by attributes of the person" (French & Kahn, 1962). The attributes of a person or personality, in general, are made up, *inter alia* of values, attitudes and past experiences.

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Perhaps the most ingrained and rigid element of personality is the value system. Value means 'the object of desire' and can generally be defined as 'that which is desired'. Indian thinkers (Hiriyanna, 1983) make an implicit distinction in the two aspects of value system—one which is internalized and seems to be the mission of the system (value), the other which is objectively external (fact) and helps in the attainment of some purpose (value) in life. Effort (fact) in performance is instrumental to the attainment of the intrinsic purpose, job commitment (value), of the individual. The controversy in logical structure notwithstanding, it is a ground reality that means and end are complementary to each other. Though the term value is primarily referred to the end, it includes the means as well. Value is both intrinsic and instrumental.

Values are learned. People are influenced by and tend to accept as their goals the values shared by members of their reference group. Action in standard behaviour events is also influenced by the values of the society. Values may be both positive and negative. The positive values are "desirables" and with growing interaction, the desirables tend to become "desired"—values become goals.

The Indian school of thought has given the foremost place to values. Broadly, human ideals are divided into four categories and those are supposed to be intrinsic sources of behaviour. The moral, social and individual behavioural values are derived from : *dharma* (moral action), *artha* (economic activity and statecraft), *kama* (subjective motives) and *moksha* (self-realization and liberation). The final ideal of *moksha* is too abstract to the common people and for everyday life purposes

connotation of 'value' is restricted to 'the aggregate three' or *tri-varga* including *dharma*, *artha* and *kama*. As motivational source of behaviour *artha* is an instrumental value, for it acts as a means for satisfying the various needs of life, *kama*, which is an intrinsic value. However all needs may not be desirable. *Dharma* which is considered the highest of the three (*trivarga*) furnishes the necessary criterion for discriminating between good and bad *kama* i.e., it provides the ethics of life and society.

Indian ethical standards of human behaviour are based on the four categories of values. In voluntary action, though the individual is expected to obey moral injunctions, perform sanctioned duties and simultaneously endeavour for spiritual realization, he is given freedom of will to act. A person is free to choose between alternative modes of action by deliberations and decisions. A voluntary action involves not only a desire to attain a foreseen objective, positive or negative, but also a belief that it is achievable by personal effort (Raju, 1983). According to modern psychology, the belief in one's capability to perform a specific task is termed 'self-efficacy' that concerns an important aspect of personality, self-concept.

Self-Evaluation: Self-Efficacy

In the perspective of learned values, a person evaluates self activities and gradually forms the self-concept—individual's conception of his own abilities, traits and skills. Self-efficacy is an important component of self-concept. Yet this is only a small portion of this concept. Individual's self-concept is perhaps the single most important factor in determining behaviour. As a part of this trait, generalized beliefs about one's self-efficacy remain stable and affect performance in a wide range of tasks. The higher the self-efficacy, the more difficult and challenging the goals chosen by individuals tend to be (Locke et al., 1984).

The direct feedback experiences of individuals of their success in various tasks and partly by experiences *ad surrgatum* in which they observe others performing various tasks and attaining varying levels of success at them influence the development of self-efficacy (Bandura, 1986). The converse of this development is true as well: a person encountering failures in wide ranging situations devalues himself, perceives himself as helpless and thus the probability of failure is enhanced.

Just as self-efficacy affects task performance, it can also affect stress response to a great extent. The greater the degree to which individuals perceive themselves of having control over the situation, the less severe their stress reactions. In other words, self-efficacy moderates

cognitive appraisal of the situation and individual differences in belief in one's ability are reflected in stress responses. Evidence pointing to this conclusion is provided in the following study.

The Study

A number of studies have been conducted to determine the psychological and organizational correlates of occupational stress. Leading experts, in recent years, have initiated investigations assessing the moderating effects of psychological variables on stress. The present study was aimed at finding out the relationship between organizational commitment and occupational stress and the intervening effect of self-efficacy on this relationship.

Organizational commitment reflects the extent to which an individual identifies and is involved with his or her organization (Mowday et al., 1979). Specifically a high degree of organizational commitment implies a person's desire to remain a member of the organization; his or her willingness to exert high effort in the task performance and a belief in the values and goals of the organization.

Commitment appears to affect several aspects of work behaviour. Organizational commitment, as an attitude variable is also linked to occupational stress. However, few investigations in the field have dealt with the causal linkage and the cause-effort relationship between the attitude variable such as commitment and the behavioural symptoms of stress reactions. In the present study, it is hypothesised that specifically the evaluation component of the attitude of commitment tends to selectively organize the individual's cognition of persons and things. The cognitive appraisal of the situation, thus plays an important role in personal stress and stress management. And cognitive appraisal being moderated by self-efficacy is reflected in the causation and extent of individual responses to stressful situation. The operating model is presented in Fig. 1.

The study was conducted on a sample of 300 technical personnel at the middle management level in a large heavy engineering industry. Homogeneity among the subjects with regard to their job demands was maintained as much as possible. There were some variations among the subjects in their personal demographic variables. But those were not wide enough to affect the results *a'dessein* with the present objective. The sample had also a specific feature related to the study. The middle level supervisors have to maintain group loyalties to two apparently opposing groups. On the one hand, they have to represent the management to workers, to implement the company

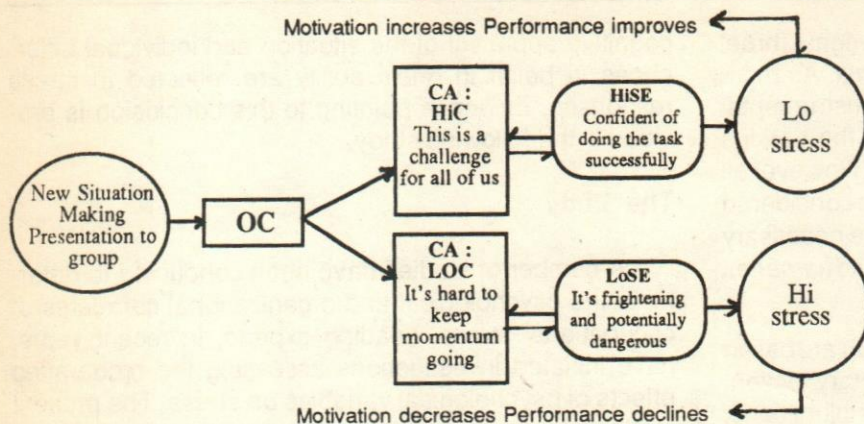


FIGURE 1 : COGNITIVE APPRAISALS AND STRESS

OC — ORGANISATIONAL COMMITMENT
 CA — COGNITIVE APPRAISAL : SE — SELF-EFFICACY
 Hi, Lo — PERSONS HIGH/LOW IN RESPECTIVE AREAS

policies and practices with and by the subordinates. And on the other they have to act as 'linking pins' between the primary group and the superiors above. This role differential seems to exert maximum stress on the personnel at the middle level.

The subject's occupational role stress, self-efficacy and organizational commitment were assessed through self-reporting inventories standardised on a sample similar to the operational one. The extent of individuals' role stress was determined by a five point scale on 'Occupational Role Stress Scale' (Pareek, 1981) and comprised 50 items. The re-test reliability index was .77. A self-efficacy scale consisting of 10 items was constructed to assess the individual's beliefs in own ability for task performance and self control. Each item of the scale included five alternative responses that indicated self-efficacy from very high to very low. The reliability index of the scale was .69 ($\sigma = 2.33$). Subject's commitment to the organization was measured by a 15-item Organizational Commitment Questionnaire prepared by Mowday et al, (1979). The calculated reliability index was .86 ($\sigma = 3.82$).

The negative coefficient of correlation (r) of $-.374$ ($p < .05$) indicated significant relationship between occupational stress and organizational commitment. The stress scores for high ($n = 152$) and low ($n = 148$) self-efficacy groups were 132.3 ($\sigma = 17.1$) and 180.6 ($\sigma = 15.2$) respectively. The F-ratio on analysis of variance was $F_{2/298} = 107.625$ ($p < .01$). The high (Hi C) - and Low (Lo C) - commitment groups differed significantly with regard to role stress and self-efficacy. The Hi C group ($N = 123$) perceived more occupational stress ($M = 154.5, \sigma = 19.00$) than the Lo C group ($n = 177, M = 136.7, \sigma = 23.8$). The

stress differential ($t = 15.9$) was significant ($p < .01$). The Hi C group scored higher on the measure of self-efficacy ($M = 42.45, \sigma = 6.4$) than the Lo C group ($M = 17.9, \sigma = 6.1; t = 10.9, p < .01$).

The moderated regression analysis results (Saunders, 1956; Zadeck, 1971) done to ascertain the moderating effect of self-efficacy are presented in Table 1. For this purpose, self-efficacy was used in two related multi regression analysis. In the primary analysis, occupational commitment scores were regressed on stress and self-efficacy scores to form independent predictor. The second regression analysis was a three variable approach using independent predictor model and adding to the

basic equation the interaction of occupational commitment and self-efficacy as the moderating component. F-ratios indicate the significant effect of independent predictor and moderated regression.

TABLE 1. Moderated Multiple Regression Analysis for High and Low Self-Efficacy Groups.

| Self-Efficacy | Organizational stress | | | | |
|----------------------------|-----------------------|----------------|--------|-------|-----|
| | R | R ² | F | df | p |
| High | | | | | |
| Organizational Commitment | .349 | .140 | 60.77 | 1/298 | .01 |
| Commitment, Self-efficacy | .371 | .160 | 97.54 | 2/297 | .01 |
| Commitment x Self-efficacy | .383 | .190 | 104.18 | 3/296 | .01 |
| Low | | | | | |
| Organizational Commitment | .253 | .121 | 0.98 | 1/298 | |
| Commitment, Self-efficacy | .264 | .137 | 89.96 | 2/297 | .05 |
| Commitment x Self-efficacy | .310 | .159 | 58.46 | 3/296 | .05 |

It is observed that the use of self-efficacy markedly altered the relationships between perceived occupational stress and organizational commitment. The addition of the interaction effect of commitment and self-efficacy led to a noticeable increase in variances of stress for both high and low self-efficacy groups.

Since the multiple regression analysis does not specify the direction of interactional effects of two categories of self-efficacy, correlations for the two categories were obtained. Pearson correlation coefficients between occupational stress and commitment for high and low self-efficacy groups were .48 and .26 respectively. The comparison of the two coefficients yielded a significant

difference ($CR = 2.64, p < .01$). The result leads to the conclusion that high organizational commitment coupled with identical self-efficacy attenuates the effects of occupational stress and the low commitment—self-efficacy group have converse effects on stress of the focal employees.

High organizational commitment coupled with identical self-efficacy attenuates the effects of occupational stress.

Conclusion

In the pioneering work on stress by Selye (1956), the stressors included were physical and physiological and the reactions studied were bodily reactions. Behavioural consequences were not emphasised though in his later discussions (Selye, 1976), he mentioned some of them. Very soon, however, the study of stress expanded its boundaries and moved to psychosocial arena. The concept of stressor was extended to include psychological factors like frustration, conflict, deprivations and threat to and/or lack of self-esteem and security. Reactions to these stressors, of course, included effective and cognitive processes and coping, personal efforts to adapt to stress, grew in importance.

Apart from certain personality characteristics, studies of stress have suggested that individuals perceive different degrees of threat in potentially stress-prone situations. When the individual perceives the situation as threatening, its stressfulness is greater if the threat appears to be one that cannot be controlled. In short, stress occurs where the individuals appraise the situation, rightly or wrongly, as overwhelmingly exceeding their personal resources (McGrath, 1976). Organizational commitment however, as an attitudinal measure, precedes the individual's cognitive selectivity (Bentler & Speckart, 1979) and intrinsically plays its primal role in the cause-effect relationships between cognition and stress. This sequence of variables suggests that preventive measure at the attitudinal level is most effective for occupational stresses.

An attitude, which is again closely related to a value that is basic to the individual, acts in a congruent manner. In the context of occupational stress self-efficacy is such a belief that plays its role along with commitment.

Self-efficacy helps persons in their coping behaviour. Actually self-efficacy distinguishes stress-resistant people from those who are more susceptible to the harmful effects of stress. It helps in developing higher levels of commitment and deeper involvement in jobs and other life activities. Persons with high self-efficacy show higher levels of self-control—the belief that they can, in fact, influence the environment of their work activities and the outcomes from that end.

Writers on occupational socialization (Frese, 1982) propose that work is a fundamental condition of socialization. Norms and values are obtained, qualifications and competences are acquired. Therefore the harmful effects of occupational stress may be attenuated by fostering growth in commitment and self-efficacy of individuals by value-oriented socialization in work activities and work environment.

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WHAT IS A CUSTOMER?

A Customer is the most important person ever in this office ... in person or by mail.

A Customer is not dependent on us ... we are dependent on him.

A Customer is not an interruption of our work ... he is the purpose of it. We are not doing a favour by serving him ... he is doing us a favor by giving us the opportunity to do so.

A Customer is not someone to argue or match wits with. Nobody ever won an argument with a Customer.

A customer is not someone to argue or match wits. It is our job to handle them profitably to him and to ourselves.

(A poster that is prominently displayed all around L.L. Bean, in Freeport, Maine)

Stress Audit : Diagnostics & Action at Micro-Level HRM

D. M. Pestonjee & Nina Muncherji

The consequences of stress in the work place are manifold and merit careful consideration. In addition to the repercussions on personal health, there is loss of productivity and damage caused by illegal behaviour due to stress. Hence the methods of auditing stress assume importance. The authors present the diagnostics and treatment of stress at micro level human resource management.

Stress in the work place is receiving increasing attention in management literature because of its theoretical significance in the study of performance and effectiveness as well as its practical relevance to management development and training. The consequences of stress are manifold and merit careful consideration if stress has to be managed in such a way as to enhance positive outcomes and minimise negative results. There are personal consequences that members experience due to stress resulting in "burnout", coronary heart disease and other forms of psychological and physical damage.

For the individual, stress means 'suffering'—short-term discomfort and unhappiness with the possibility of long-term disease. There is a substantial body of occupational health literature which documents those effects of relevance in the work place—*anxiety, inability to concentrate, irritability, minor physical ailments etc.* If an individual is affected, there must be repercussions for his or her family. When one family member is showing symptoms of stress, this can seriously disrupt the whole pattern of family relationships. A British study depicts the wife as an indirect sufferer of stress effects. (Marshall & Cooper, 1979.)

An optimum degree of stress may result in increased motivation, involvement and commitment to the job and organisation. Using "time of work" as the unit of measurement, we find that stress costs the economy substantially more than industrial injury and strikes. There are other less evident costs of stress to the employer : high labour turnover rates, low staff morale, poor job satisfaction of

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employees resulting in absenteeism, sabotage and alienation which increase the organisation's costs whilst reducing its efficiency. At a macro-level, American writers have tried to calculate the cost of stress to the national economy. They include in their account such items as loss of production, treatment, prevention and damage done by illegal behaviour.

Stress : A Brief History of the Term

'Stress' was used popularly in the 17th century to mean : 'hardship, straits, adversity or affliction'. Only during the 18th and 19th centuries did its use evolve to denote force, pressure, strain or strong effort ; with reference now also to objects but still primarily to a person or a person's organs or mental powers'. (Hinkle, 1973). These connotations of an external being resisted by the person/object, which it sought to distort and disrupt, were taken up when the term gained currency in engineering and physics and have subsequently been passed on to social scientists.

The idea that 'stress and strain' contribute to long-term ill health, rather than merely short-term discomfort, can be found early in the concept's development. According to Selye (1956), the body reacts to any stress in three stages which he describes as the "General Adaptation Syndrome" (GAS). The three stages are ;

1. *Stage of Alarm Reaction* : The first stage includes an initial "shock phase" in which the defensive mechanism becomes active. There is confusion, disorientation and distortion of realities and resistance is down.
2. *Stage of Resistance* : Maximum adaptation occurs in this stage; the signs include fatigue, anxiety, tenseness and irritability. If the stressor persists, or the defensive reaction proves ineffective, the organism deteriorates to the next stage.
3. *Stage of Exhaustion* : Adaptation energy is exhausted, signs of alarm reactions reappear, and resistance level begins to decline irreversibly. The organism collapses.

The first major shortcoming of the theory, according to Pestonjee (1987), is that it has evolved out of researches carried out on infra-human subjects. In such experiments, the stressors are usually physical or environmental,

whereas the human organism is not always afflicted by such stressors. Secondly, Selye's work on stress depends on the existence of a non-specific physiological response. But as noted by researchers, there are certain stimuli, for example, exercise, fasting, and heat, which do not produce non-specific response and hence, General Adaptation Syndrome does not occur. Thirdly, intra-psychoic or social (interpersonal/interactional) factors emerge as major stressors in human beings. These have not been given their due place in this approach. And lastly, the reactions of infra-human subjects are more direct, perceptible, and (hence) easily measurable whereas in human beings, responses are always mediated through several layers of cultural and social filters.

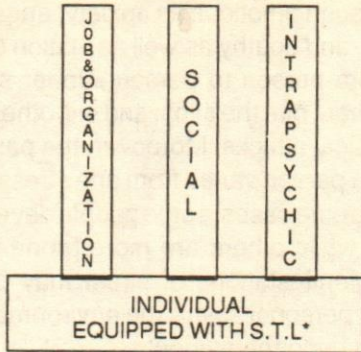
Stress costs the economy substantially more than industrial injury and strikes.

Pestonjee (1984) attempted to diagrammatically present the nature and consequences of the stress phenomenon. He identified three important sectors of life in which stress originated—Job and Organisation, Social Sector, and Intra-psychoic Sector. The first, namely job and organisation refers to the totality of the work environment (task atmosphere, colleagues, compensations, policies etc). The social sector refers to the social/cultural environment of one's life. It might include religion, caste, language, dress, food habits and such other factors. The intra-psychoic sector encompasses those things which are intimate, personal, and specific to the individual like temperament, values, abilities and health. It is contended that stresses can originate in any of these three sectors or in combinations there of.

In a balanced state, the magnitude of stress emanating from the three sectors of life is in consonance with the stress tolerance limit of the individual.

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STRESSORS OR LOADS



ORGANIZATION-INDIVIDUAL
NORMAL INTERACTION PATTERN

* STRESS TOLERANCE LIMIT
SOURCE : PESTONJEE (1983)

In the last ten or fifteen years, there has been a determined effort by social scientists to consider systematically the sources of management and organisational stress (Cooper & Marshall, 1976.) It appears that stress is not a characteristic of either environment or individual but is the outcome of the interaction of two. Lazarus (1971) has emphasised that it is a person's perception of a situation, his 'cognitive appraisal', which defines it as stressful. Seven major categories of stress can be identified—six external and one internal to the manager concerned. Figure 1 is a diagrammatic representation of the same.

Work and Non-Work Life

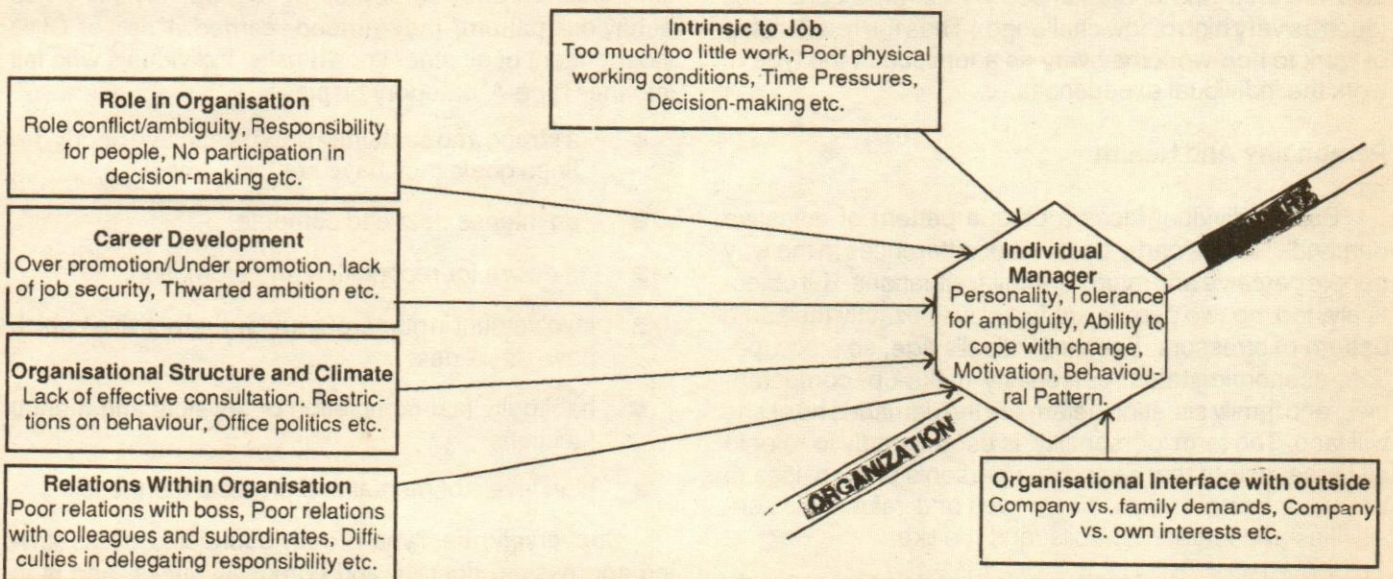
Work is a social phenomenon that must be understood

in the context of social institutions and structures. The conditions which influence human work are not only social and historical, but also individual and personal. Work is conceived of as an instrumental activity, performed in order to procure the necessities of existence, no matter how broadly the term "necessities" is construed.

Since early writings of Adam Smith, work has been thought to have an influence of life outside of work. Regardless of the direction of influence, non-work experiences may be important descriptors of the milieu in which job-related responses such as absenteeism and satisfaction occur.

In studies, two models are used to describe the relationship of work to non-work : the spillover model and the compensatory model (Wilensky, 1960). The spillover model suggests that experiences characterizing work will be positively related to non-work experiences. Individuals who have unenriched jobs (e.g. those jobs low on variety, interpersonal relations and decision making) will have similar non-work experiences if the spillover model is supported.

Work is a social phenomenon that must be understood in the context of social institutions and structures.



Source : Lazarus (1971)

FIG. 1 SOURCE OF MANAGERIAL STRESS

Staines (1977), Champoux (1976), Rousseau (1978), Near, Rice and Hunt (1980), and Kahn (1981) have reviewed literature showing that affective experiences at work are indeed related to affective outcomes outside work, that is, there is a spillover of organisation based experiences into the extra-organisational lives of employees.

Individuals who have unenriched jobs (e.g. those jobs low on variety, interpersonal relations and decision making) will have similar non-work experiences if the spillover model is supported.

The compensatory model, on the other hand, holds that there is a negative relationship between work and non-work. Thus, individuals who have routine, socially isolated jobs with little autonomy will have varied and challenging activities with a high degree of social interaction. In general, the spillover model appears to be more strongly supported.

Support for the spillover model comes from research in diverse occupations such as logging (Meissner, 1971), manufacturing (Kornhauser, 1965) etc. The compensatory model is supported by studies of individuals in stressful occupations such as coal mining (Dennis, Henriques & Slaughter, 1956) and fishing (Tunstall, 1962). Studies supporting the spillover model tend to have a range of jobs varying in content, while those supporting the compensatory model have been based largely on jobs with undesirable features and characterized by extreme conditions (such as very high or low challenge.) Thus the relationship of work to non-work may vary as a function of the type of work the individual experiences.

Personality And Health

Each individual faces a unique pattern of adjustive demands. This is partly because of differences in the way people perceive and interpret similar situations. But objectively, too, no two people are faced with exactly the same pattern of stressors. Each individual's age, sex, occupation, economic status, personality make-up, competencies, and family situation determine the demands he or she will face. The term 'personality' is used broadly to refer to all those factors that describe a person's propensities to behave in certain ways, his motives and values, his sensitivities and fears, his habits, and the like.

Just as individuals differ in the conditions which produce strain for them, there are individual differences in the

experiences and expression of strain. Propensities for experiencing such emotions as anxiety, anger, guilt, self-hatred, futility, and apathy as well as elation and satisfaction, differ from person to person. Under stress, some people cry, others bite their lips, and still others lash out in verbal or physical attacks. Moreover, the particular reaction for a given person varies from one stress condition to another. In extreme cases, some people develop ulcers or heart attacks while others are more prone to psychotic breakdown. Manifestations of strain may be as highly individual and personal as are the environmental circumstances which bring them about.

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As occupations vary in the stress-related health risks they carry, it is now accepted that individuals similarly differ in their proneness to stress-related health risks. As early as 1868, a German doctor, Von Dusch, noted that people who developed coronary heart disease (CHD) were often excessively involved in their work.

In 1959, Friedman and Roseman made their most controversial contribution to the understanding of the relationship between stress and heart disease. They operationalised a behavioural pattern termed 'Type-A'. This behaviour pattern, they argued, carried a risk of CHD independent of all other known risks. Individuals who fall into the 'Type-A' category display :

- a strong and sustained drive to achieve poorly defined goals they have set for themselves.
- an intense desire to compete.
- a desire for recognition and promotion.
- involvement in numerous and varied activities which have deadlines.
- habitually fast completion of physical and mental functions.
- high levels of mental and physical alertness.

Conversely, the 'Type-B' individual displays striving aggression, hostility and competitiveness, is in general more relaxed.

Stress Audit

When an organisation decides to have a scientific peep into the mental-cum-physical health status of its backbone group (executives), it is called a Stress Audit. Stress audit refers to the attempt organisations make to study, explore, and to control the various types of stresses which the individual executives experience by virtue of their organisational membership.

In setting up a stress audit in an organisation, a distinction can be made among three categories of variables : causal stress variables (the stressors), mediating variables (the effect of personality, culture and contemporary non-work environment) and end result variables (the stress reactions). The data needed for the stress audit can be collected with the aid of questionnaires, clinical diagnostic interviews and if possible, physical examination. Stress audit helps to identify the organisational stressors as well as the interpersonal variables and career variables causing stress.

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Organisational Stressors

Organisational membership is a dominant source of stress. The concept of organisational stress was first evolved in the classic work of Kahn et al (1964). They were the earliest to draw attention to organisational stress in general and role stress in particular. Pareek (1983) pioneered work on role stress by identifying as many as ten different types of organisational role stresses. They are :

1. *Inter-role Distance Stress (IRD)* is experienced when there is a conflict between organisational and non-organisational roles. For example, the role of an executive versus the role of a husband.
2. *Role Stagnation (RS)* : This kind of stress is the result of a gap between demand to outgrow his previous role and to occupy the new role effectively. It is the feeling of being stuck in the same role. Such a type of stress results in the perception that there is no opportunity for one's career progression.

3. *Role Expectation Conflict (REC)* : This type of stress is generated by different expectations by different significant persons about the same role; and the role occupant is ambivalent as to whom to please.
4. *Role Erosion (RE)* : This type of role stress is the function of the role occupant's feelings that functions which should properly be belonging to his role are transferred to/or performed by some other role. This can also happen when the functions are performed by the role occupant but the credit for them goes to some one else.
5. *Role Overload (RO)* : When the role occupant feels that there are too many expectations from the significant roles in his role set, he experiences role overload. There are two aspects of this stress, quantitative and qualitative. The former refers to having too much to do, while latter refers to too difficult.
6. *Role Stagnation (RI)* : This type of role stress refers to the psychological distance between the occupant's role and other roles in the same role set. It is also defined as role distance which is different from inter-role distance, in the sense that IRD refers to the distance among various roles occupied by the same individual, role isolation is characterised by the feeling that others do not reach out easily, indicative of the absence of strong linkages of one's role with other roles.
7. *Personal Inadequacy (PI)* : This type of stress arises when the role occupant feels that he does not have the necessary skills and training for effectively performing the functions expected from his role. This happens when the organisations do not impart periodic training to enable the employees to cope with the fast changes both within and outside the organisation.
8. *Self-Role Distance (SRD)* : When the role a person occupies goes against his self-concept, then he feels self-role distance type of stress. This is essentially a conflict arising out of mismatch between the person and his job.
9. *Role Ambiguity (RA)* : It refers to the lack of clarity about the expectations of role which may arise out of lack of information or understanding. It may exist in relation to activities, responsibilities, personal

styles, and norms and may operate at three stages :

- (a) When the role sender holds his expectations about the role
 - (b) When he sends it, and
 - (c) When the occupant receives those expectations.
10. *Resource Inadequacy (RI_n)* : This type of stress is evident when the role occupant feels that he is not provided with adequate resources for performing the functions expected from his role.

Organisations have for almost a century now paid due attention to maintenance, creation and updating of technology. In the past machines were better cared for than men. A stage has now been reached when the significance of human resources should be recognised for productive and healthy functioning of the organisation.

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Interpersonal Variables

Interpersonal variables such as leadership styles, group cohesion and participation can be measured by various methods such as interviews, questionnaires etc. Similarly stresses experienced by an individual at entry level in an organisation, mid-career and retirement can be discovered by stress audit and steps taken accordingly to eliminate the stress or reduce it. Employees under stress should be provided psychological support by their superiors to cope with stress and improve upon their job performance. Employees could be rotated out of potentially stressing positions and not allowed to over-work even on critical issues. They should be encouraged to express their views freely and their contributions should be recognised. Training programmes should be organised for awareness of ways and modes of overcoming stress and also for updating knowledge and skills of the employees to face the challenges brought about by the fast changing technological milieu.

Stress Audit as a Special Manifestation of HRM

Contemporary writings on HRD and HRM focus mainly on the role of individuals in organisations while the employees at a personal level are generally overlooked. Realisation about the significance of the health of the individual

Employees under stress should be provided psychological support by their superiors to cope with stress and improve upon their job performance.

executives is slowly emerging . The following are certain key organisational issues which relate to health and how HRD systems can help in redeeming the same.

Performance Appraisal is one of the most important sources of stress in organisations. Being evaluated by superiors is a highly stressful experience for many persons.

Career Paths is another HRD variable which is linked to stress. As individuals move through various stages of their careers, they are also moving from one stage of life to another. The sequence of occupations and jobs that individuals hold during their working life constitutes their careers.

Crucial points in career planning occur at key times during the individual's life—at about age thirty, during the early forties, and again in the late fifties. Each career stage is characterised by different issues and problems.

The twenties are a time of getting started and choosing a career; by the thirties one gets a fairly clear idea about talents and abilities. These self-perceptions guide and stabilise a person's career in choosing jobs and goals that are consistent with his basic characteristics. As one nears forty, one discovers that he has reached a career plateau, besides there is also competition from the horde of ambitious, energetic and better trained (technically) younger lot. In the late fifties, new sets of problems arise. This is the stage when the individual has to face the fact that his power and influence within the organisation is beginning to fade. The most important issue is coming to terms with his own retirement.

HRD systems and processes should help reduce these stresses. HRD departments should establish 'career management programmes' to help employees cope with such problems and plan effectively for the development of their careers.

These programmes vary greatly in scope and content, but most of them involve efforts to (1) help employees assess their own career strengths, (2) set priorities and specific career goals, (3) provide information on various career options and alternatives within the organisation, and (4) offer employees yearly reviews of their progress towards these goals by managers. In addition special

workshops and technical training opportunities are often part of such programmes. OD interventions such as job enrichment, job design, role efficacy workshops/labs etc. could also be used to reduce stresses experienced by individuals in organisations and improve work performance and lead to job satisfaction.

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Advantages of Stress Audit

Stress audit can be used as an organisational development (OD) technique. It provides valuable insights into the functioning of various units and departments : their policies, practices and climates. These data can then be utilised for planning other OD interventions. A stress audit, even on a limited scale, makes the people receptive to other OD interventions and changes. Besides, the stress audit being a 'person based' intervention, people tend to look at it as a demonstrated concern which organisations have for the individual executive.

Sharing the stresses in an open-feedback session has the added advantage of making everybody realise that it is not uncommon to have stresses and also given the same organisational environment people show diversity in reactions, both functional and dysfunctional. Besides these, structural imbalances within the organisation are revealed and can be rectified. Conflicts and flashpoints also come to the fore making it easier for the management to deal with them. Stress audit also helps in exposing the unproductive practices in the organisation. It also helps in identification of problem executives as well as the problems of executives.

Stress-audit is not merely a theoretical postulate of HRM. Today, several organisations have utilised it as a strategy to overcome problems experienced by individual managers in their organisational and non-organisational roles. It has fairly high utility as a diagnostic technique and also for individual - specific development which can be further extended as an organisation development action strategy.

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Technology Transfer & Organization Development

Ajeet N. Mathur

The new international competitive environment has demonstrated the possibility and durability of differences in the development of organization systems, structures and processes in firms that receive transfer of technology. This necessitates the critical re-assessment of the need, and efficacy of organization structures, systems and processes established in one national or cultural context from being packaged together with technology transfers. This is crucial for the growth of international business that may involve transfer of technology from multiple sources within the same enterprise. The problem concerns multinational firms and overseas business as well as local firms seeking partnerships across national borders. Cases are presented of how firms in India and Nepal are learning from their experiences. Preliminary findings indicate that organization structures, systems and processes need not and perhaps, should not be packaged with transfers of technology.

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Technology transfer to developing countries involves the resolution of certain inherent conflicts : the development of a strong economic base demands modern technology diffusion while capital scarcity and surplus labor create pressures for preservation of obsolete and inferior technologies; maximizing rates of return on scarce capital entails high interest rates that militate against innovation while the need to integrate the economy with world markets induces choice in favour of modern technology through technology transfer. Enterprises—private and public—actively seek and create arrangements with overseas partners for technology transfers.

These arrangements are often associated with replication of organization structures, socio-technical systems and human social processes that have developed successfully in the enterprises from where technology transfers are sourced. The assumptions underlying the success are seldom questioned and their relevance often taken for granted as representing the only choices. In this paper, we analyze the possibility and durability of international differences in the development of organization systems, structures, and processes in the new globally competitive environment. The efficacy of packaging forms of organization together with technology is questioned on economic and social grounds particularly when the growth of international business involves transfer of technology from multiple sources within the same enterprise.

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Technology & Organization

One of the major consequences of technology is the division of tasks and roles and establishment of a rate of

engagement within the primary task of an enterprise¹. Structures adjust to a given technology but also depend on assumptions about plans and resources. In turn, plans and resources together provide an enterprise the capacity to respond to the environment. Information creation assumes a significant dimension in visualizing the loci of communication and decision-making. Human resource is invariably influenced by re-inforcement to norms, values, beliefs and attitudes from within the enterprise and from the proximate environmental interfaces. The patterns of human response are classified in conventions, customs and precedents unique to specific local environments. The degree of competition in capital and labor markets, differences in trade regimes, the pervading collective voice mechanisms and societal values are important factors that shape patterns that characterize such response.

Technology Transfer & Culture

The response of nations in South Asia to the imperatives of Development Management has been generally associated with concerns that originate from the politics of development processes. The curious mix of interventions comprising world aid, bi-lateral aid, barter trade, internal development finance and structural reforms has contributed to a mind-set that accepts not only diversity, but also differences in the values with which resources are used and the way in which institutions are created. For instance, a foreign donor agency promoting health care brings with it a structure of organization and style of working just as a national management institute engaged in building managerial skills nurtures a pool of resources and 'know-how' or a multi-national company in an era of liberalization moves in with technical and organizational expertise of another kind. The interfaces that such processes generate between individuals, groups, communities and nations are usually at a premium because they are considered to represent a higher order resource than internal resources. The relative degree of dependence on the different higher order resources in a society then shapes the conditions necessary for their continuance. While this is welcome in many ways there are several unintended implications of such processes. These include ways in which resource use is linked and assumptions about human response.

In January 1987, I was invited to attend the inaugural functions of the first Grindlays Bank in Nepal. High tech modern banking had arrived in Nepal, I thought, as I surveyed the facilities that the bank would offer. The

incongruence struck me when I found the bank staffed with young attractive Nepalese girls dressed in shirts, skirts and ties. Now I have nothing to complain about a form of dress. The significance is that technology had been imported along with its style and trappings as if the latter were an inseparable part of technology transfer. I am aware that the novelty could soon become society fashion to an extent. Yet, social distance became a barrier that soon created inclusion-exclusion processes between those willing to adapt to the 'new' style and those who found it more difficult to associate the benefits of high-tech banking with breaking cultural norms. A technology transfer became a cultural invasion. Now, we may say that the onus of exclusion lies on those who feel threatened or excluded and to an extent, investments in education will help overcome prejudice. However, a few questions arise: Is there sufficient investment in human development in South Asia to change the mind-set? Are technology and style inseparable?

We may now raise another question: Are economic agents in developing societies sufficiently sensitive to institutional processes? A good example is the case of Unilever subsidiary in India, Hindustan Lever Limited that operated in India for decades with a particular form of manufacturing organization. It took a competitor, Nirma, to prove that a product like a detergent is best manufactured with a different structure of organization in India and only after losing substantial market share did Hindustan Lever follow suit. What makes this case even more interesting is that Unilever did not learn its lesson and again took a beating in Pakistan under similar circumstances from Lakhani's Brite. We now know that there is scope to examine all low-tech manufacturing enterprises in South Asia because they have created vulnerable organizations fundamentally incompatible with the institutional forms of resource use available in this region, particularly with regard to human resource.

Technology transfers usually involve exercise of preferences between technologies, between countries and between firms. A technology transfer from a medium sized firm in Western Europe is not viewed in the same way as technology transfer from a large firm in U.S.A. or Japan. For instance, Telecom technology to India was available from Britain, France, Sweden and USA. China could source electronics technology from USA or Japan. The logic of technology transfer may reflect demand based private initiative in markets or it may reflect supply based government initiative for development. Countries like India and China followed national strategies of planned self-reliance whereas in countries like Hong Kong, Singapore,

1. The 'primary task' framework detailed in Lawrence (1979) and Chattopadhyay et al. (1985) as applied in management offers a useful concept.

The reach and impact of technology diffusion vary with each type and the nature of arrangements that facilitate or impede technology transfer are also different.

South Korea and Taiwan, export led growth impulses provided a more encouraging role for foreign investment and collaboration which promoted a greater range of technology transfers. The obstacles to organization development in cases of technology transfer are more severe where unemployment arising from factors other than technology remains an enduring feature as in Jamaica, India and China. According to Edquist (1985) Cuba and Korea at comparable stages of development were more successful because the pressure from the unemployed was insignificant.

We may classify high technology diffusion as taking three major forms:

1. through its consumption (e.g. electronic consumer goods)
2. through the use of information technology in the production of goods and services
3. through the development and production of high technology products and processes

The reach and impact of technology diffusion vary with each type and the nature of arrangements that facilitate or impede technology transfer are also different. The range of experience with high-tech technology transfers in the fields of telecommunication, electronics, heavy engineering, automobiles etc. to developing countries has caused organization development to take into consideration the technology transfer dimension in a big way. The variety of responses is worth examining.

Characteristics of Technology Transfer

Before analysing the responses, it is necessary to recognize important characteristics of technology transfers common to organization development in any context.

- * An important characteristic of high-tech is that they are knowledge intensive and play a catalytic role in the development of human capital.
- * They usually require new inputs, new sources and considerable vendor development to sustain them.
- * They are spurred by innovation and capital intensity for labor saving based on the logic of production and

consumption requirements in affluent countries.

- * They require organization structures and socio-technical systems to support them and usually involve restructuring of tasks and roles.
- * Their expansion and global commercialization depend on factor cost logistics which are more favourable in low cost countries.
- * They are usually associated with competitive and flexible labor markets.
- * They have distributive and allocative impact in recipient firms and the local environment through changes in relative shares of wages and employment for any given workforce.
- * They influence quality of work life positively and negatively.
- * Technology transfers involve technological forecasting and organizational development to prepare strategic plans.
- * Patterns of country specialization cause shifts in production and trade volumes.

Like technology, forms of organization also link resources using creative intelligence. Designing organizations is in some ways more challenging because not all the assumptions made are immediately testable. Also, despite the common features of technology transfers mentioned above, there are differences—sharp and subtle—in the assumptions and processes that characterize the anchorage of technology transfers from firm to firm and country to country.

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A technology change is hardly ever justified for its own sake. At the enterprise level, as observed by Gonod (1990), it is usually preferred to reduce resource inputs like material, energy, labor, to establish quicker ways of producing large quantities, for economies of scale, improved quality and increased value added. Prices, markets and profitability are the guiding criteria for enterprises. It is difficult to convince an entrepreneur making profits in the manufacture of tyres through autoclave moulds to undertake modernization. We may therefore safely assume that

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technology transfers follow the economic logic of higher financial rates of return on private investment or better economic rates of return on public investment or both. The terms of transfer in the past included the whole package comprising the basic process, basic engineering, procurement and inspection, commissioning assistance, tiding over teething problems and the use of brand names (except in countries like Brazil or Korea where brand names were discouraged). Over the years, technology transfers have been unpackaged and enterprises in developing countries are increasingly picking and choosing elements and adding their own. This is not so obvious in the case of consumer products or services where global firms seek penetration of a standardized range of products and services. Whether directed towards changes in products or processes, technology transfers lead to emergence of new styles and patterns of resource linkage. The conflict between packaging style and structure with technology transfers and the search for matching structures and styles based on local considerations have received scant research attention despite their obvious implications for joint ventures, capital flows and technology transfers.

Let us take a few cases, by way of example:

1. Where technology transfer involves technology development due to differences in sourcing inputs

A public enterprise, Indian Drugs and Pharmaceuticals Ltd (IDPL) entered into a Soviet collaboration for technology transfer that was plagued by problems from the start:

- (a) Alterations/modifications were required because the plant did not respond adequately to organisms growing in culture media in India where contamination risk was higher.
- (b) Whale oil had to be substituted by ground nut oil and lactose by sugarcane.
- (c) The Butanol recovery equipment, the carbon treatment plant and rotary driers had to be redesigned.

Joshi (1990) observes that due to (a), (b) and (c), production and organization could not be stabilized. It was practically impossible to develop an organization similar to that from where technology was transferred or even develop norms and establish an organization with so much uncertainty. The company never made a profit and survives after more than 25 years as one of the loss making public enterprises in India with an unwieldy organization.

2. Where technology transfer involves new process development

Seshasayee Paper Board Ltd. (SPB), a private enterprise producing writing and printing paper developed the idea of a newsprint project based on bagasse in 1979. The technology was available from Germany (Voith), Finland (Metex), Sweden (Hansson) and U.S.A. (Beloit) and had been successfully introduced in Mexico and Peru. A package deal was negotiated with Beloit of U.K./U.S.A. Collaborative research between SPB and Beloit preceded technology transfer and many organizational aspects including some externalities were taken into consideration. The project, the first in India based on collaborative research between an Indian firm and a foreign multinational has been an outstanding success and work norms, organization structure, management style and performance standards have stood the test of time.

3. Where technology transfer involves transplanting systems, structures, culture and values as part of a package of proven technology

The Indian automobile industry was almost entirely insulated from technology transfers until 1981 when Maruti-Suzuki emerged. This Japanese collaboration brought with it a package of technology, organization structures, socio-technical systems and Japanese values. While the introduction of technology in a greenfield venture proved successful, the style of management, structure of organization and Japanese values packaged with the technology did not survive. They have not been officially dismantled but the ground situation is very different from the picture of organization visualized at the beginning and many institutions packaged with technology have all but withered. This is also true of many other Japanese collaborations in India where despite initial enthusiasm and novelty for Japanese culture, imports of organization development based on Japanese experience could not be sustained.

4. Where technology transfer involves downsizing and design changes

Gabriel India entered into a collaboration with Federal Mogul Corporation U.S.A. for transfer of technology in the

field of engine bearings in 1980. The overseas training of technicians, establishment of work norms, job responsibilities and structures, could precede the local commissioning of the technology in this case. However, Federal Mogul had automated its production with specialized manufacturing lines for each type of product. Its large volumes justified this investment. The Indian firm could only afford limited manual all-purpose equipment and the downsizing/multitasking of equipment from high volume automatic to low volume/manual meant lower productivity and more rejections. It also meant that the crewing patterns, work norms and job responsibilities had to be completely reviewed. Further, more than 50% of the output was rejects because of difference in the grade of steel available in India. Finally, the finished products optimized and value engineered to suit the collaborator's environment did not work in India due to higher temperatures, dust, uneven roads or no roads, overloading of vehicles and improper maintenance. The products had to incorporate new design features that would enable reconditioning in an environment where vehicles are operated for a much longer life than developed countries. Workforce stability at Federal Mogul depended on sustained work interest in the rapid pace of process/equipment/product development and the availability of professional growth associated with improved rewards in compensation. Gabriel had to contend with a workforce oriented to preservation of 'job' and 'status' associated with positions in the labor market, an unstable production system and market uncertainty for its products in sales and cost competitiveness. The compulsions under which the two partners formulate organization development strategies are fundamentally different as analyzed by Mathur (1990). The Federal Mogul structure and style could not be adopted.

5. Where technology transfer involves restructuring organizations as part of modernization

The British American Tobacco subsidiaries in India, ITC Ltd. and VST Industries Ltd. undertook extensive modernization in their factories that manufacture cigarettes in the 1980s. Dominant market position enabled these enterprises to import technology packages from Western and Eastern Europe and build structures and systems similar to, but not the same as prevalent in countries where technology originated. Interventions for organization development were entirely local and represent a happy blend of the best in different cultures and technology transfers have been associated with smooth transition and restructuring. The same logic applied to a Nepalese collaboration for technology transfer in the case of Surya Tobacco backfired and managers blamed 'Nepalese culture' rather than examine the relevance

and appropriateness of assumptions transported from India.

6. Where technology transfer involves multiple sources

At Indian Petro Chemicals Ltd. (IPCL), a public enterprise, a range of technology transfers were sourced from a number of countries but socio-technical systems consistent with local assumptions were transposed on technology without linking organizational issues with technology in the transfer package. This was aided by substantial investments in development of technical skills in overseas locations from where technology transfers were sourced that include USA, Spain, UK, Japan, France, Italy, Germany and Canada. The resulting process-mix and product mix are unique to IPCL while specific plants distantly resemble patterns of work and resource - use identifiable with plants of foreign collaborators. This has worked well partly because the protected domestic market enabled inefficiency in human resource use to remain hidden.

7. Where technology transfer involves proven technology with established transfer capability

At Nepal Batteries, the Union Carbide facility in Nepal, attempt by Indian managers to create socio-technical systems and structures based on the success of Union Carbide plants in India failed and there was a high cost associated with re-assessment of the real requirements in Nepal's specific context. The fact of successful technology transfer and organization development between the two locations (USA and India in this case) does not necessarily offer any set formula for replicating it in a third location even if the technology is the same. The problems of Nepal Batteries arose from imposition of work norms, procedures and internal arrangements, which though well accepted in India, were rejected by workers in Nepal unused to sophisticated contractual arrangements in a feudal society.

8. Where technology transfer involves development and diffusion within the same country

The Centre for Development of Telematics (C-DOT) is an interesting example of technology transfer within the same country. Established in 1984 in India to develop digital electronic switching systems and telematics like fax, telex, videotext etc., C-DOT enabled its 94 licensees to develop their own organization together with socio-technical systems consistent with the logic of different production levels and product markets. The diversity of organization structure and system developed bears testimony to the feasibility of separating technology transfer from organization development.

9. *Where technology transfer involves diversity in organization development and learning by experimenting*

Asian Paints, a private enterprise in the chemical industry established in India is an example of successful technology transfer in the chemical industry to its associate companies in Togo, Solomon Islands and Nepal. The experience of diversity in management process, organization structure and systems enabled the company to re-think organization for its own operations in India when it expanded and set up new plants in Ankleshwar and Patancheru. This suggests that learning by experimenting may enable new viable alternatives to be considered even from where technology is sourced.

Technology Transfers & Internal Dynamics of Firms

The need to separate organization development from technology transfer is accentuated in countries where structural changes create pressure for reallocation of resources within firms, industries and regions. Sengenberger (1988) laments the neglect of flexible and efficient production as a focus, due to pre-occupation with flexible or efficient resource allocation with respect to differences in factor cost logistics. A second order question that he raises is how organizations define and redefine the boundaries between internal and external adjustment. For instance, Sengenberger points out that in the automobile industry, U.S. firms resort much more to lay offs and re-hiring than German firms. Substantial differences exist even among OECD countries and the differences in labor market flexibility are even greater between developed and developing countries.

The need to separate organization development from technology transfer is accentuated in countries where structural changes create pressure for reallocation of resources within firms, industries and regions.

Assumptions about trainability, training and career progression also influence organization and the division of tasks and roles. The degree of externalization and final product and the extent of non-employee work possible vary at different locations and also influence organization (Mathur, 1988). Dominant firms in India, Pakistan, Srilanka, Thailand, Nepal and Bangladesh typically introduce competition and co-operation in the network of subordinate firms through infusion of technology, capital, exchange of

personnel and training. Industrial estates like Noida near Delhi, Falta in West Bengal and Kandla in Gujarat offer infrastructural advantages too that influence firms to reduce retention of exclusive skilled resource for specific technical support and maintenance activities.

Agenda for Research

The experience of technology transfers suggests that the costs and risks associated with it may be reduced with greater understanding of the related processes that determine organization development potential. While structures are dependent on technology, there may be more than one structure consistent with any specific technology. Management process and style influence the structure based on factors discussed. However, we do not know the relative influence of management process and technology on structures. While there are case studies of technology transfers, there has been no study to systematically establish how and why the impact of technology and management process varies in different technology transfers. We need to establish :

The experience of technology transfers suggests that the costs and risks associated with it may be reduced with greater understanding of the related processes that determine organization development potential.

- * A typology of technology transfers, taking into consideration the differences in packaging technology transfers.
- * The extent to which technology packaging is indivisible and the degree of unscrambling desirable for better integration of new technologies in recipient firms.
- * International differences, if any, between organization development associated with comparable technology transfers.
- * The range and set of multiple structures, systems, and styles compatible with different technologies.
- * The range of choices and approaches to organization development for different types of technology transfers.
- * A method of enabling a cogent explicit statement of implicit assumptions (that remain unstated) to facilitate appraisal of technology transfer mechanisms and organization development potential.

- * The differences in management style arising from values and culture to enable evaluation of technology transfer options.

It would be premature to insist on packaging technology transfers together with organization structures, systems and processes.

Concluding Observation

Based on the examples discussed and identification of unresolved issues that form potential agenda for research, it would be premature to insist on packaging technology transfers together with organization structures, systems and processes. There is evidence that points to this not being necessary. There is no reason to conclude that it is desirable in the face of failure experiences until research establishes safe boundary limits. This is particularly relevant for capital scarce developing countries eager to emulate and absorb anything and everything with xenomaniac intensity.

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HUMAN RELATIONS AT SONY CORPORATION

Sony has long been a leader in human resources management in Japan. The company has adopted such American concepts as the 5-day, 40-hour work-week even though Japanese law still provides for a maximum of 48 hours and the average in Japanese manufacturing remains 43 hours per week; in addition, Sony was one of the first Japanese firms to close its factories for one week every summer and thus allow all its employees to be off work at the same time.

In addition, the Japanese system enforces a different view of recruits. Akio Morita urges managers to see recruits as rough stones and the managerial job as the task of building a strong and sturdy wall out of these rough stones. In the Japanese system, managerial recruits are, at least ideally, shaped and smoothed so that they fit together into the cohesive whole that reflects the cohesive structure of the company as a whole.

Japanese companies, at least the large ones, also have a different view of what happens in declining industries. Most companies offer retraining — which most workers eagerly accept. Even within companies like Sony, workers are retrained when their particular jobs are no longer needed.

Clearly, Akio Morita's human resources policies accommodate the overall strategy of Sony. By focusing on the shared fate of management and employees, Sony develops among its workers a sense of commitment to the overall goals of the firm. In part, because of employee commitment, Sony has been able to stay competitive in terms of wages and benefits and to motivate highly, competent people to continue to innovate.

By focusing on people as resources rather than as costs, companies like Sony are writing the book on the future of management theory and practice.

Source: Management 4th edition by James A.F Stoner & R. Edward Freeman, Prentice Hall of India.

Human Resource Development & Corporate Performance

P.C. Jain

After four decades of intensive efforts, we have the facilities to produce a wide spectrum of goods. On a selective basis, we have kept upto date with modern technologies. Despite these developments, India had not made a significant impact on the rest of the world as an industrialized country, though there is ample evidence in literature that productivity through people is one of the main attributes that characterises high achieving countries and companies. Japanese economic miracle stands testimony to the importance of human element in production. This paper addresses two basic questions: does development of human resources make a significant difference in corporate performance and can human resource development methods embedded in one culture be effectively transferred to another?

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The relation between human resource decision and organisational performance is a central issue in the study of managerial decision making. Despite the considerable attention professionals and academicians have given to human resource development, fewer researchers have focussed on the effects of human resource development decisions on organisational performance than on the determinants of the human resource decisions themselves (Dyer & Holder, 1988; Schuler, 1987; Kleiner et al., 1987; and Ulrich, 1987). One reason for the relative scarcity of this type of research may be the absence of well-developed theories, other than the price-theoretic models that emphasize the relation between unit compensation costs and employment, that relate strategic human resource decisions to medium term and long term corporate outcomes. In addition, little effort has been made to create a taxonomy of relevant human resource strategies that might be used to measure the effects of alternative decisions on organisational performance.

The organisational performance outcomes most commonly considered are employee behaviours and attitudes. Studies of the effects of alternative gain-sharing plans on employee suggestions, performance and satisfaction (Schuster, 1983, Bullock & Lawler, 1984), effect of merit pay on performance and satisfaction (Pearce, Perry 1983; Heneman, 1984), and the effects of flexible work schedules on attendance, absenteeism, and satisfaction (Gannon, Norland Robeson, 1983) are all examples. Another research argued that the perception of organisational stockholders, employees, managers and regulatory agencies regarding the constituents of human resource activities are the relevant outcomes (Tsui, 1987). This type of analysis has been conducted using a variety of human resource-related indices as measures of performance (Fitzenz, 1984), including productivity estimates (For example, the ratio of sales reserves to total employee salaries and the ratio of production volume to labour use) and safety rates (for example, turnover rates, promotion rates, and

offer/hire rates). A series of studies has applied cost-benefit analysis to some of these indices (Boudreau, in press; Cascio, 1987; Alexander & Barrick, 1987).

Other authors have examined the relation of human resource decisions to the economic performance of organizations. Economic performance has been defined using accounting measures (for example, net income, return on assets, and return on equity) and using financial market measures of shareholder wealth (holding period dividends plus capital gains). Research in this genre includes studies examining the effects of new collective bargaining agreements (Abowd, 1989), concession bargaining (Becker, 1987), strikes (Becker & Olson 1986; Tracy, 1987, 1988), executive compensation (Baker, Jensen & Murphy, 1988; Brickley, Bhagat & Lease, 1985; Tehranian & Waagelein, 1985; Gomez-Mejia, Tosi & Himkin, 1987), and executive succession (Reinganum, 1985; Etebari, Horrigan & Landwehr, 1987; Lubatkin, Chung, Rogers & Owers, 1989).

A considerable amount of experimental research (Peters & Waterman, 1982, Donnelly, 1977; Schuster & Dunning, 1982; & Schuster, 1982) indicates that human resource development practices help to increase worker productivity, performance and job satisfaction. However, these authors were criticized for using anecdotal evidence and unsubstantiated testimony of employees, journalists, and others. They also failed to consider academic research and to operationalise how excellent companies hold to their dedication to people (Carroll, 1983).

Although numerous studies have shown a relationship between particular human resource development practice and performance, executives rightly conclude that proving a practice effective in one particular setting does not mean it will be equally effective in a variety of settings.

Although numerous studies have shown a relationship between particular human resource development practice and performance, executives rightly conclude that proving a practice effective in one particular setting does not mean it will be equally effective in a variety of settings. What is needed is supplementary evidence based on experience in a cross-section of diverse organisations to determine if the use of innovative human resource development practice leads to superior financial as well as non financial performance. This paper aims to study the impact of integrated human resource development practice upon the overall performance of the organisation in the Indian context and also to compare Indian practices with

those of American and Japanese and to see whether a particular human resource development practice embedded in one culture can successfully be implanted on another.

Research Design

To study the impact of human resource development on corporate performance, the experiences of 15 private sector organisations have been analysed using the framework of human resource development linkage with organisational effectiveness/performance. The criteria for inclusion of these organisations have been: First, recognition of the importance of the human resource development by the organisations as indicated by (a) the establishment of a human resource development department; or (b) creation of a new role for managing the human resource development function; or (c) investments made for initiating unconventional human resource development mechanism (any mechanisms other than training); or (d) adoption of an integrated human resource development system. Second, availability of published literature. Similar number of firms were then randomly selected from amongst the first 100 Indian private sector corporate giants which do not fulfil the above conditions. In addition, firms in the control group were matched with the experiment group firms in term of industry, age, assets and fiscal year. Human resource development practices followed by Indian companies were also compared with those of Japanese and American companies to explore the possibility of adopting them in the Indian context.

Human Resource Development & Corporate Performance

Table 1 presents the performance of control group companies and experiment group companies in the ten years from 1979-88.

Table 1: Performance Indicators of Control Group Companies and Experimental Group Companies Over a Period of Ten Years (1979-88)

| Performance Indicators | Control Group Companies | Experiment Group Companies |
|--------------------------------|-------------------------|----------------------------|
| Sales (%) | 23.82 | 33.67 |
| Networth (%) | 48.28 | 52.42 |
| Operating Profit (%) | 3.92 | 17.71 |
| Human Resource Costs (%) | 27.42 | 17.22 |
| Export (%) | 4.17 | 31.26 |
| Rate of Return (%) | 3.44 | 19.83 |
| NetSales/Employee (Rs.'000) | 168.00 | 327.00 |
| EPS (Rs.) | 2.14 | 6.17 |
| Book Value/ Shares (Rs.) | 4.73 | 9.81 |
| Production/Employee ((Rs.'000) | 143.00 | 287.00 |

Source: Bombay Stock Exchange Directory

Almost all the fifteen organisations have done well after adoption of human resource development programmes. A few of them (L&T, Telco: strikes, lockouts) have gone through or are still going through turbulent environment now and then but all of them have stood strong. On the whole, each organisation has done well although to varying degrees. For example, L&T, Lipton, P&G, Sundaram Fastener and Tisco have done exceedingly well in the last few years. The Chairmen of these companies acknowledge the contribution of their human resources. It may be presumptuous to say (in the absence of scientific precision) that human resource development has largely contributed to the profits and growth of these companies. However, contributions of human resource development cannot be ignored. Comparing the working and performance of experiment group companies with those of control group companies in the same industry, the study found some unique features of successful human resource development programmes.

It may be presumptuous to say that human resource development has largely contributed to the profits and growth of these companies. However, contributions of human resource development cannot be ignored.

First, in experiment group companies, human resource development was a joint effort between human resource and line managers. Human resource managers are actively involved in developing human resource programmes (Quality of work life: Sundaram Clayton; Training: Voltas, Telco & Tisco; Participative Management: P&G; Management by Objectives: Madura Coats; Crompton Greaves, Eicher Tractors, Jyoti Ltd, L&T, Lipton, Madura Coats, Sundaram Clayton, Shri Ram Fibres, Telco, Tisco & Voltas; Career Planning: Blue Star, Telco) for line departments. In contrast, line managers in control group companies administer human resource programmes independent of human resource departments.

Second, in experiment group companies, human resource programmes are consistent with corporate strategic plans, human resource managers actively participate in formulating and implementing corporate strategies (Growth: Eicher, SRF; Diversification: ITC; Turnaround: Crompton Greaves, Expansion and Diversification: L&T; Positioning of a New Product: Telco; Productivity through People: Sundaram Clayton). In contrast, the human resource functions in control group companies are mostly oriented towards maintaining traditional human resource functions of selection, training and placement.

Third, in experiment group companies, human resource programmes are introduced to meet specific needs (Ballarpur: Changes in employee attitudes, belongingness; Jyoti: Preparation for better future; Madura Coats; Identification of corporate goals and opportunities of the firm). In contrast, control group companies tend to adopt human resource programmes to keep up with the latest trends in human resource management. As a result, control group companies introduced more human resource programmes than did experimental group companies for a given period which is reflected in their human resources costs (table 1).

Fourth, human resource managers in experiment group companies are productive in initiating and communicating human resource programmes (recruitment, training, induction, performance appraisal, career planning, skills inventory, etc.) with line managers. They keep up with current developments (role analysis, corporate philosophy, organisational diagnosis, counselling, etc.) in the field and alert line managers concerning human resource problems as well as opportunities. In contrast, human resource managers in control group companies tend to react to the request of line managers.

Finally, in experiment group companies, corporate and divisional human resource staff work closely in developing and managing human resource programmes. In contrast, the corporate human resource staff in control group companies rarely work with divisional human resource staff. In essence, experiment group companies manage their human resources with a strong strategic orientation (Lipton: Shaping HR to respond to business needs, team building, motivation, networking for change and growth, insight into future trends, etc.), while control group companies lack such an orientation.

Human Resource Development Practices: A cross-Cultural Analysis

Ouchi (1981) sees the American model as a contrast to the Japanese model on at least seven counts. Indian dimension is also added to see how the Indian system differs from the two on the same criteria for cross-cultural analysis.

The Indian model appears to have more similarities with the American model than the Japanese. It appears closer to the Japanese only on two counts. Average employment tenure is longer than the American but short of life time employment. It can be viewed as 'long term' in the public sector where security of job is stronger and 'medium' term in the large scale enterprises as compared

Table 2: Human Resource Practices : Japan, USA and India

| Criteria | Japan | USA | India |
|----------------------------|-----------------|-------------|---------------------------|
| Employment | Life-time | Short-time | Medium-time, Long-time |
| Evaluation/ (Promotion) | Slow | Rapid | Moderate/ feudal |
| Career Path | Non-specialised | Specialised | Specialised |
| Responsibility | Collective | Individual | Individual |
| Control-Mechanism | Implicit | Explicit | Explicit |
| Employee-Concern | Holistic | Segmented | Segmented |
| Decision-Making | Consensus | Individual | Individual |

to the 'company-hopping' tenure in USA. The evaluation system is not slow and is moderate as compared to rapid promotions. Quick promotions are often caused by feudal attitudes reflected through family ties, caste considerations and social connections. The management concern for employees remains segmented by and large as is indicated in the multiplicity of unions that intervene in the workplace to fill the 'concern' vacuum. However, in some sectors, the semi-paternalistic approach can be seen particularly in small-scale family managed enterprises and some large-scale enterprises that exhibited harmonious industrial relations.

The homogeneity in Japanese society encourages managers to view their employees as not very different from themselves.

Human resource development practices in USA, India and Japan are quite different. Experts on management offer the following explanations. Cole (1980) asserts that the Confucian doctrine of human goodness, filial piety and altruism taught people to be well-educated, disciplined, committed to their organisations and compelled to help others. The pursuit of pleasure is viewed as moral decay and a person seeking pleasure is considered to be public enemy. This doctrine encouraged businessmen to be altruistic and thereby they gained the public's respect. According to Pascale (1982) Zen Buddhism also may have influenced Japanese to be more harmonious in group settings. Rather than seeking individual competition and disharmony, Zen Buddhism taught them to search for harmonious living with others. In contrast, the Western

culture has its roots in Judeo-Christian linkage and the capitalistic doctrine. Cole points out that the Christian concept of original sin places an emphasis on the fundamental weakness of human beings and the capitalistic doctrine motivates people to pursue self interest. According to Chakraborty, (1987) Indian thought consistently takes the individual as its central focus. The group, the society, the country—for all of them—the individual is the foundation. A popular proverb all over India is *aap bhala to jagat bhala* (if I am good, the world is good). This is the most profound message for ensuring the wholesome quality of work-life. Scape-goating is discounted here. The individual essentially seeks happiness which is full, unchanging and non-fluctuating. Objective dependent pleasure does not and cannot meet these criteria. Observation shows that such pleasure is followed, sooner or later, by adverse reactions of varying degrees. Yet the individual mistakenly chases only after such satisfactions (name, fame, money, power, etc.). This is *maya* or *avidya*. One of the *Upanishad (Chhandyogya)* declares *bhumaiva sukham, narapne sukhmasti* (the infinite alone is bliss, but never is it in the finite). Therefore, navigating his course through the finite, objective world, the individual's developmental process is keyed to a constant striving for arousing this consciousness about his essential existential pursuit.

Ouchi argues that the homogeneity in Japanese society encourages managers to view their employees as not very different from themselves. This egalitarianism in Japanese industry helps managers to treat their employees in a more humanistic way. In contrast, Cole states that the heterogeneity in American society serves as an impetus for differentiating.

This differentiation might hinder the use of human resource tools in the United States, since it could foster an elitist attitude on the part of managers. Psychoanalytic researches in both India and Japan have shown that they have evolved a different type of self from the matrix of familial and group hierarchical relationships. It is a self that is far more oriented towards emotional interdependencies, reciprocal responsibilities in varying social contexts, a public and private self, and functions in very different psycho-social dimensions of hierarchical intimacy relationships than in the West—dimensions that simultaneously encompass both intimacy and structure, as well as the qualities of the persons involved. But the integration that Indians have to make, in contrast to the Japanese, has been counterminated and complicated by two centuries of colonial denigration of anything Indian: that what is good

is western, and what is inferior is Indian. This has by no means disappeared with independence. Thus, the absorption of western innovations in an Indian context often becomes a value-laden situation of superiority-inferiority.

The absorption of western innovations in an Indian context often becomes a value-laden situation of superiority-inferiority.

Finally, Japan is an old nation which has a long history of paternalistic arrangements known as *oyabu kobun* system between employees and employers and between superiors and subordinates. Persons of authority assume the responsibility of guiding and mentoring their subordinates as if they were foster parents and conversely the subordinates behave faithfully and have personal loyalty toward their superiors. George De Vos (1975) maintains that the feudal-familial relationships foster mentoring relationships between superiors and subordinates. By contrast, the United States is a relatively young nation, settling in a new sparsely populated land, encouraging people to be self reliant and individualistic. The historical circumstances reinforce the cultural values expressed in individualistic pursuit of happiness, wealth and success. Although mentoring exists in American firms, it is not yet as widespread as it is in Japan. Indian thought, by means of the *Atman-Brahman*-theory lays a secure foundation for trust, co-operation, teamwork, altruism, and similar indispensable lubricants of organisational and societal life. It causes an essential inalienable unity amongst all of us. It is only in terms of our outer, objective selves that differentiation exists. But this is not the whole truth, nor is it real. The unit one feels with one's wife or son or husband is, in principle, extendable to all creations. And this extension is imperative too. But since no *sadhana* for its inner realisation is incorporated at any stage of our education, this powerful concept remains sterile.

Adoptability of Japanese or American Practices

An individual's HRD practices are the reflection of his or her managerial philosophies which in turn are the reflection of culture. If Indian managers want to adopt the Japanese or American HRD practices, they need to adopt the Japanese/American managerial philosophies and cultural norms. This requirement will make the adoption of Japanese/American practices extremely difficult. It is not likely that Indian firms will restructure their methods of

obtaining funds, it is unlikely that life time employment with slow promotion will be accepted by Indian managers and that labour-management relations will attain the degree of compatibility they have in Japan and homogeneity in employment could be achieved or would be allowed. In fact, some Japanese companies having collaboration with Indian companies (Telco, Sundaram Clayton, SRF) have not adopted their HRD practices (except common uniform, common canteen for all, and an open office system, etc.) in India because they are aware of the cultural differences. Furthermore, these companies which have adopted the Japanese systems are even experiencing labour problems leading towards unionisation.

Can we adopt the Japanese or American HRD practices in India? The answer is mixed. Several well-managed companies such as Jyoti Ltd., SRF, Ashok Leyland, Punjab Tractors and Telco have been using or are adopting something similar to the Japanese (Long-term employment, quality control circle, etc.) and Blue Star, Ballarpur, P&G and Mukand Steel are using American (Participative decision making, OD, MBO, Assessment Centre) HRD practices. Despite this optimistic note, a prevailing feeling among some management scholars (Cole, 1980; Schein 1981; Tino Puri, 1981; Dayal, 1989; Rao, 1985; Durlabhji, 1986) is that HRD practices are the outgrowth of a country's unique cultural heritage thus rendering these practices unadoptable in other countries of the world.

Does this mean that it is impossible or inadvisable to adopt the alien systems in Indian organisations? It all depends. The following points are germane when one considers an adoption of foreign HRD systems.

Firms in relatively stable and dominant industrial positions are more likely to or may more easily adopt the Japanese/American HRD systems than those in weak and unstable positions.

First, firms in relatively stable and dominant industrial positions are more likely to or may more easily adopt the Japanese/American HRD systems than those in weak and unstable positions. Strong companies are less vulnerable to environmental constraints and can develop an internal organisational climate compatible with the Japanese/American HRD style. They can provide life time employment and make major investments in employee training. It is not difficult for P&G and Tisco to adopt such managerial philosophy. But struggling companies like Metal Box, Binny, Kirloskar Oils, etc., are less likely to look beyond

current operational results, let alone long-term developmental goals. The irony, of course, is that the stable and dominant firms may not see the need for change.

Second, not all Japanese or American HRD practices are culturally bound and non-transferable. Many of the technical programmes such as quality control and plant maintenance can be easily transferred without much resistance. This is the reason why many Indian companies including L&T, Jyoti, Lipton, Madura Coats, P&G have adopted quality control programmes. Even among the culturally bound managerial practices, some are more adoptable than others. For example, Indian managers seem to be receptive to the idea of long-term employment but not the practice of slow promotions with an emphasis on seniority. Many managers specially those who feel that they are capable, seem to prefer a reward system based on performance rather than seniority.

If a company chooses to adopt the alien rather than the indigenous HRD system, it has to prepare the foundations on which the newly adopted system can stand.

Third, the Japanese HRD practices which stress consensual decision making and group harmony are not all that desirable for industries pursuing aggressive and risky ventures. The Japanese systems are good at managing the nuts and bolts of manufacturing activities, but the emphasis on group harmony and consensus can easily smother creative thinking and innovative behaviour. When technological innovation is the key to organisational survival, the Indian/American way of managing people, stressing creative ideas and individualistic performance, can be more advantageous than the Japanese approach.

Finally, if a company chooses to adopt the alien rather than the indigenous HRD system, it has to prepare the foundations on which the newly adopted system can stand. It involves careful selection of people who can function effectively under the employee training on a continuous basis, decentralisation of operational decisions and sharing its benefits with the employees. It also requires the development of a partnership attitude between management and unions. It is indeed a time-consuming process, requiring much dedication and subtlety on the part of management. Unless one is willing to change the whole philosophy of managing people, one would be better off by not altering the existing system of management.

Conclusion

Taken as a whole, the limited evidence that is available on HRD-Performance issue, points to two basic conclusions. First, development of human resources does account for performance variations within firms to a substantial degree. However, these impacts are generally insufficient to outweigh the inbuilt differences among firms that largely account for performance variations among firms and therefore, casual inferences cannot be imputed directly to the observed relationship between HRD and performance. Other factors associated with HRD may be of greater significance to performance than HRD itself. Data collected in the study further indicate that initiating HRD has been a reactive step for most organisations in India where everything has failed. Our sensitivity to attitudes and values of people has been very low. We have tried to impose Western models of organisation on ourselves. This has created a tremendous gap between Indian ethos and the modern organisations, resulting in

There is an urgent need to evolve an indigenous HRD system that could preserve the spirit of Indian cultural norms while at the same time adopt to the changed physical and social environment of the twentieth century India.

value erosion, alienation, and loss of commitment. Further, most organisations refuse to consider renewal steps and become rigid due to the euphoria of past successes and therefore, competent executives have become dull. There is an urgent need to evolve an indigenous HRD system that could preserve the spirit of Indian cultural norms while at the same time adopt to the changed physical and social environment of the twentieth century India.

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Organizational Effectiveness: Relationship With Job Satisfaction Facets

Omer Bin Sayeed

Organizational performance has been measured by two distinctive approaches—the tangible indicator assessment and the perceptual method based on perceived productivity and perceived adaptability of the organization. The author has pursued the latter methodology for his study and presents the linkage between employee satisfaction and organizational effectiveness.

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Organizational effectiveness as a central concept in organizational researches has been analysed from several angles (Cameron & Whetton 1983). One of the angles frequently considered is the assessment of organizational performance through tangible indicators reflecting the organization's successful transaction with the environment in exploiting scarce resources.

Tangible Indicator Approach

The tangible output criteria are uniquely defined and assessed for the purpose of designating the organization as worthy and effective. Sayeed (1980) employed tangible criteria for assessing organizational effectiveness mainly due to two reasons. First, such indicators are quantifiable and provide a valid basis for inter-organizational comparison and evaluation over the time period. Second, the potential influencing factors that render an organizational system effective or ineffective can be isolated to measure their impact on the effectiveness parameters. In the investigation reported above (Sayeed, 1980), several soft measures of organizational health, viz., adaptiveness, organizational excellence, problem solving adequacy, conflict management etc. were chosen to relate with the tangible business criteria employed for assessing organizational effectiveness. Being in line with the above conceptual framework, Denison (1990) also hypothesized that organizational effectiveness is a function of

Organizational effectiveness is a function of organizational culture (a term synonymous with organizational health) and can be described adequately by adaptability, consistency in norms, values, beliefs, etc. and mission reflecting stability and direction.

organizational culture (a term synonymous with organizational health) and can be described adequately by adaptability, consistency in norms, values, beliefs, etc. and mission reflecting stability and direction. Several points from case studies supporting the above proposition cogently brought out the linkages between the two constructs apparently different from each other, one being tangible and emanating in the business environment and the other a soft measure of organizational and managerial processes emanating in the interaction of individuals within the organizational system.

Soft Perceptual Approach

On the contrary, among other investigators who explored the construct of organizational effectiveness, Mott (1972) preferred measurement of organizational effectiveness on the basis of perceptual criteria, rated by the constituent members and knowledgeable persons within and outside the organization. Even though several perceptual measures can be taken up for the study, broadly two dimensions were considered to be most relevant, namely, perceived productivity and perceived adaptability of perceptual measures on the grounds that such assessment criteria are easy to define and reliable data can be obtained with a well-designed questionnaire. Moreover, such indicators are relatively less susceptible to environmental variations as seen in the case of tangible performance indicators. In essence, these two distinctive approaches possess their own strengths and weaknesses. A researcher's deeper understanding of uniquely defined organizational effectiveness parameter and caution play a dominant role in making the study more acceptable. In the present study, instead of using tangible indicator approach a soft or perceptual measure has been used to assess organizational effectiveness. One of the widely researched variables concerned with motivation and/or satisfaction dimension of individual was also used along with the effectiveness dimension. The main objective of the study was to assess the impact of individual level processes on the organizational level processes, i.e., perceived organizational effectiveness.

Individual Level Measures & Group Outcome

Researchers have often used soft measures that dealt with individual level processes and related the same to the individual level soft measures. For example, Sharma & Bhaskar, (1991), Sinha & Sinha-Sengupta (1991) showed that individual level measures can predict some of the desirable outcomes for the individual, but failed to establish a linkage between individual level processes and

Linkage between individual and organizational levels is possible if the source of data is defined at the group or at the organizational level, and then related to tangible performance indicators

group level outcomes which have been measured at the individual level. There is also substantial evidence concerning significant relationship between some of the personal traits and one's job satisfaction (Sharma & Bhaskar, 1991) perceptions of power measures and non-managerial behaviour. In essence, methodologically it appears to be difficult to obtain significant and substantially positive relationship between individual level perception of organizational processes and the group level outcomes when the group level outcomes are measured in tangible terms. Sayeed (1980) confirmed the arguments mentioned above. Akin to the studies that have used perceptual measures at the group level, Khandwalla & Jain (1984) hypothesized that goal congruence at the top management level creates conditions for the satisfaction of lower management. Using a methodology in which referents for independent and dependent variables were different, positive relationships were hypothesized. Even though such a focus can be meaningful, studies in this area failed to pay serious attention to this line of thinking. Sharma & Bhaskar's (1991) investigation rationally related individual level and organizational level measures in terms of the units of analysis being the larger groups; the source of data, however, was the individual perception about self and organizational processes. Linkage between individual and organizational levels is possible if the source of data is defined at the group or the organizational level, such as organizational health perception defined at the individual and group levels and then related to tangible performance indicators (Sayeed, 1980) or the job satisfaction at the lower organizational level related to the goal attainment at the higher level with two different sources of data the unit of analysis being the organization group.

Objectives of the Study

Though the present study does not propose to have different sources of data for the individual (job satisfaction) and organizational level measures (organizational effectiveness), the main objective is to relate satisfaction with organizational effectiveness along with personal attributes such as age, education, pay and length of service. Furthermore, the study is intended to assess the

aforenoted influence through two regression models, differing in the entry of the variables in the equation, preplanned for the purpose.

Sample

Data were collected from 44 supervisors of a public sector undertaking manufacturing engineering goods. The sample was randomly drawn from a single unit of the company. Out of 70 prospective respondents, 44 supplied the data voluntarily. The response rate was found to be 63 per cent. Respondents of the study belonged to the first line supervisory cadre whose age varied from 22 to 48 years with its median at 32 years. They had already put in 2 to 22 years of service in the organization (Median = 6 1/2 years). While none of the respondents had acquired postgraduate qualification, a handful had attained graduate qualification; the majority of respondents had completed high school level education.

Instruments

The battery of instruments included Worker Opinion Survey (Cross, 1973) developed on the line of Job Descriptive Index of Smith, Kendall and Hulin (1969), and Mott's Organizational Effectiveness Index (1972) and personal data bank. The worker opinion survey measures job satisfaction under 6 facets of which 5 facets (viz., satisfaction with pay, promotion, job itself, supervisor and co-worker) had comparable names as that of job Descriptive Index, while the 6th facet (viz., satisfaction with organiza-

tion) was specially included as a significant variable in the cluster of satisfaction variables. All the satisfaction facets had 8 items each, measuring employee satisfaction on forced choice format (Yes/No/Not Sure). In each sub-scale, positive and negative items were included to offset the response set. The Organizational Effectiveness Index included items that tapped organizational productivity and adaptability processes reflecting organizational effectiveness. The productivity dimension had 3 items measuring quantity, quality and efficiency as perceived by the respondents, while adaptability dimension encompassed 5 measures that indicated anticipation of change, quick adjustment to the change, flexibility, etc. The items were rated on a 5 point semantically anchored scale specific to the item concerned.

Table 1 reports mean and standard deviations of all the study variables. Me-

dian corrected item-total correlations and Alpha reliability are presented for 6 job satisfaction dimensions, while Alpha coefficients are reported for overall productivity and adaptability subscales of organizational effectiveness.

Satisfaction with co-worker, promotion and organization figured prominently in the analysis suggesting higher satisfaction experienced by the respondents, while other elements such as satisfaction with pay, supervisor and job have resulted in lower satisfaction. Similarly, amongst organizational effectiveness variables, higher mean values of quantity, quality and efficiency are seen whereas most of the adaptability variables assumed lower mean values, thereby suggesting higher organizational effectiveness regarding productivity measure but the contrary with respect to adaptability factor.

Table 2 verifies factor structure of 8 organizational effectiveness variables comprising productivity related and adaptability related measures as conceptualized by Mott (1972). The findings confirmed the intuitively derived structure of organizational effectiveness, comprising productivity and adaptability dimension. The three items of productivity dimension clearly loaded on a single factor, with their corresponding loading on the second factor being relatively low. Similarly, the 5 items of Adaptability dimension had relatively strong loadings on a single factor ranging from .59 to .74. Thus this factor was labelled Adaptability. It can also be seen that two of the adaptability items and one of the productivity items had factor loadings on the

Table 1: Means and Standard deviations of job satisfaction facets and organizational effectiveness variables

| Job satisfaction and organizational effectiveness | Mean | Rank | S.D. | Median corrected item total correlation | Alpha Coefficient |
|---|------|------|------|---|-------------------|
| Satisfaction with | | | | | |
| Organization | 15.1 | 3 | 5.8 | .50 | .79 |
| Pay | 12.9 | 4 | 7.0 | .73 | .86 |
| Promotion | 15.2 | 2 | 7.3 | .62 | .87 |
| Job | 9.8 | 6 | 7.4 | .71 | .87 |
| Supervisor | 11.8 | 5 | 6.9 | .62 | .85 |
| Co-worker | 16.6 | 1 | 6.4 | .63 | .85 |
| Organizational Effectiveness | | | | | |
| Quantity | 3.3 | 1 | 0.8 | - | - |
| Quality | 3.1 | 2 | 0.8 | - | - |
| Efficiency | 3.0 | 3.5 | 0.7 | - | - |
| Anticipating problem | 2.7 | 7 | 0.8 | - | - |
| Keeping abreast of change | 2.9 | 5 | 0.9 | - | - |
| Promptness of adjustment | 3.0 | 3.5 | 0.9 | - | - |
| Prevalence of adjustment | 2.5 | 8 | 0.9 | - | - |
| Coping up with emergencies | 2.8 | 6 | 1.0 | - | - |
| Global Productivity | 9.4 | | 1.9 | - | - |
| Global Adaptability | 14.0 | | 3.5 | - | - |
| Global satisfaction | 13.6 | | 4.9 | - | - |

Table 2: Varimax rotated factor matrix of organizational effectiveness variables

| Organizational effectiveness variable | Factor I Adaptability | Factor II Productivity | h ² |
|--|--------------------------|---------------------------|----------------|
| 1. Quantity | .26 | .69 | .54 |
| 2. Quality | .14 | .88 | .80 |
| 3. Efficiency | .35 | .53 | .40 |
| 4. Anticipating problem | .60 | .42 | .54 |
| 5. Keeping abreast of changes | .59 | .15 | .37 |
| 6. Quick adaptability | .68 | .46 | .67 |
| 7. Proportion of people accepting change | .74 | .13 | .57 |
| 8. Coping with emergencies | .65 | .26 | .49 |
| Percentages of variance | 82.6 | 17.4 | |

corresponding factor higher than .30, suggesting some overlap between productivity and adaptability dimensions but it was not too large to be considered significant. The percentage of variance was found to be very high (82.6%) for the first factor labelled Adaptability dimension, while the second factor explained relatively small percentage of variance and was termed productivity dimension.

Table 3 presents stepwise regression results using two separate regression models. In the first model, satisfaction facets alone were used as independent variables against productivity and adaptability dimensions of organizational effectiveness, so as to assess the explanatory power of job satisfaction measures covering diverse elements such as satisfaction with co-worker, promotion, job itself, organization, pay and supervisor. Model II has been

employed to assess the extent of influence of personal variables first, and then job satisfaction facets were included in the equation. Thus, an overall assessment of personal attributes and satisfaction facets were determined through model II.

It is quite evident that between Model I and II, job satisfaction facets seem to have more explanatory power than the personal attributes of respondents. Although several satisfaction facets had significant positive relationship with organizational effectiveness criteria, the significant point noticed in the result is the importance of satisfaction with co-worker and promotion that have consistently entered into the equation explaining 50 per cent and 29.2 per cent of variance, significantly well beyond .05 level of confidence.

As seen in Model I, all the 6 facets of satisfaction together showed significant R² explaining 54.3 per cent of variance in the productivity dimension than the adaptability factor of organizational effectiveness. Personal attributes entering into the equation first explained 17.8 and 4.6 per cents of variance in productivity and adaptability dimension which turned out to be very low in comparison with satisfaction facets that explained 44.7 and 28.7 per cents of variance after the personal attributes entered into the equation. None of the simple correlations between personal attributes and organizational effectiveness dimensions were found significant.

Table 3: Stepwise regression results between personal attributes, satisfaction facets and organizational effectiveness dimension (N = 44)

| Organizational Effectiveness dimensions as dependent | Satisfaction facets as Independent | Model I | | | Personal attributes and satisfaction facets | Model II | | |
|--|------------------------------------|---------|--------------------|----------------|---|----------|---------------------|----------------|
| | | Simple | R ² chg | R ² | | Simple r | R ² chg. | R ² |
| Productivity | Co-worker | .65* | .419* | | Salary | .24 | .056 | |
| | Promotion | .54* | .081* | | Age | -.11 | .090 | |
| | Job | .25 | .016 | | Education | .05 | .023 | |
| | Organization | .50* | .017 | | Service | .12 | .008 | .178 |
| | Pay | .30* | .006 | | Satisfaction facets together | | .447 | .625* |
| | Supervisor | .27 | .004 | .543* | | | | |
| Adaptability | Promotion | .48* | .235* | | Service | -.20 | .039 | |
| | Co-worker | .40* | .047 | .282* | Salary | -.01 | .006 | |
| | Pay | .37* | .011 | | Age | -.16 | .001 | .046 |
| | Job | .25 | .004 | | Satisfaction facets together | | .287 | .333 |
| | | .38* | .005 | .303 | | | | |
| Global Effectiveness | All satisfaction facets together | | | .576** | Service | -.19 | .037 | |
| | | | | | Salary | .08 | .034 | |
| | | | | | Age | -.16 | .009 | |
| | | | | | Education | .09 | .004 | .084 |
| | | | | | Satisfaction facets together | | .412 | .496** |
| | | | | | | | | |

** p < .01

* p < .05

Table 4 reports regression results using satisfaction facets and job demographics (personal attributes) as independent variables and organizational effectiveness variables belonging to productivity dimension as dependent variables under two separate regression models as described earlier.

It can be seen that in Model I, where only satisfaction facets were used, there was a strong relationship with quality and efficiency criteria of organizational effectiveness, explaining 52.8 and 47.4 per cent of variance respectively. With respect to the effectiveness criteria of quality, satisfaction with co-worker and organization significantly contributed to it whereas satisfaction with promotion alone contributed to efficiency criterion. Using satisfaction facets separately, many significant correlations were obtained, but employing them in a stepwise regression model, only one or two satisfaction facets qualified to be included as significant variables. On the whole, the overall goodness of fit (R^2) was statistically significant with respect to quality and efficiency. The satisfaction facets that contributed significantly to productivity dimension were found to be satisfaction with co-worker, promotion and organization.

In model II, satisfaction facets were forced to enter into the regression equation after personal variables. The variables (viz., age, education, length of service and salary)

failed to signify relationship individually and also together in the regression equation. However, satisfaction facets substantially contributed to productivity facets on organizational effectiveness explaining 23.7, 41.7 and 43.1 percents of variance with regard to quality, quantity and efficiency respectively of which 43.1 percent of variance was found to be significant. These findings strongly suggest that personal attributes seem to contribute negligibly to the productivity facets on organizational effectiveness explaining 23.7, 41.7 and 43.1 percents of variance with regard to quality, quantity and efficiency respectively of which 43.1 percent of variance was found to be significant. These findings strongly suggest that personal attributes seem to contribute negligibly to the productivity dimension; but satisfaction facets that imply emotional integration with the job can promote greater productivity.

In line with the productivity dimension, adaptability dimension was also individually analyzed in relation to satisfaction in Model I and collectively alongwith personal attributes in Model II. As noted earlier, several satisfaction facets individually showed significant relationship to adaptability criteria; most significant in the order were found to be satisfaction with promotion, pay, co-worker and organization. However, in the regression model using stepwise method, satisfaction with co-worker, promotion and pay entered into the equation first and the facets of satisfaction indicated very small R^2 change which were statistically

Table 4: Stepwise regression results between satisfaction facets personal attributes and organizational effectiveness in Model I and Model II (N = 44)

| Organizational effectiveness variables as dependent variable | Job Satisfaction facets as independent | Model I | | | Personal attributes and job satisfaction facets | Model II | | | |
|--|--|----------|--------------------|----------------|---|----------|--------------------|----------------|--------|
| | | Simple r | R ² chg | R ² | | Simple r | R ² chg | R ² | |
| Quantity | Co-worker | .53* | .285* | .304* | Salary | .29 | .084 | .178 | |
| | Supervisor | .12 | .009 | | Age | -.00 | .040 | | |
| | Job | .08 | .003 | | Education | -.01 | .039 | | |
| | Promotion | .24 | .006 | | Service | -.05 | .014 | | |
| | Organization | .24 | .001 | | Satisfaction facets together | - | .237 | | .415* |
| | Pay | .18 | .000 | | | | | | |
| Quality | Co-worker | .60** | .365** | .528** | Services | -.20 | .041 | .165 | |
| | Organization | .60** | .120** | | Salary | .19 | .091 | | |
| | Promotion | .50* | .018 | | Age | -.17 | .023 | | |
| | Pay | .25 | .019 | | Education | .12 | .009 | | |
| | Supervisor | .34* | .006 | | Satisfaction facets together | - | .417 | | .528** |
| | Job | .33* | .002 | | | | | | |
| Efficiency | Promotion | .60** | .364** | .474** | Age | -.11 | .013 | .072 | |
| | Co-worker | .48** | .057 | | Salary | .11 | .043 | | |
| | Job | .21 | .047 | | Education | .00 | .015 | | |
| | Organization | .41** | .003 | | Service | -.05 | .000 | | |
| | Pay | .34* | .001 | | Satisfaction facets together | - | .431* | | .503** |
| | Supervisor | .20 | .000 | | | | | | |

** p < .01

* p < .05

nonsignificant. The percentages of variance for all the 5 variables of adaptability dimensions were found to be ranging from 15.7 percent to 34.9 percent.

Model II evaluated contribution of satisfaction facets over and above the contribution of personal variables. None of the personal variables related significantly to the criteria of adaptability; taken together their percentage of variance ranged from 4.4 to 14.9 percent. In comparison, satisfaction facets explained 14.9 to 33.2 percent of variance with respect to adaptability criteria. Taken together or alone, regression steps failed to identify a set of variables that showed statistically significant contribution. However, personal attributes and satisfaction facets together explained percentages of variance ranging from 20.6 to 43.3. Overall results suggested greater importance of satisfaction facets than the personal variables in the present study.

Discussion

As intuitively suggested by Mott (1972), the organizational effectiveness items formed two factors confirming the reasoning that there are basically two factors of organizational effectiveness. In the present analysis adaptability factor had five variables inclusive of flexibility item that has not been originally grouped together by Mott. The productivity factor distinctively had 3 variables, viz., quality, quantity, and efficiency. The internal structure of items clearly separated out those items that belonged to productivity without overlap with the corresponding factor of adaptability, but the adaptability items tended to suffer from some degree of overlap though the overlap was not very high. The results broadly suggested that refinement in the construct of organizational effectiveness is further possible by means of a focussed analysis of the meaning and contents of adaptability items, so that overlap between

Table 5: Stepwise Regression results between Job satisfaction facets, personal attributes and organizational effectiveness variables under adaptability dimension (Model I and II)

| Organizational effectiveness facets under adaptability | Job Satisfaction Facets | Model I | | | Personal attributes and satisfaction facets | Model II | | | |
|--|-------------------------|----------|---------------------|----------------|---|----------|---------------------|----------------|------|
| | | Simple r | R ² chg. | R ² | | Simple r | R ² chg. | R ² | |
| Anticipating Problem | Co-worker | .48** | .230* | .349* | Service | -.28 | .079 | .092 | |
| | Pay | .38** | .053 | | Age | -.16 | .009 | | |
| | Organization | .43** | .025 | | Salary | -.13 | .002 | | |
| | Supervisor | .15 | .039 | | Education | .10 | .002 | | |
| | Job | .22 | .000 | | Satisfaction Facets | - | .332 | | .424 |
| Keeping abreast of Changes | Pay | .40* | .158 | .185 | Service | -.09 | .009 | .044 | |
| | Supervisor | .27 | .025 | | Age | -.02 | -.023 | | |
| | Job | .21 | .002 | | Education | -.05 | .011 | | |
| | | | | | Salary | -.05 | .001 | | .238 |
| Quick adaptability | Promotion | .53** | .279* | .330 | Satisfaction facets | - | .284 | .433* | |
| | Co-worker | .36** | .021 | | Service | -.29 | .086 | | |
| | Organization | .41 | .009 | | Salary | .08 | .051 | | |
| | Job | .26 | .014 | | Education | .11 | .007 | | |
| | Supervisor | .18 | .005 | | Age | .21 | .004 | | .149 |
| | Pay | .29* | .001 | | | | | | |
| Prevalence of adjustment | Promotion | .37** | .136 | .157 | Satisfaction facets | - | .149 | .206 | |
| | Pay | .12 | .006 | | Age | -.21 | .045 | | |
| | Co-worker | .21 | .006 | | Education | .13 | .011 | | |
| | Organization | .16 | .003 | | Service | -.20 | .001 | | .057 |
| | Supervisor | .15 | .005 | | | | | | |
| Coping with emergencies | Promotion | .36* | .132 | .253 | Satisfaction facets | - | .201 | .274 | |
| | Job | .07 | .041 | | Salary | .11 | .013 | | |
| | Co-worker | .33* | .040 | | Age | -.05 | .018 | | |
| | Supervisor | .15 | .002 | | Service | .08 | .038 | | |
| | | .25 | .001 | | Education | .09 | .004 | | .073 |

** p < .01

* p < .05

the two factors could be reduced if not fully eliminated. When compared with adaptability dimension, productivity items appeared to be more specific and suffered less from being broad based resulting in an orthogonally independent set of variables.

Refinement in the construct of organizational effectiveness is further possible by means of a focussed analysis of the meaning and contents of adaptability items.

The perceptual measure of organizational effectiveness has been operationalised to offset the difficulty of obtaining tangible organizational data reflecting attainment of goals and missions of the organization. Although the perceptual criteria reflecting characteristics of effectiveness were obtained intuitively, an attempt was not made to define the attributes of effectiveness through a factor structure. (cf. Mott, 1972). Thus our attempt at verifying conceptual independence of items considerably added meaning and significance to the composite scales of productivity and adaptability. The mean values of productivity and adaptability tended to follow the pattern of a previous study (Sayeed, 1991) in that the productivity had relatively higher mean scores than the mean scores of adaptability. The ranking of both the measures across two studies had a perfect match. Also in comparison with Mott's data, the mean values of our study tended to be roughly comparable (Mott, 1972, p.31).

The application of Model I and II assessed the comparative value of personal attributes and facets of job satisfaction in terms of percentage of variance associated with each of the independent variables of the study. It was confirmed that the personal attributes contributed very little to organizational effectiveness, but the same was not true with regards to job satisfaction facets. Job satisfaction facets had significant impact on perceived organizational effectiveness. The evaluation of job satisfaction facets across Model I and II has unequivocally shown the significance of job satisfaction with respect to overall productivity and overall organizational effectiveness.

The relationship with individual items of organizational effectiveness showed similar trend with regard to items of productivity dimension, but it was less so for the items of adaptability dimension. However, the higher degree of relationship between job satisfaction and organizational effectiveness is consistently seen across models I and II. It appears to be an interesting circular linkage in that the

The organization through its human resource development policies and practices creates better environment for employees, resulting in greater satisfaction which in turn enhances organizational effectiveness.

organization through its human resource development policies and practices creates better environment for employees, resulting in greater satisfaction which in turn enhances organizational effectiveness. The aforementioned linkage rests on the premise that positive HRD practices make the employees respond to the desire of making themselves useful, relevant and growth-oriented. If this takes place, a major change in organizational problem solving will be seen resulting from responsiveness and/or work-oriented tendencies of the employees, ultimately resulting in a sense of satisfaction. Thus, in this sense linkage between satisfaction and effectiveness is justified for further theorization about possible connection between individual perception and the perception about organization level processes such as organizational effectiveness.

Satisfaction facets such as co-worker, organization, and pay contributed to perceived productivity a great deal, and satisfaction with co-worker, promotion and pay contributed more to adaptability facet of organization.

More specifically, satisfaction facets such as co-worker, organization, and pay contributed to perceived productivity a great deal, and satisfaction with co-worker, promotion and pay contributed more to adaptability facet of organization. In several respects, simple relationships between satisfaction and organizational facets were significant, but there were independent contribution of aforementioned satisfaction facets strongly suggesting that the job satisfaction facets meaningfully contribute to organizational effectiveness. On the contrary, the effect of personal attributes (job demographics) turned out to be negligible as a set of personal processes that entered the equation first. When percentages of variances between personal attribute and satisfaction facets were compared with each other it was apparent that satisfaction facets explained independently four times more percentage of variance in the organizational effectiveness than the personal attributes did.

In conclusion the relationship between employee satisfaction and perceived organizational effectiveness

signified the importance of employee morale, satisfaction and growth orientation. The satisfied perceived themselves to be working in an environment relatively more productive than adaptable even though adaptability was not totally rejected. The factors of effectiveness reflecting productive and adaptive environment were found to be distinctly representing the construct of organizational effectiveness.

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TRAINING MANUAL

A retailer, who had run a store for six or seven years, personally conducted all the training; she correctly thought it was a vital function. As the store grew to seventy five employees (with retail's typical high turnover, though hers was far below average), the task became almost impossible. She began to write a training manual, and was thinking about appointing someone to assist her as training manager. But that sounded bureaucratic to her, so she shifted gears and decided to ask her best people in each area if they would like to do some of the training. Would they ever! She was astonished by the outpouring of enthusiasm. Old hands signed up for even the most inconvenient shifts to train a newcomer. It became a major distinction to be chosen/allowed to train. And the enthusiasm—and talent—had been all there, lying untapped, during the prior two years, when the task had been getting beyond her control. Moreover, she readily admitted, "The quality of the training has gone way up, mainly as a function of the enthusiasm the new 'trainers' bring to it."

Source : Tom Peters,
A Passion for Excellence,
Collins, London, 1988

HRM Strategies for Employee Retention : Case of a Hong Kong Bank

Doreen Tan & Syed Akhtar

In Hong Kong, some organizations are adversely affected by high rates of employee turnover. Personnel specialists are called upon to identify human resource management strategies that promote employee retention. This case exemplifies how such strategies can be utilized to create the linkage between employees and the organization. It is argued that there is no single strategy which can adequately address the issue of employee turnover. Instead, a right mix of human resource management strategies within a holistic framework is advocated to ensure a sense of belonging.

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In Hong Kong, where opportunities for employment abound, organizations are faced with the challenge of maintaining a stable workforce. To this end, some employers have introduced a range of human resource management practices in the hope that employees will develop identification with and concern for the organizations in which they work.

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What follows is a case study of a local bank, referred to as the Hong Kong Mandarin Bank¹, which illustrates how human resource management strategies can indeed be successfully adopted to retain valued employees. The uniqueness of this bank lies in its characteristic Chinese ownership and its ability to maintain one of the lowest employee turnover rates of 9.9 per cent in the entire banking industry².

This study presents the report of a survey conducted within the organization to ascertain the impact of the selected human resource management practices on employees' intention to stay. For this purpose, a random sample of 110 employees was selected across different organizational levels. Instruments used for data collection included a checklist of human resource management practices, a turnover intention inventory and a background information questionnaire.

1. This case study is based on an actual bank. A pseudonym has been used to disguise the identity of the bank as requested by the management.
2. An earlier study found that the labour turnover rate for the banking industry ranges from 9.9% to 35% in Hong Kong. For details, see Wyatt Company. (HK) Ltd. (1991)

Company Background

Established in 1949, the Hong Kong Mandarin Bank offers a comprehensive range of banking products and services to the local community in Hong Kong. Besides traditional retail banking, it is also engaged in merchant banking, loan financing, trust fund management and joint-venture investment activities.

Operating in an increasingly sophisticated and competitive financial climate, the Hong Kong Mandarin Bank has steadily been making forays into the international arena in order to strengthen its business presence. Besides its thirty-eight branches and six subsidiary companies in the territory of Hong Kong, it has set up operations in four major business cities in China and in San Francisco, USA. Currently, the organization has slightly over 2000 employees in Hong Kong.

Through the years, in spite of attracting a growing clientele, the Hong Kong Mandarin Bank has remained faithful to its longstanding domestic customers. In its mission statement, the bank has expressed its commitment to the continued prosperity of Hong Kong and to serving its customers and growing with them. As on December 1991, it had total assets of HK\$44.6 billion, while business profits stood at HK\$443 million. These figures represent an increase of 0.09 per cent and 33 per cent respectively over the previous year.

The organizational structure of the Hong Kong Mandarin Bank has been designed to facilitate the growth of a service-oriented culture. Reporting to the Board of Directors are four management committees:

- General Management Committee
- Human Resource Management Committee
- Assets and Liabilities Management Committee
- Credit and Loans Management Committee.

The Human Resource Management Committee is particularly well represented on the Board of Directors in that three out of five members are Hong Kong Mandarin Bank directors, including the Chairman cum General Manager. Besides these committees, there are six main functional divisions to oversee the operations of various departments.

Strategic Human Resource Management

While the Hong Kong Mandarin Bank is unmistakably a local Chinese bank, its management of human resources does not, however, completely conform with the

approach that is normally associated with "traditional" Chinese banks³. In this bank, the human resource management policies have been integrated into the overall business goals. This raises the human resource management function to a strategic level.

The strategic human resource management policies attempt, among other things, to promote organizational commitment and retain valued employees. These policies are reflected in the following strategies:

- Finding the best fit
- Facilitating inclusion
- Developing competencies
- Rewarding the best
- Making a competitive deal
- Identifying potential
- Fostering a sense of belonging
- Keeping doors open

Finding the best fit : There are clearly defined recruitment and selection practices to ensure that prospective employees meet the job and organizational requirements. Job applicants are screened with a view to creating the best fit between the applicant and the job. The Hong Kong Mandarin bank does not place as much importance on educational qualifications and previous work experience as on the trainability of the applicants. This criterion is of particular importance given the explicit concern for cultivating its own class of employees. During job previews, applicants are given a realistic view of their jobs and what they can expect from the organization in the longer term. Besides, they are encouraged to voice their own expectations from the organization. At the beginning of the selection process, this practice eliminates those applicants who might not fit into the organization.

Facilitating inclusion : Given the emphasis on trainability, all new employees are introduced to the workings of the Hong Kong Mandarin Bank through a formal orientation programme. A special feature of this programme is the mentoring or "buddy" system whereby a longer-serving employee, who could either be the immediate superior or a colleague, guides the new employee during the first three months. During this period, the personnel

3. Traditional Chinese organisations are run in the style of family businesses. Their management is characterised by paternalism, centralisation of decision-making power, low level of specialization and differentiation, and an emphasis on harmonious relationship. See Bond (1986.)

department obtains feedback on the mentoring system so as to monitor it.

After the initial three months, a one-day "New Employees Seminar" is organized. Presentations are made on the history and development of the organization, personnel policies, staff welfare and training opportunities focussing on the quality of service and self-development. Conducting the seminar at this stage has more impact on new employees because by then they have learnt some of the ropes in the organization. The mentoring system together with the induction seminar have contributed towards inclusion and retention of employees in the organization.

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Developing competence : The HongKong Mandarin Bank has a well-equipped training and development department which uses a computerized system to record each individual staff-member's training path. Each employee is allocated an average training budget of HK\$3000 per year. In 1991, the department conducted over 500 training programmes, in different functional areas, which were attended by more than 3000 employees. This indicates that some employees had an opportunity to participate in more than one training programme. Besides the in-company programmes, selected employees were sponsored to attend external courses. These employees in turn would recommend such programmes to their colleagues and subordinates depending on the perceived benefits. Such a comprehensive and systematic training system reflects the organization's commitment to the continuous development of human resources.

Rewarding the best : Rewards in terms of promotion are based on a combination of performance, potential and seniority. However, outstanding employees may be promoted out of turn when vacancies arise. Candidates who are earmarked for promotion are interviewed and training is provided as deemed necessary for them to assume any new position of responsibility. The organization prefers internal promotions to external recruitments. Those who do not get promoted are counselled and given guidance on improving work performance in order to qualify for advancement. Since promotion exercises are conducted twice a year, these employees have subsequent opportunities for promotion. A consequence of rewarding the best is that some of those employees who are not promoted may leave the organization. This form of voluntary em-

ployee turnover is regarded by management as positive and acceptable.

Making a competitive deal : Employees generally receive competitive compensation packages in comparison with market rates. The inflation rate is taken into consideration during salary reviews which are conducted regularly. Pay adjustments also take into account the findings of surveys on salaries and wages in Hong Kong. Such progressive payment system pre-empts employees from looking for similar positions elsewhere.

The organization has a bonus scheme based on the annual turnover which is distributed according to individual performance and position at different organizational levels. There are other benefits such as preferential-interest loans, subscription-free credit cards, educational subsidies, insurance plans, retirement schemes, paid annual holidays, and medical and hospitalization benefits. The whole remuneration package is comparable with that offered by local competitor banks.

Identifying potential : The Hong Kong Mandarin Bank has a systematic procedure to evaluate performance. The underlying objective is to identify and develop employee potential and establish a link between performance and reward. Annual appraisals are initially conducted by employees through completion of a self-evaluation form. Employees are encouraged to communicate their expectations, concerns and needs, and to offer any work-related suggestions. On the basis of self-appraisals, an appraisal meeting is arranged with the immediate supervisor to discuss both management and employee expectations. A course of action is then planned for future employee development in the organization.

Encouraging employee participation : The organization introduced quality circles three years ago with the view to promote employee participation and involvement. It is obligatory for every employee to join the quality circle.

Quality circle meetings are held during or after office hours. Noteworthy suggestions are translated into action plans and implemented either by the quality circle members themselves or by the responsible departments. A best "Quality Circle" competition is held annually.

Noteworthy suggestions are translated into action plans and implemented by quality circle members or by the responsible departments.

Fostering a sense of belonging : Regular social and recreational activities in each work unit or branch are usually arranged after quality circle meetings. In addition, there are organization-wide social functions such as an annual picnic and annual dinner. These have the dual purpose of fostering a sense of belonging among employees while allowing management the opportunity to communicate important organizational objectives and goals to employees in an informal setting.

Keeping doors open : The Hong Kong Mandarin Bank has an open-door policy whereby employees are encouraged to communicate their concerns and grievances to the management. Staff in the Personnel Department are available everyday after office hours to hear grievances. Grievances are rare, but those that are verbalized are usually related to relationships at work and requests for transfers rather than to substantive issues of terms and conditions of employment.

The Hong Kong Mandarin Bank has an open-door policy whereby employees are encouraged to communicate their concerns and grievances to the management.

Survey Results

A survey was carried out among 110 randomly selected employees of the Hong Kong Mandarin Bank to investigate the impact of human resource management practices on turnover intention. The majority of respondents were young with a basic education, and most of them had spent considerable time in the organization. Details of the respondents' background characteristics are presented in Table 1.

Employee turnover intention : Turnover intention was measured through an inventory based on five items from Mowday's Organizational Commitment Questionnaire⁴. Factor analysis was a seven-point scale, ranging from 'strongly agree' to 'strongly disagree'. Univariate analysis showed that the mean turnover intention of the sample was 3.4 with a standard deviation of 1.1. This indicates that the respondents had a low to moderate level of turnover intention. In other words, most of the respondents had a desire to stay in the organization. This finding corroborates

4. The five items for measuring turnover intention were taken from the Organizational Commitment Questionnaire. The complete questionnaire is available in Mowday et. al (1982).

TABLE 1: Background Characteristics of the Sample (N = 110)

| Variable | Category | Percentage |
|--|-----------------------|------------|
| Sex | Male | 41.8 |
| | Female | 58.2 |
| Age | Upto 29 years | 60.0 |
| | 30 - 39 years | 30.0 |
| | 40 years and above | 10.0 |
| Marital Status | Single | 53.6 |
| | Married | 46.4 |
| Education | Upto secondary school | 77.3 |
| | Post-secondary school | 11.8 |
| | University degree | 10.9 |
| Years of full-time working experience | Upto 5 years | 30.0 |
| | 6 - 10 years | 38.2 |
| | 11 - 15 years | 19.1 |
| Years of service with present organization | 16 years and above | 12.7 |
| | Upto 5 years | 45.5 |
| | 6 - 10 years | 28.2 |
| Position | 11 - 15 years | 14.5 |
| | 16 years and above | 11.8 |
| | General staff | 58.2 |
| | Middle management | 36.4 |
| | Senior management | 5.4 |

the actual low employee turnover rate which stands at 9.9 percent.

Data were further analyzed in terms of high-and low-turnover intention groups (HTOI and LTOI). Table 2 shows that the mean differences between the two groups were significant in respect of age, marital status, length of service and job position. This reflects that older and married employees with longer years of service in the organization tend to have a higher inclination to stay. These employees were primarily found in middle management positions. Sex was not a significant factor in employees' turnover intention.

Human resource management practices. Respondents were given a checklist consisting of nine human resource management practices to score in terms of importance and satisfaction on a seven-point scale. Higher scores reflected higher importance and higher satisfaction. The human resource management checklist included the following areas :

- Advancement in the organization
- Quality of training provided
- Use of special aptitude/training
- Level of responsibility

TABLE 2: Mean Differences Between High and Low Turnover Intention Groups w.r.t. Background Characteristics

| Variable | LTOI (n = 18) | HTOI (n = 19) | MD | t |
|--|----------------|----------------|------|--------|
| | Mean/SD | Mean/SD | | |
| Sex | 1.61 (0.50) | 1.74 (0.45) | 0.13 | 0.80 |
| Age | 3.00 (0.91) | 2.37 (0.60) | 0.63 | 2.51** |
| Education | 2.67 (1.88) | 2.05 (0.52) | 0.62 | 2.05* |
| Marital Status | 1.83 (0.38) | 1.47 (0.51) | 0.36 | 2.40* |
| Years of full-time working experience | 3.72 (0.02) | 3.21 (0.92) | 0.51 | 1.61 |
| Years of service with present organization | 3.78 (1.11) | 2.89 (0.99) | 0.89 | 2.55* |
| Position | 1.89 (0.38) | 1.26 (0.45) | 0.63 | 3.32* |

Note: LTOI = Low Turnover Intention Group

HTOI = High Turnover Intention Group

MD = Mean Difference;

t values were computed to test significance of mean differences;

Positive and negative signs were removed.

*p < 0.05

**p < 0.01

- Compensation
- Job security
- Participation in decision-making
- Relationships with colleagues
- Relationships with supervisors

Data were analysed to find out the differences between low and high-turnover intention groups with respect to the above human resource management practices. Results presented in table 3 show that importance ratings given by the two groups to the selected human resource management practices ranged from moderate to high for both groups. Between the two groups, however, the low-turnover intention group gave significantly high ratings to job security. (MD + .86, p < .01) and relationships with colleagues (MD = .80, p < .01).

Table 4 indicates that the mean scores for satisfaction ranged from 4.67 to 6.00 for the low-turnover intention group and from 3.00 to 5.00 for the high-turnover intention group. The low-turnover intention group had significantly higher levels of satisfaction with all the human resource management practices than the high-turnover intention group. Respondents in this group were most satisfied with

TABLE 3: Mean Differences Between High and Low Turnover Intention Groups w.r.t. Importance Attached to HRM Practices

| Variable | LTOI (n = 18) | HTOI (n = 19) | MD | t |
|-------------------------------|----------------|----------------|------|-------|
| | Mean/SD | Mean/SD | | |
| Advancement | 5.11 (1.41) | 5.68 (1.63) | 0.57 | 1.14 |
| Quality of training | 5.77 (1.11) | 5.79 (1.18) | 0.02 | 0.03 |
| Use of aptitude | 5.11 (1.13) | 4.79 (1.08) | 0.32 | 0.88 |
| Responsibility | 5.00 (1.19) | 4.63 (1.53) | 0.37 | 0.81 |
| Compensation | 6.17 (1.20) | 6.10 (1.10) | 0.07 | 0.16 |
| Job security | 6.28 (0.89) | 5.42 (1.26) | 0.86 | 2.40* |
| Employee participation | 4.44 (1.25) | 4.53 (2.14) | 0.09 | 0.14 |
| Relationship with colleagues | 6.33 (0.97) | 5.53 (1.07) | 0.80 | 2.40* |
| Relationships with Supervisor | 6.17 (0.98) | 5.58 (1.46) | 0.59 | 1.42 |

Note. LTOI = Low Turnover Intention Group, HTOI = High Turnover Intention Group;

MD = Mean Difference;

t Values were computed to test significance of mean differences; Positive and negative signs were removed.

*p < 0.05

job security (M = 6.00) followed by relationships with colleagues (M = 5.89), the same two human resource management practices which they perceived as most important. Interestingly, they were only moderately satisfied with compensation (M = 4.67). In contrast, the high-turnover intention group expressed relatively less satisfaction with advancement (M = 3.00) followed by participation (M = 3.05) and compensation (M = 3.31). It may be noted that this group had given highest importance to compensation.

These findings suggest that the selected human resource management practices are generally valued by employees and do contribute towards employee retention. The more important practices include those which promote job security and satisfying work relationships. As a matter of fact, the Hong Kong Mandarin Bank has embarked on business expansion which means, among other things, the creation of more job and promotion opportunities. Besides, termination of staff is rare in the

TABLE 4: Mean Differences Between High and Low Turnover Intention Groups w.r.t. Satisfaction with RM Practices

| Variable | LTOI (n = 18) Mean/SD | HTOI (n = 19) Mean/SD | MD | t |
|-------------------------------|--------------------------|--------------------------|------|--------|
| Advancement | 5.20 (1.31) | 3.00 (1.41) | 2.20 | 4.95** |
| Quality of training | 5.28 (1.56) | 3.84 (1.30) | 1.44 | 3.04** |
| Use of aptitude | 5.56 (0.92) | 3.79 (0.03) | 1.77 | 5.50** |
| Responsibility | 5.11 (0.96) | 3.84 (0.96) | 1.27 | 4.02** |
| Compensation | 4.67 (1.53) | 3.31 (1.42) | 1.36 | 2.80** |
| Job security | 6.00 (0.91) | 4.74 (1.37) | 1.26 | 3.30** |
| Employee participation | 4.78 (0.81) | 3.05 (1.39) | 1.73 | 4.57** |
| Relationships with colleagues | 5.89 (0.76) | 5.00 (1.25) | 0.89 | 2.60* |
| Relationships with Supervisor | 5.56 (1.15) | 4.16 (1.54) | 1.40 | 3.19** |

Note. : LTIO = Low Turnover Intention Group,

HTOI = High-Turnover Intention Group;

MD = Mean Difference;

t Values were computed to test significance of mean differences; Positive and negative signs were removed.

*p < 0.05

**p < 0.01

organization. This therefore provides an added measure of security in the context of Hong Kong, where retrenchment is not unusual and where even the law does not provide for unfair dismissal. Furthermore, the high incidence of mergers and acquisitions in the banking sector coupled with the recent liquidation of the Bank of Credit and Commerce Hong Kong have understandably caused employees to place a greater value on job stability.

It is obvious that relationships at work do matter a great deal to the employees. With the introduction of a variety of mechanisms aimed at promoting interpersonal relationships, such as mentoring, quality circles and other social events, employees become better acquainted with one another and with the organization. Such involvement also contributes towards 'bonding' of the employee to the organization.

Another noteworthy finding is that while both the groups attached high importance to compensation, they

While monetary rewards may be a potent force influencing employee turnover intention, the extent of its impact depends on its interaction with a combination of other human resource management practices.

were only moderately satisfied with it. This seems to suggest that while monetary rewards may be a potent force influencing employee turnover intention, the extent of its impact depends on its interaction with a combination of other human resource management practices. By implication, therefore, human resource management practices have to be viewed as a whole in order to promote employee retention.

Discussion and Conclusions

At a first glance, it would seem that employees take first priority in the HongKong Mandarin Bank. However, on deeper analysis, the approach to human resource management within this organization takes on the semblance of a paternalistic welfare model, where the concern for providing quality service to the customer forms the basis of much of the carefully selected human resource management practices.⁵

Recognizing that quality service to customers can best be provided through quality workforce, the management has integrated the human management function with strategic business planning. As noted earlier, the human resource management function is well embedded in the organizational structure in that the Chairman of the Board also chairs the Human Resource Management Committee. Human resource management policies therefore cohere with other business elements and in themselves form a wholesome pattern.

Recognizing that quality service to customers can best be provided through quality workforce, the management has integrated the human management function with strategic business planning.

5. The paternalistic welfare model is typified by "a concern for the customer leading to careful selection, training and treatment of staff, a concern for staff resulting in excellent staff management and welfare facilities and a senior management in touch with and responsive to the concerns of staff, community and customers" (See Guest, 1987).

Within the paternalistic welfare model, the management seems to have made strategic choice in the selection and retention of employees. Central to these choices the following themes: belief in human potential, concern for employee development and individualism within collectivism.

Lest the paternalistic welfare model be taken as a universal panacea for employee turnover, it must be added that there are other approaches to human resource management which may be equally effective in addressing the issue under different circumstances⁶. A primary consideration is the extent of relevance of the chosen approach to the cultural realities of the organization. In the case of Hong kong Mandarin Bank, the paternalistic welfare model matches the Chinese culture within which it operates.

Although it is difficult to generalize, certain lessons for employee retention can still be drawn from this case:

It is important to design human resource management strategies based on an accurate identification and recognition of employees' needs. In other words, human resource management strategies need to be shaped and periodically reviewed in terms of 'what employees value'.

No single human resource management strategy in isolation can be regarded as the answer to employee turnover. This case highlights the need for adopting a holistic approach to identify the right combination of human resource management strategies appropriate to a particular context.

It is also crucial to define the focus of each human resource management strategy and to ascertain whether these strategies cohere with one another. In this, the Hong kong Mandarin Bank has ensured individual-organization

compatibility, management-employee communication and feedback, and commitment to employee development and growth within an overriding concern for fostering a sense of belonging.

Effort at promoting employee retention is an on-going process. Though it is essential to develop employee-organizational linkage through a right mix of human resource management strategies, this is not a sufficient condition for sustaining it. The Hong kong Mandarin Bank conducts both internal and external surveys and accordingly reviews its human resource management strategies to ensure comparability and equity with its competitors in the market. In the process, it has been able to keep employee turnover low.

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6 The other human resource models identified by Guest (1987) are: human resource model, production model, professional model.

Multivariate Analysis of Job Satisfaction Using Linear Discriminant Analysis

J.C. Nwachukwu

The analysis of job satisfaction, as is true of behavioural research generally, comprises several different dimensions. Rarely can the complex behaviour observed in the work environment be traced to a single stimulus; consequently most behavioural research requires the use of multivariate statistical methodology.

The results of the analysis showed that in terms of job satisfaction considering the three variables, (work, pay and promotion taken together), there was no significant differences between production and non-production managers; between graduate and non-graduate production managers; between production managers in different company size categories and between managers at different management levels. There were differences in job satisfaction of different age categories. The older managers were more likely to score higher on work and pay dimensions.

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Today, there is a recognition that managerial talent is of critical importance to the British manufacturing industry. This awareness has been brought about by the increasing inability of production management to attract young and able personnel in sufficiently high numbers. Rapid strides in affluence, cultural values and general and technological education for all mean that people's expectations in their jobs are now much higher than what they were two decades ago. The lack of appeal of production management can be attributed to its failure to meet these expectations resulting in job dissatisfaction.

A study of managerial perception (Haire et al. 1966) in thirteen nations showed that managers in all the countries without exception ranked different need areas in terms of their importance to them, in the following order; self-actualization, autonomy, security, and social esteem. This shows that managers attach more importance to higher-order needs. Those types of jobs where these needs cannot be fulfilled will tend to be unpopular.

Rapid strides in affluence, cultural values and general and technological education for all, mean that people's expectations in their jobs are now much higher than what they were, two decades ago.

If the top management making policy level decisions and the individuals themselves, knew more about the psychological aspect of production management jobs and how these requirements affect job satisfaction, then recruitment, promotion, training and other personnel errors might be significantly reduced.

It has been proposed by Triandis (1959) and Lawler and Porter (1968), among others, that the perception by managers of certain psychological relationships between their personal needs and their jobs is a major determinant

in the attainment of organizational goals. The job perceptions of production managers will enable management to understand some aspects of their motivational problems.

Purpose of the Job Satisfaction Study

Linear Discriminant Analysis has been used

- i) To explore the interrelationship between job satisfaction and demographic, organizational and structural variables.
- ii) To compare the mean job satisfaction scores of production managers at various managerial and educational levels.
- iii) To compare the job satisfaction scores of production managers with that of managers in other functions.

Null Hypothesis

In order to delimit the scope of the study, the following hypotheses were set up.

- (i) The vectors of the mean scores for the individual components of the Job Descriptive Index (work, pay and promotion) are not significantly different for
 - (a) graduate and non-graduate production managers;
 - (b) production and non-production managers.
- (ii) Managers in different company size categories.
- (iii) Managers at different levels of management.
- (iv) For various age groups.
- (v) Demographic variables and job features cannot be used to predict the level of satisfaction in work itself.

Procedure

Two separate questionnaire booklets were designed for the study. The first was meant to gather data on personal details of production managers, demographic variables and several aspects of job satisfaction and organizational variables. The second was designed to gather personal and job data from non-production managers.

The questionnaire was sent by mail to four hundred randomly selected manufacturing companies. The companies were selected from all the regions of England and Wales through the Kompas Company Information Services. The questionnaires were to be completed by managers in the production function including those whose positions in the company lay between the inclusive limit of

a manager immediately senior to a production superintendent and the director for production. The second questionnaire booklets aimed at measuring demographic factors and job satisfaction of non-production managers in industry, were sent to one hundred randomly selected manufacturing companies throughout England and Wales to be completed by managers in functions other than production.

Research Instruments

The survey instruments consisted of three parts. The first part entitled "Background Details" asked questions designed to measure job features and personal characteristics variables. The second part was Job Descriptive Index which measured job satisfaction. The third part consisted of interval scales which were used to measure the production manager's perception in decision making, influence and autonomy in their jobs.

Coding of the Variables

Management Levels

The management levels of respondents were not based on their actual decision-making position in their respective organization. They were based on the Hay-MSL job evaluation levels. The levels in the analysis were purely tentative. The managers were categorized into middle, senior and top management.

Educational Levels

The classification of qualifications into several educational levels was largely based on government classifications as of 1971. (Studies of official statistics).

Statistical Methodology

The analysis of job satisfaction, as is true of behavioural research generally, comprises several different dimensions. Rarely can the complex behaviour observed in the work environment be traced to a single stimulus, consequently most behavioural researches require the use of multivariate methodology (Kerlinger, 1973). Univariate analysis may lead researchers to conclude that two groups

Rarely can the complex behaviour observed in the work environment be traced to a single stimulus, consequently most behavioural researches require the use of multivariate methodology.

are different on several dimensions when in fact the dimensions measure the same things, or nearly so. In addition, univariate analysis may fail to detect some differences between groups (Kerlinger & Pedhazur, 1973).

Hypotheses i), ii), iii) and iv) were tested using linear discriminant analysis, which is a multivariate statistical method. Computation was carried out by the statistical package for the social science subprogramme "Discriminant".

The usual objective of a discriminant analysis is to classify objects or individuals, by a set of independent variables, into one or two or more mutually exclusive and exhaustive categories. For example, on the basis of an individual's age, income, education etc. Another procedure is to assign individuals to two or more groups on the basis of their scores on two or more tests or scales.

The above objectives were not the concern in this analysis. Rather linear discriminant analysis was used to :

- (i) determine the importance (as shown by the standardized discriminant function coefficient) of the independent variables, in separating the groups of managers
- (ii) determine the distance between the centroids of the groups and thus obtain a multivariate F. statistics which was then used to see if the groups were statistically different from each other. Consequently linear discriminant analysis was used in descriptive rather than in predictive manner.

The independent variables used in this analysis were the three components of job descriptive index, (Work, pay and promotion) while the dependent variables were the group categories (0, 1, 2, 3).

Stepwise Method of Discriminant Analysis

A stepwise (Wilks) method was chosen for the analysis. In stepwise method, independent variables are selected for entry into the analysis on the basis of their discriminating power. In many instances, the full set of independent variables contains excess information about the group differences or perhaps some of the variables may not be very useful in discriminating among the groups. By sequentially selecting the "next best" discriminator at each step, a reduced set of variables is found which is almost as good as, and sometimes better than, the full set (Klecka, 1975).

The Wilks criterion was chosen for the analysis. It is the overall multivariate F. ratio for the test of differences among the group centroids. The variable which maximizes the F ratio also minimizes Wilks Lambda; a measure of group discrimination. This test takes into consideration the differences between all the centroids and the cohesion (homogeneity) within the groups.

Hypothesis (v) was tested using stepwise multiple regression sub-programme of statistical package for social sciences. The dependent variable was "satisfaction with work" as measured by Job Descriptive Index. The independent variables were age of respondent, educational level, managerial level, and perceived degree of autonomy, influence and participation in decision making in his job.

Results and Analysis

Using a linear discriminant analysis with Wilks criterion, null hypotheses i), ii), and iii) were accepted; the Lambda statistic (λ) was not statistically significant in each case. This means that, in terms of job satisfaction, (the three variables—work, pay and promotion taken together), there were no significant differences between production and non-production managers; between graduate and non-graduate production managers; between production managers in different company size categories; and between managers at different management levels (Tables 1-5). Looking at the standardized discriminant functions, the most important variable separating production and non-production managers was pay, while that separating graduate and non-graduate production managers was promotion.

Null hypothesis (iv) was rejected at $P < .001$. The test statistic Wilks Lambda (λ) was 0.81240. (Table 4). The most important variable separating the three age groups was promotion. The continuum of centroids shows that the responses of the three groups were totally different. The negative sign for work and pay for the standardized discriminant function coefficient, means that the (46-55) years old managers are more likely to score higher (indicating satisfaction) on the two dimensions than the (26-35) year-old production managers. The (46-55) year-old managers were more likely to score low on promotion than other age groups. The younger groups were more satisfied with promotion.

Hypothesis number (v) was tested using a stepwise multiple regression equation analysis. The F ratio of the multiple regression was statistically significant at $P \leq 0.01$. The multiple correlation was 0.4066 ($R^2 = .16535$). (Table 6). Thus R^2 was significantly greater than zero but

TABLE 1: Analysis of Differences in Job Satisfaction Among Production and Non-Production Managers.

| Mean Job Satisfaction Scores (J.D.I) | | | | |
|--|----------------------|--------------------------|--------------|---------|
| | Work | Pay | Promotion | N |
| Production Managers | 38.42 | 16.27 | 14.10 | (144) |
| Non-Production Managers | 38.16 | 16.74 | 14.44 | (54) |
| Standardized Discriminant function Coefficient | | | | |
| Variable | Function Coefficient | | | |
| Work | 0.62939 | | | |
| Pay | -0.79040 | | | |
| Promotion | -0.29267 | | | |
| Group Centroids | | | | |
| Production Managers | 0.02718 | | | |
| Non-Production Managers | -0.07098 | | | |
| Step No | Variable | No. of variables entered | Wilks Lambda | Sig (P) |
| 1 | Work | 1 | 0.98859 | 0.648 |
| 2 | Pay | 2 | 0.98819 | 0.841 |
| 3 | Promotion | 3 | 0.99805 | 0.946 |

Table 2: Analysis of Differences in Job Satisfaction Among Graduate and Non-Graduate Production Managers.

| Mean Job Satisfaction Scores (J.D.I) | | | | |
|--|------------------|------------------|--------------|---------|
| | Work | Pay | Promotion | N |
| Graduates | 37.14 | 15.14 | 14.28 | (42) |
| Non-Graduates | 37.73 | 16.73 | 14.08 | (96) |
| Standardized Discriminant function Coefficient | | | | |
| Variable | Function | | | |
| Work | 0.14964 | | | |
| Pay | -0.06905 | | | |
| Promotion | -0.06950 | | | |
| Group Centroids | | | | |
| Production Managers | 0.08245 | | | |
| Non-Production Managers | -0.18846 | | | |
| Step No. | Variable entered | No. of variables | Wilks Lambda | Sig (P) |
| 1 | Work | 1 | 0.98859 | 0.212 |
| 2 | Pay | 2 | 0.98482 | 0.356 |
| 3 | Promotion | 3 | 0.98448 | 0.551 |

Table 3: Analysis of Differences in Job Satisfaction Among Production Managers at Different Management Levels

| Mean Job Satisfaction Score | | | | |
|--|------------------|--------------------------|--------------|---------|
| | Work | Pay | Promotion | (N) |
| Middle Mgt. | 35.5 | 15.33 | 13.77 | (36) |
| Senior Mgt. | 38.4 | 16.11 | 14.94 | (54) |
| Top Mgt. | 40.10 | 17.50 | 13.85 | (48) |
| Standardized Discriminant Function Coefficient | | | | |
| Variable | Function | | | |
| Work | -0.8706 | | | |
| Pay | -0.466 | | | |
| Promotion | -0.163 | | | |
| Group Centroid | | | | |
| Middle Mgt | 0.37441 | | | |
| Senior Mgt. | 0.01449 | | | |
| Top Mgt. | -0.29710 | | | |
| Step No. | Variable entered | No. of variables entered | Wilks Lambda | Sig.(P) |
| 1 | Work | 1 | .94595 | 0.024 |
| 2 | Pay | 2 | .93525 | 0.061 |
| 3 | Promotion | 3 | .92666 | 0.116 |

Table 4: Analysis of Differences in Job Satisfaction Among Production Managers in Different Size Company

| Mean Job Satisfaction Scores | | | | |
|--|------------------|-------------------------|--------------|--------|
| Company Size/ Variable | Work | Pay | Promotion | (N) |
| 0-49 | 39.06 | 16.96 | 12.46 | (30) |
| 500-1000 | 37.23 | 14.96 | 15.05 | (57) |
| 100 + | 38.66 | 17.33 | 14.43 | (51) |
| Standardized Discriminant Function Coefficient | | | | |
| Work | -0.375 | | | |
| Pay | -0.828 | | | |
| Promotion | -0.564 | | | |
| Group Centroid | | | | |
| 0-499 | -0.252 | | | |
| 500-1000 | 0.258 | | | |
| 1000 + | -0.140 | | | |
| Step No. | Variable entered | No. of variable entered | Wilks Lambda | Sig(P) |
| 1 | Pay | 1 | 0.973 | 0.160 |
| 2 | Promotion | 2 | 0.952 | 0.162 |
| 3 | Work | 3 | 0.946 | 0.248 |

Table 5: Analysis of Differences in Job Satisfaction Among Production Managers of Different Age Categories

| Mean Job Satisfaction Scores | | | | |
|--|----------------------|-----------------|--------------|----------|
| | Work | Pay | Promotion | (N) |
| (26 - 35) years | 34.65 | 13.91 | 15.30 | (23) |
| (36 - 45) years | 36.84 | 16.86 | 15.7 | (50) |
| (46 - 55) years | 40.58 | 16.97 | 11.84 | (65) |
| Standardized Discriminant function Coefficient | | | | |
| Variable | Function Coefficient | | | |
| Work | -0.71199 | | | |
| Pay | -0.56318 | | | |
| Promotion | 0.80897 | | | |
| Group Centroids | | | | |
| (26 - 35) years | 0.68921 | | | |
| (36 - 45) years | 0.27933 | | | |
| (46 - 55) years | 0.45875 | | | |
| Step No. | Variable entered | No. of Variable | Wilks Lambda | Sig. (P) |
| 1 | Pay | 1 | 0.910 | .002 |
| 2 | Promotion | 2 | 0.856 | .000 |
| 3 | Work | 3 | 0.812 | .000 |

Table 6 : Multiple Regression Analysis of Job Satisfaction - (Work Dimension)

| |
|---|
| Dependent Variable: - Work Satisfaction (J.D.I.). |
| R = 0.40662. |
| R ² = 0.16534 |
| R ² adjusted = 0.12174 |
| F ratio = 3.7 |
| Probability of F ratio = P < 0.01 |
| Standard error of estimate = 6.2558. |

it was rather small, while the standard error of estimate was appreciably small, indicating a higher reliability in prediction. The result means that 16.53 per cent of the variables in work satisfaction were explained by age of respondent, educational level, managerial level, perceived participation in decision-making, perceived autonomy enjoyed by respondent and time in present position. Only one variable, age was statistically significant; $P < 0.05$.

Discussion

It has often been assumed that production managers on the average are very poorly paid relative to managers in other functions (New 1976, Business Graduate Association 1977). While this may be true in terms of relative salary levels, production managers appear as satisfied (with pay) as managers in other functions, as evidenced from the study. If the production manager is satisfied with his pay despite the reported relative disadvantage, it means that he may be gaining some intrinsic benefits or rewards in his job, which compensate for lack of higher pay. In other words production managers as a group appear to attach less importance to the level of pay than other managers.

Some commentators have also blamed the failure of production management, (as a vocation) to attract college and university graduates, on the low status and poor remuneration (Nicholson, 1976). While this may be true with regards to low status, the same may not be true with remuneration, because the evidence from this study suggests that there are no significant differences in job satisfaction between graduate and non-graduate production managers. In the light of this result, one could argue that those graduates who abandon production management in favour of other jobs, are probably unsuitable for this type of vocation. This result is in contrast to the findings of Maher and Klein (1966). They found in a sample of 727 first level managers in an electronics firm, that higher education was associated with relative dissatisfaction with pay. They compared the pay satisfaction of graduates with that of non-graduate first line managers. However, there appears to be a clear distinction between Maher's sample and the present study's respondents in that this study consisted of middle, senior and top management.

The results also show that job satisfaction among production managers does not depend on the size of one's firm, neither does it depend on the managerial levels of individuals. The latter result (on managerial level) contrasts with the findings of Rosen (1961), which showed that higher level managers tended to report more satisfaction than lower level managers. The results of this study

confirm Vroom's (1964) suggestion that job satisfaction depends on individual perception and personality.

Job satisfaction (work, pay and promotion taken together) was found to be statistically different for various age groups. The (46-55) year group were more likely to score low (indicating lower satisfaction) on promotion. This is not surprising since a high proportion of these managers with perhaps relatively lower qualifications have progressed from the ranks of the operatives to their present positions (a feature of British production management). Such career profile tends to be promotionally disadvantageous. This group of managers have worked exclusively in production and therefore lacked broadening experience which would have enhanced their chances of promotion. An examination of the sample characteristics shows that 42 percent of the production managers had not worked outside the production function.

The (46-55) year group of managers were more satisfied with pay and work than the younger managers. Their higher satisfaction with work is in agreement with previous studies which suggested that job satisfaction increases with age. (Benge & Capwell, 1947). This tendency for job satisfaction to increase with age is due perhaps to the fact that the individual has had enough time to adjust to that aspect of the job which does not favour him.

If production managers' lots are no worse than other managers in terms of job rewards or outcomes, and yet the function lacks appeal, it could mean that intrinsic job rewards such as self-actualization, achievement and esteem are the missing values.

The results of this job satisfaction survey suggest that production managers are satisfied with their job in terms of work, pay and promotion, as much as other managers in different functions. The results also show that graduate and non-graduate production managers are no different in terms of these job outcomes. If production managers' lots are no worse than other managers in terms of these job rewards or outcomes, and yet the function lacks appeal, then something other than extrinsic job rewards must be missing in that vocation. It could mean that intrinsic job rewards such as self-actualization, achievement and esteem are the missing values. If this is true, then top management could improve the attractiveness of production management by injecting those motives or needs in the job which tend to satisfy these intrinsic rewards. These motives include the individual's need for growth and devel-

opment, the opportunity for independent thought and action, the opportunity for participation in the setting of goals, and the authority connected with his management position. The need for such higher level outcomes is demonstrated by the statistically significant positive relationship found between satisfaction with work and the following variables: perceived autonomy, influence and participation in decision making. Recent studies show that production managers do not appear to be happy with their perception of these intrinsic outcomes (Business Graduate Association 1977).

Production management would probably become more popular as a vocation, when production managers begin to report higher need satisfaction in these higher order rewards.

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PRODUCTIVITY IN RESEARCH

A department administer in a research hospital came up to Tom after a seminar he gave for the Association of Western Hospitals. Her story was an involved one, but it boiled down to just a couple of sentences. About a year before, with each of her groups she had taken a new tack on managing. "My approach was to tell people in the department, 'Do whatever you want to as long as it's legal and within the budge.'" She said that she'd provided virtually no guidelines beyond that. The results? "I was astounded. Research productivity in the department, in terms of papers produced and accepted for publication, for instance, increased by a factor of six! And all within less than a year. I still can't believe it. Do you think the ownership phenomenon is really that potent?" Yes.

Source : Tom Peters, A Passion for Excellence, Collins, 1985

Strengths & Weaknesses of Senior Executives

T.V. Rao & Tamil Selvan

A survey of strengths and weaknesses of senior executives was undertaken in the context of increased use of self-awareness and personal growth programmes in the country and the introduction of open appraisal systems to enhance development through feedback and counselling.

It was found that senior executives frequently mentioned managerial and human relations competences as the qualities contributing to managerial effectiveness. Subordinates have felt that, improving interpersonal relationship, communication and time management would further enhance the effectiveness of their bosses. The study brings out the relevance of personal development and human relations skill to management.

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Behavioural scientists opine that an increased awareness of one's own strengths and weaknesses enhances one's personal effectiveness as well as managerial effectiveness. Such an awareness: (i) enables an intelligent choice of situations so as to use one's strengths and enhance the chances of success or effectiveness; (ii) leads to avoidance or better management of situations that expose one's weaknesses; and (iii) helps the individual to build on the strengths and overcome the weaknesses. More the awareness, more the movement towards exploration and growth of inner potential.

Sensitivity training or T-groups, and other forms of personal growth laboratories frequently used in professional management and applied behavioural science worlds are based on such beliefs and aim at self-discovery, insight and self-awareness. Attempts are made in these laboratories to help the individual explore his potential through experimentation and also become aware of his blind spots through feedback from others.

Sensitivity training or T-groups, and other forms of personal growth laboratories frequently used in professional management and applied behavioural science worlds are based on such beliefs and aim at self-discovery, insight and self-awareness.

While it is accepted that self-awareness facilitates effectiveness, very little has been done in the past to identify the qualities that contribute to managerial effectiveness. Studies using performance appraisal have not indicated any consistent results about the qualities that contribute to managerial effectiveness. Organizations assume that qualities like initiative, team spirit, creativity, dynamism, perseverance etc., contribute to managerial effectiveness. Most organizations believe that performance appraisals and review discussions should be used as instru-

ments of enhancing self-awareness and through it the growth and development of the employee. In the context of introduction of self-awareness and personal-growth programmes in the country and increased use of open appraisal systems to enhance development through feedback and counselling, this survey was undertaken.

Objectives

This survey was undertaken to find out the following:

1. Characteristics or qualities that are perceived by Indian managers as contributing to their effectiveness.
2. Characteristics or qualities that are perceived as hindering the effectiveness of Indian managers.
3. Most-frequently-mentioned strengths of Indian managers by their subordinates.
4. Most-frequently-mentioned weaknesses of Indian managers by their subordinates.
5. Qualities/characteristics on which there is a good degree of agreement in the perceptions of their subordinates.

Methodology

In the first study, 85 senior executives attending a senior executives' programme were asked to recapitulate their managerial work life and identify their own qualities that helped them to be effective/ineffective in specific situations. In the second study, 73 senior executives attending another senior executives' programme were studied for their subordinates' perception of their strengths and weaknesses. Each senior executive was sent a set of questionnaires for distribution to the subordinates directly supervised by him or interacting with him. Each subordinate (respondent) was required to answer the following three questions about the executive (their boss) being assessed.

- Q1. What do you see as three of his/her greatest strengths as a manager?
- Q2. What do you think are three of his/her weaknesses as a manager?
- Q3. What are your suggestions for improving his/her managerial effectiveness?

The respondents were requested to mail their answers anonymously to the Programme Coordinator. The respondents were assured that no individual questionnaire will be shown to the Senior Executive but only typed

and tabulated responses will be given to him as feedback after adequate theoretical foundations have been laid in the programme.

Responses were received from 583 subordinates of the senior executives. Although each respondent was requested to mention three strengths and three weaknesses, some of the respondents listed as many as six and a few others listed none.

Characteristics that Contribute to Managerial Effectiveness

Table 1 presents the characteristics most frequently mentioned by the senior executives as contributing to their effectiveness. These qualities can be classified under :

1. Technical or technological competence (good understanding of the job and qualifications)
2. Managerial and systems competence (analytical and problem-solving skills, work-planning and work-organisation, result-orientation and role efficacy)
3. Human relations competence (interpersonal skills)
4. Group/team building competence
5. Leadership competence
6. Other personal characteristics (hard work, commitment, confidence, adaptability, honesty etc)

Table 1: Characteristics Contributing to Managerial Effectiveness (N 85)

| Characteristics | Percentage of Executives Mentioning |
|---|-------------------------------------|
| Interpersonal relationships and good public relations skills | 27 |
| Analytical and problem-solving skills | 25 |
| Hard work | 20 |
| Leadership abilities | 19 |
| Systematic work-planning (Methodical-Organized) | 18 |
| Team-building capabilities (Group cohesiveness and team spirit) | 18 |
| Sincerity - Integrity - Honesty | 18 |
| Good understanding of job | 16 |
| Result-oriented approach | 15 |
| Role efficacy | 9 |
| High qualifications | 9 |
| Commitment | 9 |
| Confidence | 9 |
| Adaptability | 9 |

Of the six categories, managerial and human relations competences are the most frequently mentioned. Although leadership and team building competence is put separately it could be considered as heavily loaded with human relations skills.

Table 2 presents the characteristics that were perceived as preventing the managers from being effective. Most of the qualities that prevent managers from being effective are personal characteristics and human relations competence. Very few have mentioned technological and managerial competence as characteristics that prevent them from being effective. Of the 23 characteristics mentioned, only one relates to technical skills, two relate to managerial capabilities (not analytical, unorganised), about seven relate to inter-personal competence (lack of tact, low sociability, high sensitivity, please all tendency, brutally frank and straight forward, autocratic, poor communication skills) and the rest are personal characteristics mostly dealing with temperament and emotional stability.

Both the tables put together bring out the importance of personal characteristics and interpersonal competence in managerial effectiveness.

Table 2: Characteristics that Prevent Managers from Being Effective

| Characteristics | Percentage of Executives Mentioning |
|---|-------------------------------------|
| Lack of tact and poor interpersonal relations | 18 |
| Poor communication skills | 14 |
| Introverted | 13 |
| Lack of modern technical knowledge and specialisation | 13 |
| Not fully adaptable | 12 |
| Emotional—short tempered | 12 |
| Impatient | 11 |
| Low drive—Not assertive or aggressive | 11 |
| Impulsive | 9 |
| Lack of tenacity | 9 |
| Low sociability | 9 |
| Too self-conscious and too sensitive to what others think | 9 |
| Unorganised—Not methodical | 9 |
| Low confidence level | 8 |
| Please-all behaviour | 8 |
| Brutally frank and straight forward | 7 |
| Insecure | 7 |
| Oversensitive - Emotional | 7 |
| Low analytical power | 6 |
| Autocratic attitude | 6 |
| Procrastination | 6 |
| High anxiety | 6 |
| Avoidance of challenge | 6 |

Strengths of Managers

In the second sample of 73 senior executives, 583 of their subordinates listed their strengths. A total of 1,866 strengths were listed by them. These were condensed to 130 after putting together strengths of similar nature but marginal variations in language. Each strength was assigned a code number. Two types of analyses were done after coding. Number of senior executives for whom each strength was mentioned by atleast one subordinate was calculated. This gives the commonality of a strength among the senior executives and is given under the 'frequency' column in tables 3 to 8.

Number of respondents (out of 583) mentioning the strength was also counted for each strength. This is given under the 'status' column in tables 3 to 8. The strengths were further classified into

- Category 1 : Technical/Technological competence
- Category 2 : Managerial competence
- Category 3 : Human relations competence
- Category 4 : Managing subordinates and team
- Category 5 : Other leadership qualities
- Category 6 : Personal characteristics.

This classification was arrived at after studying the list of 130 strengths. Human relations competence was separated from subordinate and team management due to the high frequency with which it was mentioned. Tables 3 to 8 present both the frequency and the status of each strength.

The tables reveal that the following strengths are more frequently found in Indian managers:

1. Technical knowledge
2. Planning, decision making (quick and accurate decision making) and delegation

Table 3: Strengths of Managers

Category 1: Technical/Technological Competence

| Code | Strength | Frequency* N = 73 | Status** N = 583 |
|------|---|----------------------|---------------------|
| 6 | Knowledgeable | 14 | 18 |
| 22 | Good in solving technical problems | 4 | 4 |
| 33 | Knowledge in the field of operation/ technical knowledge | 52 | 149 |
| 78 | Experience in the field | 11 | 13 |
| 130 | High level of functional competence | 1 | 1 |

* indicates the response counted only once per manager.

** indicates the total number of respondents (subordinates) mentioning this as strength of their boss.

Table 4: Strengths of Managers

Category 2: Managerial competence

| Code | Strength | Frequency* N = 73 | Status** N = 583 |
|------|---|----------------------|---------------------|
| 3 | Follow-up | 9 | 11 |
| 4 | Effective delegation | 29 | 35 |
| 7 | Good planning | 33 | 49 |
| 8 | Good organiser | 13 | 15 |
| 31 | Designing systems | 3 | 4 |
| 43 | Quick decision-making | 26 | 44 |
| 44 | Accurate decision-making | 22 | 32 |
| 66 | Good social contacts | 3 | 4 |
| 67 | Systematic working | 26 | 32 |
| 69 | Ability to monitor and control | 16 | 18 |
| 85 | Firm decision making and implementation | 9 | 13 |
| 96 | Good public relations | 9 | 9 |
| 98 | Time management | 3 | 3 |
| 100 | Effective in managing crisis | 4 | 6 |
| 103 | Good understanding of the environment | 4 | 5 |

* indicates the response counted only once per manager.

** indicates the total number of respondents (subordinates) mentioning this as strength of their boss.

Table 5: Strengths of Managers

Category 3: Human Relations Competence

| Code | Strength | Frequency* N = 73 | Status** N = 583 |
|------|--|----------------------|---------------------|
| 2 | Clarity in instruction | 10 | 13 |
| 16 | Accepting superior's directions unhesitatingly | 1 | 1 |
| 52 | Rapport with superiors | 13 | 15 |
| 82 | Ability to project good things to superiors | 3 | 3 |
| 91 | Good interdepartmental relations | 5 | 5 |
| 99 | Effective communicator | 32 | 46 |
| 107 | Direct approach with other departments for information | 1 | 1 |
| 119 | Informing superiors of his decisions | 1 | 1 |
| 122 | Negotiating skills | 4 | 5 |

* indicates the response counted only once per manager.

** indicates the total number of respondents (subordinates) mentioning this as strength of their boss.

3. Communication skills
4. Ability to motivate subordinates
5. Ability to get things done, leadership, commitment, hard work, analytical ability and task-orientation.
6. Personal characteristics like cool headedness and sincerity.

Agreement in Perception of Strengths

From the data on perceptions of strengths, an attempt was made to study the strengths on which there is agreement in perception. The following question was proposed to be answered.

What are the strengths which are likely to be perceived more consistently by different subordinates?

Table 6: Strengths of Managers

Category 4: Managing Subordinates/team

| Code | Strength | Frequency* N = 73 | Status** N = 583 |
|------|--|----------------------|---------------------|
| 11 | Willingness to listen | 20 | 27 |
| 12 | Unbiased or impartial | 5 | 5 |
| 13 | Deciding on merit | 2 | 2 |
| 14 | Less influenced by emotions | 4 | 5 |
| 15 | Bearing | 1 | 1 |
| 20 | not vindictive | 4 | 4 |
| 26 | Providing opportunity for growth | 1 | 1 |
| 29 | Protects subordinates | 6 | 6 |
| 30 | Enjoys employees' confidence | 10 | 11 |
| 41 | Optimum utilisation of available potential | 9 | 10 |
| 42 | Ensuring proper discipline | 4 | 5 |
| 45 | Ability to motivate subordinates/team | 45 | 79 |
| 47 | Educating subordinates | 9 | 10 |
| 48 | Genuine concern for subordinates | 17 | 26 |
| 51 | Ability to develop subordinates | 9 | 9 |
| 54 | Understanding the needs of subordinates | 14 | 22 |
| 55 | Uses participative approach | 7 | 8 |
| 57 | Reaching subordinates directly | 2 | 2 |
| 59 | Allowing subordinates to take decisions on their own | 15 | 18 |
| 60 | Sharing information with subordinates | 4 | 4 |
| 63 | Appreciates good suggestions from subordinates | 2 | 3 |
| 68 | Ability to manage people | 5 | 5 |
| 70 | Providing adequate support during crucial periods | 3 | 4 |
| 71 | Effective projection of himself and his subordinates | 4 | 6 |
| 72 | Easily accessible | 8 | 11 |
| 73 | Giving freehand | 8 | 13 |
| 92 | Treating employees with respect | 3 | 3 |
| 93 | Cooperating with subordinates | 7 | 8 |

* indicates the response counted only once per manager.

** indicates the total number of respondents (subordinates) mentioning this as strength of their boss.

For this purpose, any strength perceived by more than 50 per cent of the subordinates of each senior executive was taken as a strength with consistency. Table 9 presents the code numbers of each manager and the strength which was mentioned by more than 50 per cent of their subordinates.

In the case of 30 of the managers there is some consistency in the perception of their subordinates.

Technical knowledge appears to be one quality that is more prominently perceived. In nine out of the 30 cases, this characteristic figures out. This is followed by hard work, aggressiveness and cool headedness.

Weaknesses of Managers

1368 weaknesses were actually perceived by the subordinates. They were grouped according to similarities in responses resulting in 128 items. The same procedure as in identifying strengths was adopted here.

Tables 10 to 15 give the details of weaknesses, their frequency and status. Status and frequency were

Table 7: Strengths of Managers

Category 5: Other Leadership Qualities

| Code | Strength | Frequency* N = 73 | Status** N = 583 |
|------|--|----------------------|---------------------|
| 9 | Measuring or calculating | 3 | 3 |
| 21 | Strong in values | 2 | 2 |
| 23 | Ability to get things done | 24 | 29 |
| 25 | Approachable | 2 | 2 |
| 32 | Disciplined leadership | 32 | 46 |
| 37 | Dynamic | 9 | 11 |
| 39 | Conceptual clarity | 12 | 12 |
| 40 | Reacting rapidly to developments | 4 | 4 |
| 46 | Maintaining a limit in all aspects | 2 | 2 |
| 49 | Persuasive talker | 14 | 17 |
| 50 | Good analytical ability | 29 | 49 |
| 53 | Making others feel at ease in his presence | 3 | 4 |
| 58 | Diplomatic | 3 | 3 |
| 64 | Result oriented | 18 | 22 |
| 65 | Adaptability to a given situation | 8 | 9 |
| 74 | Hardworker | 44 | 91 |
| 75 | Desire for knowledge/learning | 7 | 8 |
| 76 | Willingness to involve | 11 | 11 |
| 77 | Initiative | 14 | 18 |
| 79 | Committed | 34 | 56 |
| 80 | Foresight | 18 | 19 |
| 81 | Flexibility | 4 | 3 |
| 87 | Task oriented | 22 | 31 |
| 89 | Prompt attention to problems | 2 | 2 |
| 90 | Endeavour betterments | 8 | 9 |
| 95 | Sense of humour | 3 | 3 |
| 105 | Tactful | 7 | 7 |
| 109 | Uptodate information | 4 | 4 |
| 110 | Punctuality | 2 | 3 |
| 111 | Ability to take criticism | 3 | 3 |
| 113 | Helpful | 9 | 9 |
| 115 | Enterprising | 1 | 1 |
| 116 | Innovative | 2 | 6 |
| 118 | Preaching only that he practises | 1 | 1 |
| 124 | Doesn't allow outside interference | 2 | 2 |
| 127 | Keeping office politics at minimum | 1 | 1 |

- * indicates the response counted only once per manager.
- ** indicates the total number of respondents (subordinates) mentioning this as strength of their boss.

calculated by the same procedure as for strengths.

Poor communication abilities, poor delegation, inability to motivate subordinates, poor planning are some of the weaknesses prevalent among many managers (as perceived by their subordinates). Poor technical knowledge, poor delegation, delayed decision-making, non-participative approach in decision-making, inability to motivate subordinates, personal biases, lack of courage, stubborn nature, soft heartedness and impatience are some of the more-frequently perceived weaknesses.

Agreement in Perception of Weaknesses

In order to assess the weaknesses on which agreement in perceptions exists, the code numbers of the senior executives for whom more than 50 per cent of their

Table 8: Strengths of Managers

Category 6: Personal Characteristics

| Code | Strength | Frequency* N = 73 | Status** N = 583 |
|------|---|----------------------|---------------------|
| 1 | Soft spoken | 5 | 5 |
| 10 | Keeps his cool or coolheadedness or temperament | 34 | 53 |
| 17 | Trustworthy or confidential | 11 | 12 |
| 18 | Optimistic | 9 | 9 |
| 19 | Self-confident | 12 | 13 |
| 24 | Grasping power | 9 | 9 |
| 34 | Aggressive | 4 | 4 |
| 35 | Intelligent | 19 | 28 |
| 36 | Pushy | 3 | 3 |
| 61 | Loyalty | 17 | 22 |
| 62 | Sincerity | 22 | 30 |
| 83 | Good or pleasant personality | 19 | 22 |
| 86 | Maturity | 7 | 7 |
| 88 | Speaks little | 1 | 1 |
| 94 | Patience | 12 | 13 |
| 101 | Good memory | 9 | 10 |
| 104 | Enthusiasm | 7 | 7 |
| 106 | Bold/courageous | 5 | 11 |
| 108 | Stability | 4 | 4 |
| 114 | Ambitious | 4 | 6 |
| 115 | Enterprising | 1 | 1 |
| 117 | Determination | 6 | 9 |
| 120 | Simplicity | 1 | 1 |
| 121 | Doesn't give up | 2 | 2 |
| 123 | Perfect gentleman | 5 | 6 |
| 125 | Good health | 1 | 2 |
| 126 | Non-Egoistic | 3 | 2 |
| 128 | Comprising | 1 | 1 |
| 129 | Fatherly figure | 1 | 1 |

- * indicates the response counted only once per manager.
- ** indicates the total number of respondents (subordinates) mentioning this as strength of their boss.

subordinates mentioned the same weakness were identified. The details are presented in Table 16. In 16 of the 73 cases of senior executives, there is agreement on at least one weakness of each of them. This is low as compared to the strengths where agreement was observed in 30 cases. Experience of the authors indicate that weaknesses are more often noticed and talked about than strengths. Data here show the reverse. Since anonymous data were collected for this study, the issue of inhibitions in perceptions also is not significant.

Weakness in communication, short-temper and low involvement or aloofness are more consistently perceived.

Suggestions given by Subordinates

1159 suggestions were given by the subordinates of the 73 senior executives for improving their managerial effectiveness. The suggestions were grouped (as done earlier) which resulted in 79 different dimensions of suggestions.

Tables 17 to 22, present suggestions offered by the respondents for their bosses. Some of the suggestions

Table 9: Perceived Strengths of Managers

(only those mentioned by more than 50% of their subordinates)

| Sl. No. | Code No. of Manager | Strength | Frequency (No. of subordinates mentioning this) | Percentage of respondents |
|---------|---------------------|-----------------------------|---|---------------------------|
| 1. | 17 | Technical knowledge | 9 | 64 |
| 2. | 20 | Technical knowledge | 8 | 73 |
| 3. | 36 | Technical knowledge | 5 | 62 |
| 4. | 40 | Technical knowledge | 8 | 80 |
| 5. | 43 | Technical knowledge | 6 | 67 |
| 6. | 45 | Technical knowledge | 3 | 75 |
| 7. | 46 | Technical knowledge | 7 | 88 |
| 8. | 51 | Technical knowledge | 4 | 57 |
| 9. | 55 | Technical knowledge | 2 | 67 |
| 10. | 72 | Accurate decision making | 5 | 56 |
| 11. | 48 | Administrative skills | 2 | 67 |
| 12. | 50 | Good planning | 2 | 67 |
| 13. | 9 | Hardworker | 9 | 82 |
| 14. | 12 | Hardworker | 2 | 67 |
| 15. | 67 | Hardworker | 2 | 67 |
| 16. | 55 | Disciplined leadership | 2 | 67 |
| 17. | 3 | Ability to get things done | 2 | 67 |
| 18. | 32 | Good analytical ability | 7 | 54 |
| 19. | 12 | Concern for subordinates | 2 | 67 |
| 20. | 48 | Aggressive | 2 | 67 |
| 21. | 67 | Aggressive | 2 | 67 |
| 22. | 24 | Task oriented | 2 | 67 |
| 23. | 67 | Patience | 2 | 67 |
| 24. | 18 | Courageous/Bold | 6 | 75 |
| 25. | 63 | Perfect gentleman | 2 | 67 |
| 26. | 44 | Good health | 2 | 100 |
| 27. | 63 | Keeps cool/Cool headedness | 2 | 67 |
| 28. | 2 | Trustworthy or confidential | 2 | 67 |
| 29. | 15 | Keeps cool/Cool headedness | 4 | 67 |
| 30. | 56 | Honest/Frank/Open | 3 | 60 |

Table 10: Weaknesses of Managers

Category 1: Technical/Technological Competence

| Code | Weakness | Frequency* N = 73 | Status** N = 583 |
|------|-----------------------------|----------------------|---------------------|
| 38 | Poor in technical knowledge | 20 | 25 |

* indicates the response counted only once per manager.
 ** indicates the total number of respondents (subordinates) mentioning this as a weakness of their boss.

given more frequently by the respondents include: should have more exposure to programmes in his area, should delegate giving proper feedback to subordinates, should improve decision-making ability, communication and interpersonal relationships, should give proper feedback, must develop all, must listen to all rather than a few, should be more committed, should impose discipline, should learn to understand subordinates, should be firm and have patience.

Further analysis of the data revealed that for 12 out of the 73 respondents, there was some agreement in the suggestions offered. Out of these, three cases dealt with improving interpersonal relationships, two with improving

Table 11: Weaknesses of Managers

Category 2: Managerial competence

| Code | Weakness | Frequency* N = 73 | Status** N = 583 |
|------|--|----------------------|---------------------|
| 2 | Poor delegation | 28 | 47 |
| 6 | Postponement of decision | 20 | 44 |
| 18 | Non-participative approach in decision making | 20 | 27 |
| 19 | Excess delegation | 8 | 11 |
| 23 | Clarity in prioritizing objectives | 1 | 1 |
| 34 | Tendency to avoid problems | 14 | 16 |
| 37 | Concentrating on more than one issue at a time | 3 | 3 |
| 41 | Poor organising ability | 11 | 11 |
| 61 | Hasty decisions | 6 | 9 |
| 63 | No planning | 26 | 32 |
| 64 | Poor time management | 13 | 22 |
| 67 | Lack of innovative ideas | 3 | 3 |
| 73 | Non clarity about managerial responsibilities | 5 | 6 |
| 86 | Managing change | 2 | 2 |
| 101 | Too professional | 2 | 2 |
| 106 | Doesn't give proper feedback | 2 | 2 |
| 108 | Not good at resolving conflicts | 2 | 3 |
| 110 | Cuts into the hierarchical levels | 3 | 3 |
| 113 | Doesn't confront when necessary | 2 | 2 |

* indicates the response counted only once per manager.
 ** indicates the total number of respondents (subordinates) mentioning this as a weakness of their boss.

Table 12: Weaknesses of Managers

Category 3: Human Relations Competence

| Code | Weakness | Frequency* N = 73 | Status** N = 583 |
|------|--|----------------------|---------------------|
| 1 | Weak in communication* | 42 | 97 |
| 24 | Clarity in communication | 1 | 1 |
| 27 | Poor interpersonal relations | 20 | 34 |
| 43 | Doesn't push beyond a point with his boss | 18 | 24 |
| 57 | Can't project a tough image to other departments | 2 | 2 |
| 94 | Doesn't give due respect to those who donot matter | 2 | 2 |
| 113 | Doesn't confront when necessary | 2 | 2 |

* indicates the response counted only once per manager.
 ** indicates the total number of respondents (subordinates) mentioning this as a weakness of their boss.

communication, and another two improving time management. In other five cases delegating more, being flexible and open, devoting time for administration, attending training programmes and imparting knowledge to subordinates were the suggestions mentioned.

Conclusion

Given the nature of the environment in which our managers work and the type of roles they play, it is imperative

Table 13: Weaknesses of Managers

Category 4: Managing Subordinates and Team

| Code | Weakness | Frequency* | Status** |
|------|--|------------|----------|
| | | N = 73 | N = 583 |
| 3 | Non discrimination down the line | 4 | 4 |
| 9 | Does not motivate subordinates | 26 | 32 |
| 10 | Does not develop subordinates | 19 | 24 |
| 11 | Not involved/alooof/cold | 19 | 43 |
| 15 | Giving full freedom to subordinates | 5 | 6 |
| 16 | Tendency to buy peace | 8 | 7 |
| 19 | Excess delegation | 8 | 11 |
| 20 | Too frank/open | 13 | 17 |
| 29 | Intolerant to disagreement of his/her views | 13 | 23 |
| 30 | Playing one against the other | 5 | 5 |
| 31 | Inability to perceive human needs | 14 | 16 |
| 32 | Expects subordinates to consult him/her | 2 | 2 |
| 33 | Trusts few | 16 | 20 |
| 35 | Non-availability at the office | 2 | 4 |
| 40 | Too friendly relations | 6 | 8 |
| 46 | Doesn't follow up | 5 | 5 |
| 47 | Boasting | 10 | 10 |
| 48 | Criticising subordinates | 19 | 28 |
| 50 | Tactless | 6 | 8 |
| 51 | Biased | 20 | 25 |
| 52 | Doesn't care for rules and regulations | 4 | 4 |
| 53 | Takes time to establish rapport | 4 | 5 |
| 54 | Doesn't make his intentions known | 3 | 3 |
| 55 | Doesn't share information | 6 | 8 |
| 59 | Doesn't know people intimately | 1 | 1 |
| 66 | Subordinates don't like him/her | 2 | 2 |
| 71 | Unrealistic commitment | 7 | 8 |
| 75 | Not a team man | 7 | 8 |
| 76 | Demoralises subordinates | 4 | 4 |
| 78 | Close supervision | 1 | 1 |
| 81 | Concentrating on work only | 1 | 1 |
| 83 | Creating a hostile atmosphere around him/her | 1 | 1 |
| 85 | Only preaches | 2 | 2 |
| 92 | Passes the buck | 4 | 6 |
| 93 | Authoritative/strict | 7 | 10 |
| 98 | Takes the credit for the job done | 1 | 2 |
| 100 | Involving too many persons in discussions | 2 | 2 |
| 103 | Fails in estimating subordinates abilities | 6 | 6 |
| 106 | Doesn't give proper feedback | 2 | 2 |
| 110 | Cuts into the hierarchical levels | 3 | 3 |
| 114 | Too much value to people | 2 | 2 |
| 115 | Does not help subordinates | 5 | 5 |
| 116 | Does not trust | 3 | 3 |
| 117 | Making subordinates responsible for failure | 3 | 3 |
| 118 | Depending on others | 2 | 2 |
| 123 | Over protective of subordinates | 1 | 1 |
| 126 | Expects perfection in work | 2 | 2 |
| 127 | Trusting people | 1 | 1 |

* indicates the response counted only once per manager.

** indicates the total number of respondents (subordinates) mentioning this as a weakness of their boss.

Table 14: Weaknesses of Managers

Category 5: Other Leadership Qualities

| Code | Weakness | Frequency* | Status** |
|------|--|------------|----------|
| | | N = 73 | N = 583 |
| 7 | Indisciplined | 6 | 6 |
| 12 | Selfish | 9 | 13 |
| 13 | Not committed | 11 | 14 |
| 16 | Tendency to buy peace | 8 | 7 |
| 17 | Overdoing things | 14 | 25 |
| 20 | Too frank/open | 13 | 17 |
| 22 | Over-confident | 6 | 8 |
| 23 | Clarity in prioritizing objectives | 1 | 1 |
| 25 | Low profile | 7 | 7 |
| 29 | Intolerant to disagreement of his/her views | 13 | 23 |
| 34 | Tendency to avoid problems | 14 | 26 |
| 37 | Concentrating on more than one issue at a time | 3 | 3 |
| 39 | Lacks courage | 20 | 25 |
| 45 | Too fast | 2 | 2 |
| 49 | Poor leadership | 19 | 27 |
| 57 | Can't project a tough image to other departments | 2 | 2 |
| 58 | Not aggressive | 12 | 27 |
| 60 | Low achiever | 5 | 5 |
| 65 | Concentrates on one problem for the whole day | 1 | 1 |
| 67 | Lack of innovative ideas | 3 | 3 |
| 68 | Weak personality | 9 | 11 |
| 69 | Too cautious | 5 | 5 |
| 70 | Poor knowledge - in general | 7 | 8 |
| 71 | Unrealistic commitment | 7 | 8 |
| 72 | Over ambitious | 7 | 7 |
| 74 | Personality development-nil over the years | 1 | 1 |
| 79 | Non-methodical | 5 | 6 |
| 80 | Not wide range of interests | 1 | 1 |
| 81 | Concentrating on work only | 1 | 1 |
| 85 | Only preaches | 2 | 2 |
| 93 | Authoritative/strict | 7 | 10 |
| 95 | Not dependable | 4 | 4 |
| 97 | At times contradicts himself | 2 | 2 |
| 99 | Lacks confidence | 4 | 5 |
| 102 | Not always pragmatic | 2 | 2 |
| 107 | Too much patience | 3 | 3 |
| 109 | Tolerates mistakes | 6 | 8 |
| 111 | Touchy/emotional | 10 | 13 |
| 113 | Does not confront when necessary | 2 | 2 |
| 120 | Less dynamic | 1 | 1 |
| 122 | Influence of family | 1 | 1 |
| 124 | Finds excuses | 1 | 1 |
| 128 | Confined more to office | 1 | 2 |

* indicates the response counted only once per manager.

** indicates the total number of respondents (subordinates) mentioning this as a weakness of their boss.

Table 15: Weaknesses of Managers

Category 6: Personal Characteristics

| Code | Weakness | Frequency* N = 73 | Status** N = 583 |
|------|--------------------------------------|----------------------|---------------------|
| 4 | Not open/hiding feelings | 7 | 7 |
| 5 | Very stubborn | 24 | 33 |
| 7 | Indisciplined | 6 | 6 |
| 8 | Lazy | 12 | 15 |
| 11 | Not involved/alooof/cold | 19 | 43 |
| 12 | Selfish | 9 | 13 |
| 14 | Introvert | 19 | 24 |
| 20 | Too frank/open | 13 | 17 |
| 21 | Soft hearted | 24 | 42 |
| 22 | Over-confident | 6 | 8 |
| 25 | Low profile | 7 | 7 |
| 36 | Losing temper/impatient | 24 | 59 |
| 39 | Lacks courage | 20 | 25 |
| 42 | Having preconceived notions | 8 | 8 |
| 44 | Expects praise | 5 | 5 |
| 45 | Too fast | 2 | 2 |
| 47 | Boasting | 10 | 10 |
| 53 | Takes time to establish rapport | 4 | 5 |
| 58 | Not aggressive | 12 | 27 |
| 59 | Doesn't know people intimately | 1 | 1 |
| 62 | Not satisfied | 3 | 4 |
| 68 | Weak personality | 9 | 11 |
| 72 | Over ambitious | 7 | 7 |
| 77 | Narrow minded | 2 | 2 |
| 88 | Sensitive to criticisms | 2 | 4 |
| 89 | Doesnot go in depth | 15 | 21 |
| 90 | Doesnot reveal his/her personal side | 1 | 1 |
| 96 | Forgetfulness | 2 | 3 |
| 97 | At times contradicts himself | 2 | 2 |
| 99 | Lacks confidence | 4 | 5 |
| 104 | Poor memory | 2 | 2 |
| 107 | Too much patience | 3 | 3 |
| 111 | Touchy/emotional | 10 | 13 |
| 119 | Adaptability | 1 | 1 |
| 120 | Less Dynamic | 1 | 1 |

* indicates the response counted only once per manager.

** indicates the total number of respondents (subordinates) mentioning this as a weakness of their boss.

that they be competent in human relations. The survey proves this point. Subordinates have indicated that their bosses are technically competent but not so in human relations. In a study on Indian Managers, Hari Das (1991) has found that managerial activity in India is intertwined with managing one's relations with friends, customers, suppliers and colleagues. Indian managers who participated in the survey appear to be in agreement with this statement. Managers have felt that to be effective human relations skills are very important and personal characteristics hinder them. Thus, both superiors subordinates agree upon the importance of human relations skill for managerial effectiveness. Therefore, human relations skills have to be imparted to our managers through various training programmes. It si for the trainers, academicians and researchers to identify the causes if any, for the lack of human relations competence and provide suitable measures to overcome them.

Table 16: Perceived Weaknesses of the Managers

(only those mentioned by more than 50% of their subordinates)

| Sl. No. | Code No. of Managers | Weakness | Frequency (No. of subordinates mentioning this) | Percentage of respondents |
|---------|----------------------|--------------------------------|---|---------------------------|
| 1. | 1 | Weak in communication | 3 | 60 |
| 2. | 2 | Weak in communication | 2 | 67 |
| 3. | 30 | Weak in communication | 5 | 56 |
| 4. | 31 | Weak in communication | 4 | 67 |
| 5. | 45 | Weak in communication | 3 | 75 |
| 6. | 2 | Not involved/Aloof | 3 | 100 |
| 7. | 35 | Not involved/Aloof | 4 | 100 |
| 8. | 38 | Not involved/Aloof | 4 | 57 |
| 9. | 13 | Losing temper/Impatience | 4 | 67 |
| 10. | 24 | Losing temper/Impatience | 2 | 67 |
| 11. | 71 | Losing temper/Impatience | 4 | 57 |
| 12. | 50 | Does not motivate subordinates | 2 | 67 |
| 13. | 67 | Does not develop subordinates | 2 | 67 |
| 14. | 23 | Tendency to avoid problems | 7 | 58 |
| 15. | 69 | Not aggressive | 4 | 57 |
| 16. | 50 | Does not go indepth | 3 | 100 |

Table 17: Subordinates' Suggestions for Managers

Category 1: Technical/Technological area

| Code | Suggestion | Frequency* N = 73 | Status** N = 583 |
|------|---|----------------------|---------------------|
| 34 | Should be exposed to program mes/course | 35 | 70 |
| 35 | Should be production oriented | 8 | 10 |
| 69 | Should aim for higher efficiency | 1 | 1 |

* indicates the response counted only once per manager.

** indicates the total number of respondents (subordinates) mentioning this suggestion..

Table 18: Subordinates' Suggestions for Managers

Category 2: Managerial competence/systems Area

| Code | Suggestion | Frequency* N = 73 | Status** N = 583 |
|------|--------------------------------------|----------------------|---------------------|
| 1 | Must delegate | 40 | 66 |
| 3 | Must give proper feedback | 22 | 26 |
| 5 | Improve decision making ability | 29 | 45 |
| 15 | Should spend more time in planning | 21 | 29 |
| 18 | Should define priorities | 10 | 13 |
| 26 | Devote more time in Administration | 10 | 13 |
| 31 | Ensure result for his recommendation | 1 | 2 |
| 37 | Should not force decirions | 4 | 5 |
| 40 | Proper utilisation of resources | 3 | 3 |
| 43 | Should improve time management | 19 | 30 |
| 70 | Keep company's objective in mind | 2 | 2 |
| 79 | Avoid too much delegation | 1 | 1 |

* indicates the response counted only once per manager.

** indicates the total number of respondents (subordinates) mentioning this suggestion.

Table 19: Subordinates' Suggestions for Managers

Category 3: Human Relations Area

| Code | Suggestion | Frequency* N = 73 | Status** N = 583 |
|------|--|----------------------|---------------------|
| 2 | Improve communication | 43 | 91 |
| 6 | Should reduce his dependency on his boss | 11 | 13 |
| 12 | Should impart knowledge to his colleagues | 6 | 17 |
| 17 | Improve interpersonal relationships | 43 | 88 |
| 36 | Must use counselling to resolve differences | 6 | 7 |
| 39 | Learn to say "no" | 4 | 4 |
| 41 | Should have top management support | 5 | 5 |
| 59 | Exchange ideas with peers, subordinates, customers | 11 | 12 |

* indicates the response counted only once per manager.

** indicates the total number of respondents (subordinates) mentioning this suggestion.

Table 20: Subordinates' Suggestions for Managers

Category 4: Managing Subordinates and Team Building Area

| Code | Suggestion | Frequency* N = 73 | Status** N = 583 |
|------|---|----------------------|---------------------|
| 1 | Must delegate | 40 | 66 |
| 3 | Must give proper feedback | 22 | 26 |
| 4 | Should impose discipline | 25 | 39 |
| 7 | Must listen to all-instead of a few | 26 | 36 |
| 8 | Must develop all-instead of a few | 25 | 33 |
| 9 | Should be more committed | 21 | 25 |
| 11 | Should allow to express opinion freely | 2 | 3 |
| 16 | He needs effective support of his subordinates | 3 | 3 |
| 21 | Project himself to his team as straight forward | 8 | 9 |
| 22 | Should defend team/subordinates | 5 | 5 |
| 29 | Inspire subordinates/motivate | 19 | 24 |
| 32 | Should not be biased | 15 | 20 |
| 33 | Should have confidence in his team | 17 | 27 |
| 36 | Must use counselling to resolve differences | 6 | 7 |
| 46 | Should develop his ability to understand subordinates | 22 | 28 |
| 48 | Avoid comparing abilities with subordinates | 3 | 4 |
| 50 | Should treat subordinates with respect | 13 | 18 |
| 52 | Should be sociable | 6 | 8 |
| 58 | Should be an example | 1 | 1 |
| 59 | Exchange ideas with peers, subordinates, customers | 11 | 12 |
| 60 | Change his behaviour when encountering labour | 1 | 1 |
| 61 | Should not pass the buck | 2 | 2 |
| 62 | Should be accessible | 1 | 1 |
| 63 | Should not be too rigid on rules | 1 | 1 |
| 74 | Be less dependent on subordinates | 1 | 1 |

* indicates the response counted only once per manager.

** indicates the total number of respondents (subordinates) mentioning this suggestion.

Table 21: Subordinates' Suggestions for Managers

Category 5: Leadership Qualities

| Code | Suggestion | Frequency* N = 73 | Status** N = 583 |
|------|---|----------------------|---------------------|
| 9 | Should be more committed | 21 | 25 |
| 10 | Should take initiative | 8 | 8 |
| 11 | Should allow to express opinions freely | 2 | 3 |
| 18 | Should define priorities | 10 | 13 |
| 20 | Have broader perspective | 14 | 16 |
| 25 | Improve ability to face problems | 10 | 11 |
| 27 | Improve leadership qualities | 16 | 22 |
| 32 | Should not be biased | 15 | 20 |
| 38 | Should be firm in his opinions | 29 | 38 |
| 44 | Should be more aggressive | 12 | 17 |
| 45 | Making him learn to approach with caution | 3 | 4 |
| 55 | Should reduce excessive perseverance | 2 | 2 |
| 57 | Should learn to implement | 5 | 5 |
| 58 | Should be an example | 1 | 1 |
| 62 | Should be accessible | 1 | 1 |

* indicates the response counted only once per manager.

** indicates the total number of respondents (subordinates) mentioning this suggestion.

Table 22: Subordinates' Suggestions for Managers

Category 6: Personal Characteristics

| Code | Suggestion | Frequency* N = 73 | Status** N = 583 |
|------|--|----------------------|---------------------|
| 14 | Should make his own "SWOT" analysis | 3 | 3 |
| 23 | Control ego | 5 | 5 |
| 24 | Develop patience | 25 | 40 |
| 30 | Should not get upset | 5 | 7 |
| 32 | Should not be biased | 15 | 20 |
| 44 | Be more aggressive | 12 | 17 |
| 47 | Should be systematic | 8 | 8 |
| 51 | Should not be over confident | 3 | 3 |
| 52 | Be sociable | 6 | 8 |
| 54 | Take care of himself | 4 | 5 |
| 58 | Should be an example | 1 | 1 |
| 61 | Should not pass the buck | 2 | 2 |
| 62 | Should be accessible | 1 | 1 |
| 64 | Should project his image | 4 | 4 |
| 65 | Should not be defensive | 1 | 1 |
| 66 | Should take efforts to improve himself | 1 | 1 |
| 67 | Develop amicable disposition | 1 | 1 |
| 71 | Must update his knowledge | 5 | 5 |
| 72 | Develop more alertness | 5 | 5 |
| 73 | Develop more enthusiasm | 1 | 1 |
| 75 | Be more creative | 2 | 2 |
| 76 | Stop carrying tales | 1 | 1 |
| 77 | Continue the good work | 1 | 1 |
| 78 | Trustworthiness | 1 | 1 |

* indicates the response counted only once per manager.

** indicates the total number of respondents (subordinates) mentioning this suggestion.

Reference

Harl Das 'The Nature of Managerial Work in India: A Preliminary Investigation; ASCI Journal of Management, Vol. 21, No. 1, June 1991.

Review of Multiple Skill Scheme : A Case Study

Arup R. Roy

Multiple Skill Scheme was introduced in the new plant of a reputed pharmaceutical company right from the inception stage. This study reviews the perceived status of the scheme in the organization and the reasons behind its failure.

A reputed pharmaceutical company commissioned a plant in West Bengal in 1984 which went in for production of bulk drugs in mid 1984. It was set to run on the basis of Multiple Skill application concept. Accordingly, the manpower planning and even the design of the plant layout were tailored to suit the introduction of Multiple Skill Scheme. In two major functional areas of the plant, viz., engineering and production, the junior non-supervisory cadres were freshers only and had no previous industrial work experience of any kind.

The Multiple Skill Scheme (MSS)

The MSS as conceived at the time of commissioning had some distinct features:

For each department, some key functions/jobs were designated as "Mother Skill Areas" (MSA). For each of such key functions, a set of related functions/jobs were also identified and termed as "Multiple Skill Areas" (MLSA). It was expected that an employee besides performing his tasks in MSA will also perform tasks in MLSA as and when required. A Multiple Skill Test (MST) was designed and administered twice a year. The successful candidates were given monetary reward equivalent to one annual increment for each test passed. Granting of reward for success in each MST was not just a financial benefit but a token of appreciation for acquiring multiple skill.

Selection, Recruitment & Training for MSS

The organization adopted a systematic method of selecting, recruiting and training employees to render MS scheme effective. For the Junior Technician Cadre in both production and engineering division, school leaving freshers with science background in the age range of 17 to 19 years were chosen through a rigorous written examination followed by a verbal interview.

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At the time of selection, emphasis was given not only to assess the candidates' potential for the mother job area where they were going to be recruited but their orientation to other related job areas as well. Selected candidates were then exposed to a 3-month full time in-house induction course. After the training the employees were put into actual job situation. In order to help the employees acquire multiple skills, there was provision for in-house as well as external training. Besides, arrangement for continuous on-the-job training was also thought of.

The reality was however different. Shortly after the employees were put into their respective job areas, it was observed that employees appeared for MST, received their increment for passing MST but did not accept any related work other than for which they were employed (MSA only). Gradually MSS came to a stall in practice and survived in paper only. Since inception, the full capacity of the plant was never utilised.

Against this background, a detailed study was conducted in order to understand the reasons for the failure of the scheme and also to find out ways and means for revitalizing it.

Design of the Study

The study was designed to cover the following research areas:

- * employees' perception of MSS in general
- * perceived status of MSS in the company
- * perceived reasons for failure of MSS in the company

Methodology

A census was attempted but due to absenteeism, only 75 (irrespective of department and dissemination) out of a total of 90 employees could be included in the study.

A quantitative study was attempted using structured questionnaires to assess the parameters detailed earlier. In addition, selected number of employees were drawn from different levels and functions for a qualitative study (through group discussion) in order to generate additional information, if any, so as to justify the quantitative data.

Findings of the Quantitative Study

Organizations introduce systems with certain expectations. Sometimes the expectations are spelt out in clear terms to the employees who are covered while sometimes no such communications are made. In the latter situation

it is generally found that different people perceive the system in different ways and sometimes the perception can be extremely divergent from what was perceived by the organization. Data on employees' perception of MSS in general supports the above contention.

The general perception was that MSS was more a "management-oriented" rather than "people-oriented" scheme.

Result shows (Table 1) majority of the employees, in that the both engineering (92%) and production (90%), perceived the scheme as a means for "maximisation of profit" while only 41% from administration group perceived the same way.

Table 1: General Perception of Multiple Skill Scheme (%)

| | ENG | ADMIN | PROD |
|--|-----|-------|------|
| Maximisation of profit | 92 | 41 | 90 |
| Optimisation of manpower | 71 | 77 | 96 |
| Increase of machine utilisation | 50 | 68 | 57 |
| Increase of marketability | 50 | 63 | 23 |
| Increase of group cohesiveness | 17 | 54 | 36 |
| To avoid close supervision | 19 | 32 | 26 |
| To maintain good manufacturing practices | 37 | 63 | 33 |
| To arrest career progression | 46 | 23 | 20 |
| No. Interviewed (75) | | | |

Again, "MSS is for increasing group cohesiveness" - was the perception of 54% from administration while only 17% from engineering and 36% from production showed similar perception. Similarly, while a large number of employees from administration (63%) felt that "MSS is for promoting good manufacturing practices", only 37% from engineering and 33% from production showed similar perception.

The general perception was that MSS was more a "management-oriented" rather than "people-oriented scheme".

Perceived Status of MSS In The Organization

Data on perceived status of MSS in the organization (table 2), however, did not give a very bright picture. For example, in engineering division about 23% employees did not consider their organization as an ideal company to operate the scheme while a large number of respondents

Table 2: Perceived Status of MSS (%)

| | Eng | | | Admin | | | Prod | | |
|---|-----|----|----|-------|----|----|------|----|----|
| | A | D | NO | A | D | NO | A | D | NO |
| An ideal company for operating MSS | 18 | 23 | 59 | 51 | 26 | 23 | 32 | 25 | 43 |
| Management has adequate initiative to run MSS | 16 | 27 | 57 | 58 | 22 | 20 | 15 | 32 | 53 |
| Supvs. have adequate initiative to run MSS | 22 | 46 | 32 | 39 | 41 | 20 | 27 | 40 | 33 |
| HODs have initiative in skill development | 6 | 73 | 21 | 26 | 12 | 62 | 33 | 39 | 28 |
| MSA and MLSA are logically linked | 25 | 55 | 20 | 22 | 11 | 67 | 11 | 32 | 57 |

A : Agree; D : Disagree; NO : No opinion

from production division (43%) did not express their opinion. Again, a sizeable number of employees from production (32%) as well as engineering (27%) expressed their dissatisfaction with management's initiative in operating the scheme properly. Doubts had been expressed by a large number of employees from both engineering (46%) and production (40%) regarding supervisors' initiative in maintaining the scheme and also a large number of employees from engineering (73%) and production (39%) mentioned the lack of initiative of the departmental heads in running the scheme. Regarding the logical relationship between the mother skill areas and the related skill modules, a large number of respondents from both engineering (55%) and production (32%) denied any such relationship.

A large number of employees in the two major departments viz., production and engineering did not consider their organization to be an ideal one in running any multiple skill scheme where the mother skill areas and the related skill modules were not logically interrelated. Departmental heads were not keen on making the scheme functional and the supervisors were reluctant in monitoring the scheme effectively.

Reasons For Poor Success Rate

A number of reasons were mentioned for the poor success rate of MSS in the organization (table 3). Large number of respondents from engineering and administration (about 77%) attributed the poor success rate to the incapability of the supervisors to implement the scheme while almost a similar number from engineering (64%), production (43%) and administration (63%) indicated the lack of initiative of the departmental heads in effectively maintaining and monitoring the scheme.

Another reason which came out quite significantly was "lack of clarity in managements' communication regarding its expectation from the scheme (production 68%; engineering 70%; administration 72%) Both production (61%) and engineering (57%) had attributed the poor success rate to "lack of proper monitoring of the scheme" which was supported by 35% of the respondents from administration. The most striking factor attributed to poor success rate of the scheme was lack of training (engineering 73%; administration 65%; production 64%) and absence of any proper syllabus on the related skill modules (production 64%).

Among various factors indicated for the poor success rate of MSS in the organization, the most significant reasons were incapability of the departmental heads, improper communication of management regarding MSS, lack of proper monitoring of the scheme and lack of organised training activity.

Findings of the Qualitative Study

The data obtained through the qualitative study indicated that there was great misconception among the

Among various factors indicated for the poor success rate of MSS in the organization, the most significant reasons were incapability of the departmental heads, improper communication of management regarding MSS, lack of proper monitoring of the scheme and lack of organised training activity.

Table 3: Reasons for Poor Success of MSS (% agree)

| | Eng | Admin | Prod |
|---|-----|-------|------|
| Incapability of HODs | 64 | 63 | 43 |
| Incapability of supervisors | 77 | 77 | 36 |
| Lack of coherence between MSA and MLSA | 45 | 45 | 21 |
| Faulty design of MS module | 59 | 50 | 25 |
| Lack of clarity in management's communication regarding MSS | 70 | 72 | 68 |
| Lack of training | 73 | 65 | 64 |
| General reluctance of people to accept MSS | 28 | 45 | 18 |
| Non availability of proper syllabus | 38 | 30 | 64 |
| Lack of proper monitoring of MSS | 57 | 35 | 61 |

No. interviewed : 75

employees regarding the MSS due to management's miscommunication regarding its expectation from the scheme. Gradually people started perceiving MSS as only a 'Money Spinning Scheme'. Such perception developed because there was neither any organised training activity for the employees to develop skill in the related modules nor any evaluation monitoring system on the part of management whether someone was really applying multiple skill or not, while employees under the scheme earned money in the form of increment without really learning the related skill modules.

Synthesis of the Findings

Synthesising the findings obtained from both the quantitative and qualitative data analysis, it appeared that due to management failure, the philosophy behind the scheme was not rightly communicated and it was interpreted more as a management-oriented than an employee-oriented scheme. However, even if the inadequacies of the management is accepted as the reason for failure, still the question as to whether the concerned employees suited the requirement of the scheme. Irrespective of a company's effort to monitor a multiple skill scheme remains unanswered, if employees were not geared up attitudinally, success of the scheme would be impossible.

Study II

Therefore, it was decided to conduct another study to assess the organizational behavioural disposition of the employees in order to examine their suitability for the scheme. The following parameters were included in this study:

- * interpersonal relation orientation of the employees
- * inter departmental collaboration in the organization
- * level of role orientation and role efficacy of the employees
- * level of work commitment of the employees

All the employees who participated in the earlier study were included and they were administered a battery of tests to assess the parameters described above.

Role Efficacy:

Data on Role Efficacy, (table 4), appeared unsatisfactory. For example, the score in "productivity" that is one's orientation to take initiative in day to day work, (engineer-

Table 4: Role Orientation

| | Eng | | Admn | | Prodn | |
|--------------------|------|------|------|------|-------|------|
| | Mean | SD | Mean | SD | Mean | SD |
| Centrality | 1.26 | 1.93 | 1.85 | 1.55 | 1.27 | 1.94 |
| Integration | 1.39 | 1.81 | 2.60 | 0.91 | 1.79 | 1.51 |
| Productivity | 0.86 | 1.94 | 1.00 | 1.09 | 0.86 | 1.40 |
| Creativity | 2.04 | 1.32 | 2.70 | 1.34 | 1.75 | 1.80 |
| Linkage | 2.00 | 2.12 | 2.30 | 1.45 | 2.34 | 1.86 |
| Helping | 2.47 | 1.44 | 2.70 | 1.48 | 3.00 | 1.30 |
| Super-ordination | 1.82 | 1.88 | 1.65 | 1.23 | 0.75 | 1.88 |
| Influence | 1.44 | 1.79 | 1.70 | 1.90 | 0.75 | 2.09 |
| Growth | 1.26 | 1.79 | 3.78 | 0.41 | 1.13 | 1.90 |
| Confrontation | 3.78 | 0.41 | 3.40 | 1.06 | 3.60 | 0.72 |
| No. interviewed 75 | | | | | | |

ing mean = 0.86, SD = 1.94; administration mean = 1.00 SD = 1.09; production mean = 0.86, SD = 1.40) was surprisingly low in all the groups. It may be ascertained from the data that making MSS successful will be difficult with a set of people who are basically not productive in nature, unless an intervention is initiated to reinforce productivity.

However, one significant feature noted in the data was that in other role dimensions, scores for all the divisions were significantly on the higher side. Such a trend indicates that although people were not 'productive', they could be made so since their orientation to other dimensions were relatively higher. Furthermore, higher standard deviations (even higher than mean score) indicating wide intra individual variability also reflect the presence of a mixed profile in the population so far as role orientation was concerned. Hence, there still exists scope for improving the role orientation of the people for making MSS a success.

Interpersonal Relationship

In any organization, the way people maintain interpersonal relations within as well as between groups is one of the most important determinants of performance, role efficacy, work commitment and productivity. These are also the basic elements that promote MSS. Data on interpersonal relations (fig. 1) showed relatively lower score in "wanted affection" for all the groups while the

In any organization, the way people maintain interpersonal relations within as well as between groups is one of the most important determinants of performance, role efficacy, work commit-

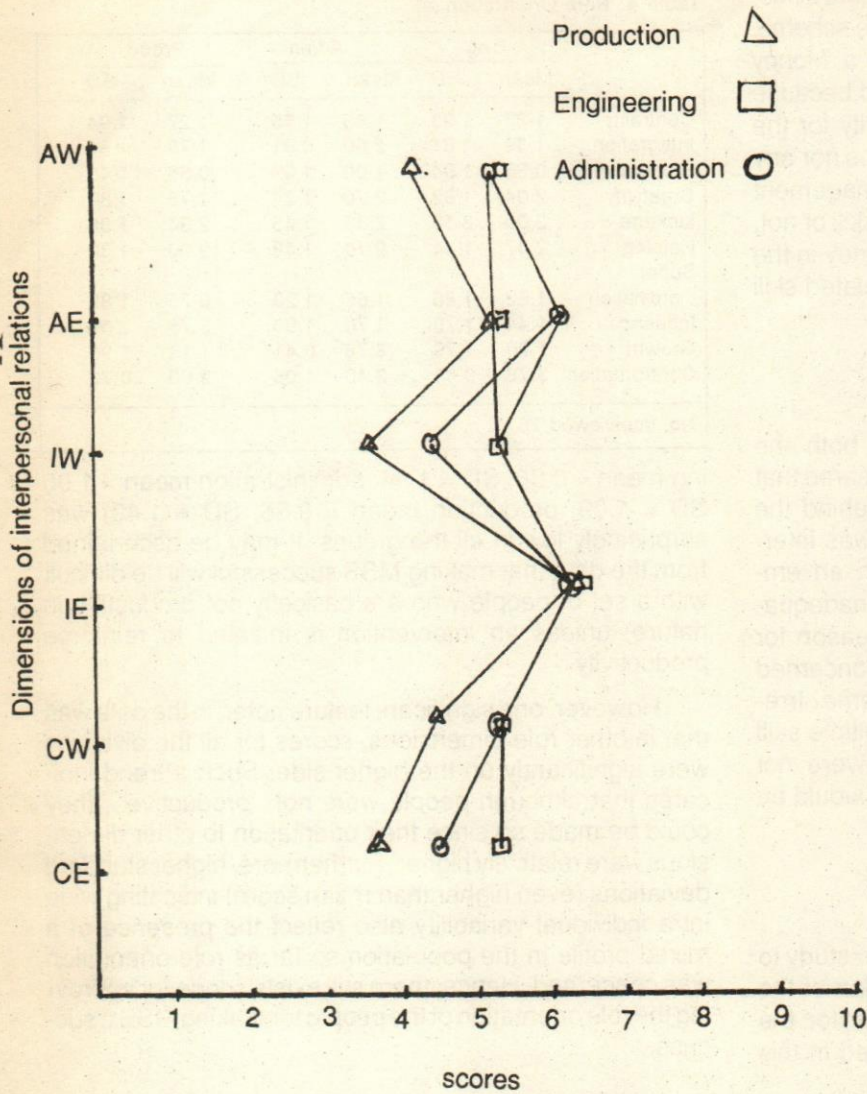


FIG.1. INTERPERSONAL RELATIONS ORIENTATION

score of administration was even lower compared to the scores of engineering and production. Similar was the trend for "extended affection" for administration and engineering while production group was better on this account.

Such a trend in data indicates a very low degree of warmth in people which is not a favourable climate for MS scheme. Surprisingly, the data on "extended inclusion" was relatively higher for all the groups compared to data on "wanted inclusion". However, such data appears to be paradoxical since it would be unlikely for one to let himself be included in others' activity without allowing others to get included in his own activity.

The pattern of interpersonal relationship between employees was not satisfactory enough to make MSS functional and effective.

Collaboration

Collaboration between people and groups is not only an organizational requirement but a philosophy by itself. Organizations promote and encourage inter departmental collaborations for smooth functioning but people have their own perception about collaboration with which they interact in an organizational set - up. Data on inter departmental collaboration (table 5) showed that in general there was an overall belief in collaboration within the total population (engineering 58%, production 76%, administration 79%). A sizeable number from all groups agreed that there existed a culture for collaboration in the organization (engineering 33%; production 43% and administration 46%), the top management was supportive of such a culture and showed initiative to promote it. However, doubts had been expressed with regard to collaboration among the departmental heads.

Although there existed a culture for collaboration and the top management was promoting it, the collaboration among departmental heads was not satisfactory.

Work commitment

Work commitment depends on a number of factors. The present inventory assessed seven important dimensions of work commitment viz., division of labour, leadership, growth opportunity, autonomy, team work and sense of belonging. The more an individual experiences the presence of these

Table 5: Perceived Inter-Departmental Collaboration (% agree)

| | Eng | Admin | Prod |
|---|-----|-------|------|
| Collaboration exists among departmental managers | 13 | 25 | 26 |
| Culture for collaboration exists in organization | 33 | 46 | 43 |
| Organization extends efforts to promote collaboration | 38 | 38 | 43 |
| Smooth inter-departmental communication | 33 | 29 | 30 |
| Top management extends efforts to promote collaboration | 29 | 71 | 37 |
| No. interviewed 75 | | | |

conditions in an organization, the more he becomes committed to work and to the organization. Data on work commitment did not show any clear trend (table 6). However, some of the dimensions like growth opportunity, division of labour etc. received higher rating uniformly by all groups.

Table 6: Dimensions of Work Commitment

| | Eng | Admin | Prodn |
|--|------|-------|-------|
| Division of Labour | 3.05 | 2.65 | 3.10 |
| Leadership | 2.81 | 2.43 | 2.77 |
| Growth opportunity | 3.38 | 3.22 | 3.50 |
| Autonomy | 2.80 | 2.64 | 3.15 |
| Team work | 2.84 | 2.87 | 2.86 |
| Sense of belonging | 2.70 | 2.34 | 2.73 |
| No. interviewed (75) Score ranges from 1 - 5 | | | |

Discussion

There are some obvious reasons behind misconceptions surrounding MSS. In an organisation, even if the general workers have a strong motivational profile, the success or failure of MSS depends mainly on two levels of employees—the senior managers and the front line supervisors. While the senior managers are expected to provide infrastructure, create the environment for skill learning, the front-line supervisors are expected to monitor whether the scheme is actually in operation. They are also expected to give feedback at the concerned level regarding the functioning of the scheme. It is also expected of the organization to install a sound evaluation and control system in order to ascertain that people are really learning the skill and applying in relevant situations, before granting any reward. Data showed neither the senior managers nor the supervisors stood up to the expectation from them in this regard.

Even if the general workers have a strong motivational profile, the success or failure of MSS depends mainly on two levels of employees—the senior managers and the front line supervisors.

In spite of having a well-designed MSS and providing more than adequate infrastructure for the smooth running of the scheme, the rate of success may be retarded if people don't have the right kind of psychological and attitudinal make-up. Data on different behavioural aspects vis. role orientation, interpersonal relations, work commitment, and collaboration, however, don't rule out this apprehension. Relatively poor role orientation, interpersonal

relation and collaboration indicate that unless these aspects are tackled carefully, the success rate of MSS will be questionable.

In such a situation, the organization should make clear and unambiguous communication to all concerned regarding its expectation from MSS which should be reinforced periodically.

Total Job Canvas

The concept of *Total Job Canvas* could be an effective solution in this regard. According to this concept, any position in an organization has a total job range (canvas) which the incumbent is expected to perform either from the first day he joins the position (depending upon the terms of employment) or master slowly over a stipulated period of time. Organizations while recruiting people at the grass root, generally recruit freshers with minimum or no experience. These people are then exposed to induction training for a stipulated period of time. Hence, if the total job canvas for these employees ranges, say, from "0 - 8", at the entry point they are expected to perform only "0" types of jobs. As these people grow with the organization, they are slowly exposed to other types of jobs either by theoretical cum on-the-job training or by trial and error method depending on the training policy of the organization.

In the process, by the time the employees reach their highest grade, they master the total job canvas (Fig 2). A well-planned MSS can also operate the same way. To boost up motivation, a financial reward may be coupled with acquiring skill in a particular job.

However, the description of job canvas should encompass the probable related skill areas with each mother activity. The related skill range should be realistic enough so that frequent opportunity could be found by the person concerned to apply the learned skill. Once the job canvas is prepared, appropriate training module should be designed based on the related skill range for different levels in different functions. Training should be imparted mostly on-the job and proper learning evaluation should be carried out so as to ensure that employees are acquiring both mother and related skills and are applying them in work situation.

MSS in India has still not crossed its infancy and therefore varied misconceptions surround the concept. In a labour-intensive country like India, MSS is likely to be perceived as a management technique for optimisation of work force and maximisation of profit, and hence, not a people-oriented concept. Therefore, any organization installing MSS should do so with reasonable level of expectation.

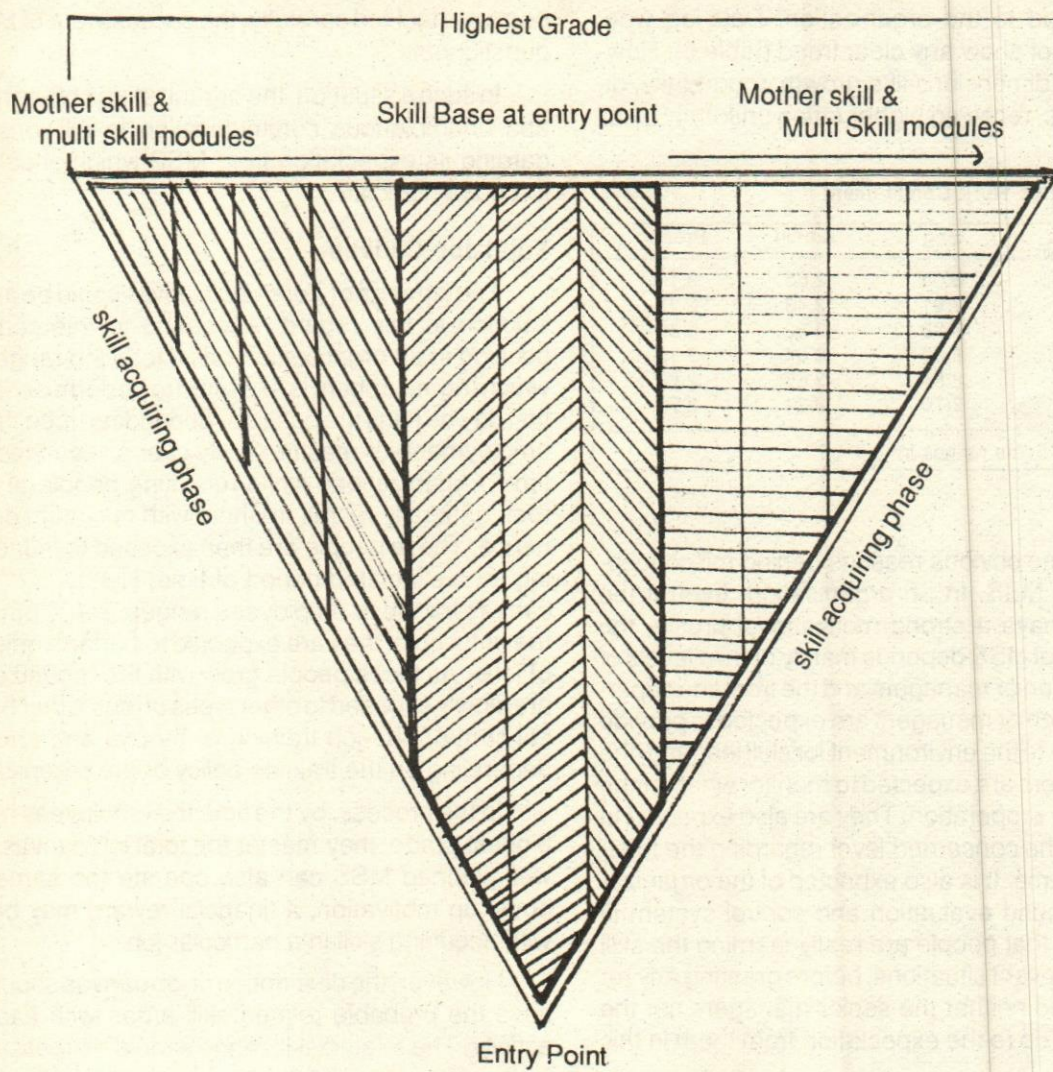


FIG.2. THE TOTAL JOB CANVAS



Investment in Human Resource: Design of Accounting System

D. Prabhakara Rao

This paper deals with the designing of Human Asset Accounting. The basic logic in favour of human resource investment activities, identification of human resource investment costs and accounting systems for human resource investment at micro-level are discussed.

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When an enterprise incurs significant expenditure in creating human capabilities, there is a strong case for treating such expenditure as an investment (Pyle, 1970). Smith (1973) included the skills and useful abilities of human beings in his concept of fixed capital. Paton (1962) expressed his notion of asset as that portion of a factor of production which has not yet reached the point in the business process, where, it may be correctly treated as 'cost of sales' or expense.

Cost is relevant to the future and is an asset, if it influences the future costs and revenues of an enterprise.

A Committee of the American Accounting Association studying the 'Matching Concept' opined that more attention should be given to determining the time, during which the accomplishment of an outlay is expected to be realised (AAA, 1965). If an outlay generates benefits beyond the period of incurrence, it may be capitalised. Sorter & Horngren (1962) argued that, a cost is relevant to the future and is an asset, if it influences the future costs and revenues of an enterprise. On the other hand, if all the expenditure on human resources is treated as an expense and charged to Profit and Loss Account, there are two basic drawbacks. Firstly, the accounting system cannot properly evaluate the current performance. For example, there is an amount of Rs. 10 lakhs incurred on employee training and development in the current period. This expenditure would normally influence the revenue of the firm, say, in the next five years. If this Rs. 10 lakhs is debited to current year's Profit and Loss Account, the current profits will be under pressure. Secondly, an important asset relating to the human capabilities formed through this training and development will be missing in the Asset-

structure of the firm. Transformation of the above arguments relating to capitalisation and expensing into action needs proper accounting systems to systematically record various revenue and investment costs of an organisation's human resource activities.

There are a number of human resource activities, the cost of which can be identified as human resource investment.

Desatnick (1972) has depicted the relevant activities in managing the human resources of a company in as fig-1. The figure mainly explains the controllable factors like management policies and their influence on human resource activities. Brummet et al (1969) have discussed several kinds of resources as shown in fig-2. The resources of an enterprise can be broadly divided into two categories, viz., (i) Internal resources and (ii) External resources. The external resources consist of product and money markets, customers and suppliers, employment market, technical and financial collaborations etc. The internal resources include human resources, physical and financial resources. The total resource productivity will be mostly affected by the way in which human resources are managed (Rao, 1982). An efficient manager would employ

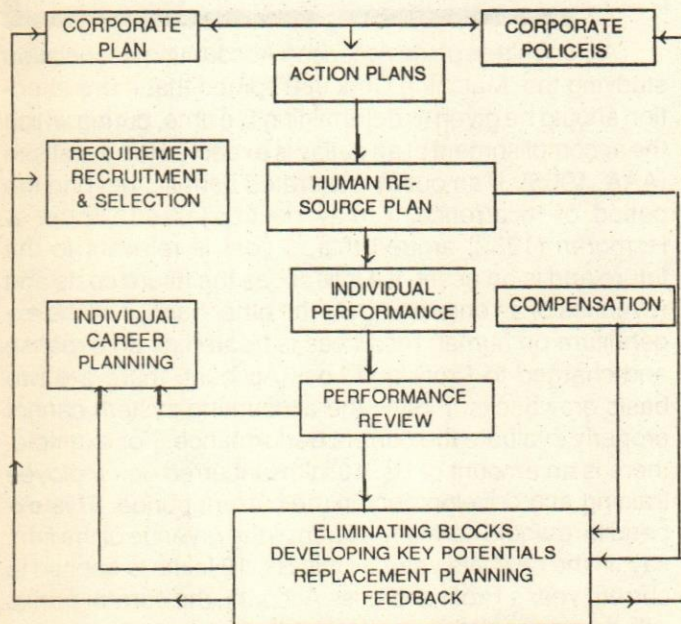


FIG. 1: HUMAN ASSET MANAGEMENT : THE BASIC ACTIVITIES

Source : Adapted from Desatnick, (1972)

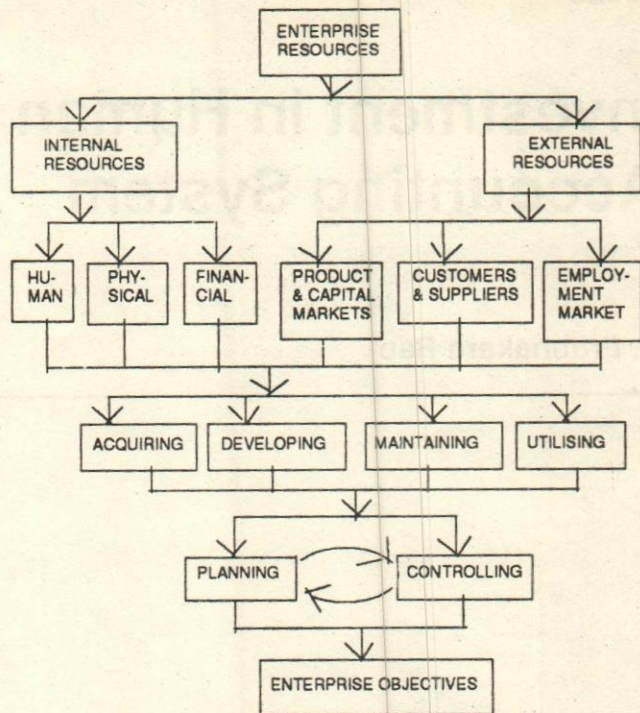


FIG. 2 : RESOURCE MANAGEMENT PROCESS

Source : Adapted from Brummet et al, (1969)

appropriate policies to acquire, develop, maintain and utilise all the resources of an enterprise, through proper planning and control for the purpose of accomplishing the organisational objectives.

From the above discussion, it is evident that there are a number of human resource activities, the cost of which can be identified as human resource investment. Fig. 3 presents the components of human resource investment. There are four categories of human resource investment costs—(i) Acquisition costs, (ii) Training costs, (iii) Costs of welfare and (iv) Other human resource investment costs. This grouping is tentative and different undertakings may adopt different groupings of the respective items of expenditure as per the purpose of analysis. The relevant argument is that all expenses which are aimed at either maintaining or increasing the human resource service capabilities are considered as human resource

All expenses which are aimed at either maintaining or increasing the human resource service capabilities are considered as human resource investment costs.

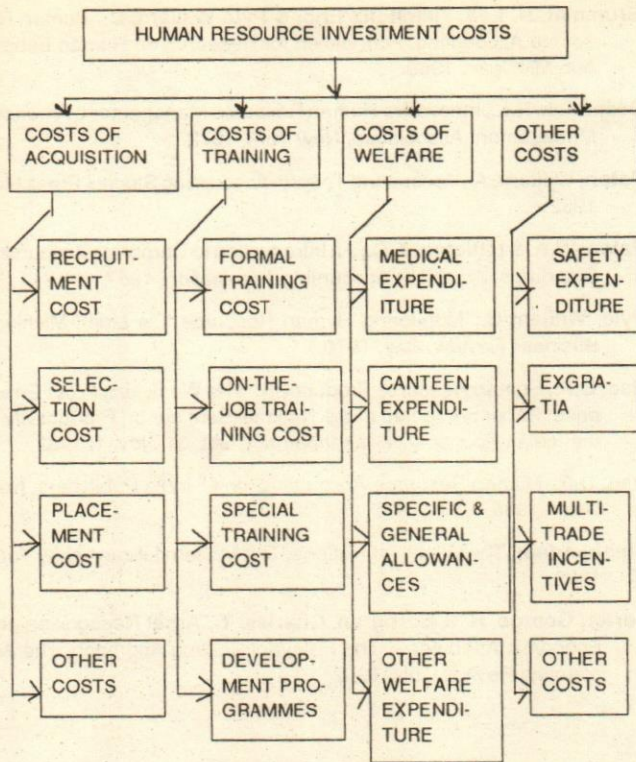


FIG. 3. HUMAN RESOURCE INVESTMENT COSTS

Source : Adapted from Rao (1986).

investment costs. This proposition is based on the premise that expenditure aimed at increasing resource productive potential has the necessary characteristics of investment. Appropriate forms are to be devised to feed data on the above investment activities (Rao, 1986, 49-56). The effectiveness of Human Resource Accounting depends on the correct identification of inputs obtained from correct sources in a suitable, accurate and useful manner.

The process of capitalisation includes posting of the investment costs to the appropriate asset accounts. At the end of each period, the asset account amount is subjected to amortisation. The rate of amortisation corresponds to the extent of utilisation of the asset, under normal conditions. If skill obsolescence takes place or if some people leave the organisation, the balance in the human resource investment account may be decreased with relevant write-off.

Figure 4 presents a view of the control accounts for human resource accounting. The flow of operations is depicted in the figure to explain the functioning of the systems of human resource accounting. As pointed by arrows, the basic input is from the vouchers. Functional human resource investment accounts absorb data from the vouchers. The balances of these accounts may be transferred to Human Resource Investment Statement. Human resource investment efficiency may be computed

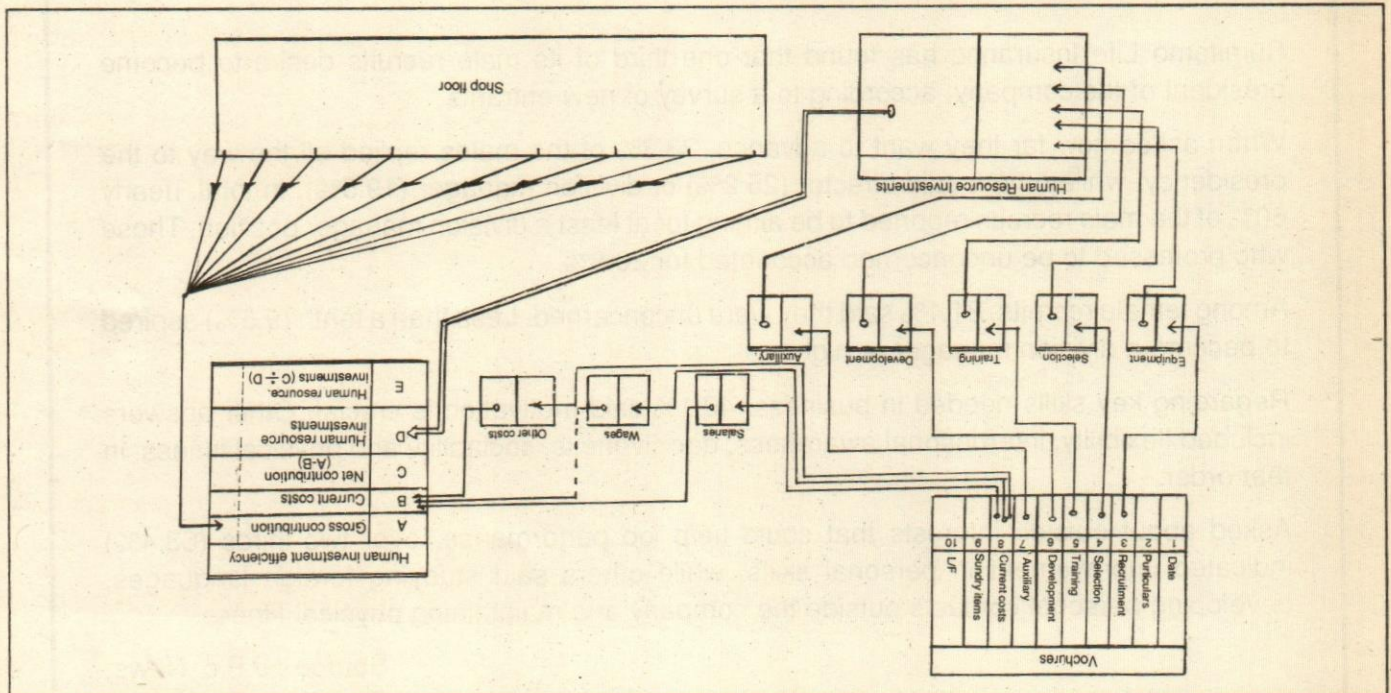


FIG. 4. CONTROL ACCOUNTS FOR HUMAN RESOURCE ACCOUNTING

Source : Adapted from Rao (1986).

periodically. The gross contribution obtained from the shop floor/business activities is reduced with the current human resource costs, to arrive at the net contribution. The net contribution times net human resource investment reveals the human resource investment efficiency.

The design of the accounting systems as proposed in this paper is only one of the alternatives. In actual practice, Human Resource Accounting may be integrated with the conventional accounting system as in the case of R.B. Barry experiment. The design aspect of Human Asset Accounting will depend upon the purpose of analysis. If it is to provide data and information to internal or managerial applications, one may follow the concept of investment sub-system as illustrated by Rao (1986). This would provide useful data for human resource planning and control.

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AIMING FOR PRESIDENCY?

Sumitomo Life Insurance has found that one third of its male recruits desire to become president of the company, according to a survey of new entrants.

When asked how far they want to advance, 33.3% of the males replied all the way to the presidency, while others said director (25.2%) or division manager (19.5%). In total, nearly 60% of the male recruits reported to be aiming for at least a division manager position. Those who professed to be unconcerned accounted for 20.8%.

Among female recruits, 81.1% said they were unconcerned. Less than a tenth (9.5%) aspired to become a division manager or higher.

Regarding key skills needed in business, 40.1% said motivation is crucial. Other answers included flexibility, international awareness, decisiveness, sociability and physical fitness, in that order.

Asked about outside interests that could help job performance, over two-thirds (68.4%) indicated improvement in personal skills, while others said studying foreign languages, developing personal contacts outside the company and maintaining physical fitness.

Source : J.P.c. News,
Sept. 1992

Self Inspection Scheme : A Case Study

N.H. Anandathirtha

This paper deals with the self inspection scheme adopted in one of the large-scale industries in India. The objective of this paper is to highlight the salient features and benefits of the self-inspection scheme which are better self control, defect-free output, reduction in inspection time and improvement in interpersonal relations.

Ever growing competition in the market, increasing cost of input resources and rising level of awareness about their self-worth among the workers have compelled top managements of many companies to deviate from conventional styles of treatment to their work force. Today a company aspiring for growth cannot afford to treat its workers as a non-living input resource like raw material, money, machines etc. Workers who are primarily responsible for optimum utilisation of resources are the key agents to improve productivity and quality, reduce wastages, bring down manufacturing costs and thus enable their company not only to survive but also to grow in a competitive business milieu. Since the workers are the task-performers, there is an absolute need to instill in them quality awareness and an attitude of defect-prevention. There is also a need for an effective feedback system for the workers, so that they can improve themselves. This need can be fulfilled by a 'Self Inspection Scheme'.

Today a company aspiring for growth cannot afford to treat its workers as a non-living input resource like raw material, money, machines etc.

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Self Inspection Scheme

Objectives

The objectives of the self inspection scheme are:

- * To promote job involvement and quality awareness, among the task-performers.
- * To encourage quality conscious persons to produce quality products.
- * To build an attitude of defect prevention among the task-performers.
- * To inspire the fellow workers.

Salient Features

- * Selection of operators is based on their past performance with regard to the consistency of quality work.
- * The selected persons are trained in the application of simple SQC techniques such as Data Collection, Histogram, Pareto Analysis, Cause and Effect Diagram and Control Charts. This is to enable them to understand and analyse problem areas for future defect prevention.
- * Every person selected for this scheme will be issued a self inspection certificate, a badge and a Rubber/Metal stamp to affix on every item produced/assembled and checked by them in order to facilitate correlated identification for future references.
- * Regular inspection is carried out by Quality Control department for a trial period of three months.
- * The Quality Control department conducts the Audit Inspection after the trial period to assure that correct decisions continue to be made.
- * The performance of selected persons is reviewed every year and a list of authorised persons to be maintained by Q.C. and concerned shops is prepared.

Functions of Production Operator

Every operator authorised for self inspection will check his output as per the specifications. In case of any non-conformance observed, operator will report the same to Q.C. for generation of Rework/Rejection report or production will raise a deviation report and send it to Engineering department through quality control department. The concerned section-in-charge will arrange to rectify the defect. Problems beyond the control of the section-in-charge are brought to the notice of the section-head for necessary corrective action. After completing the job if the operator finds that it is in line with the specifications, he affixes the stamps given to him on it and clears it for the next stage.

Evaluation by Self-Certification Scheme

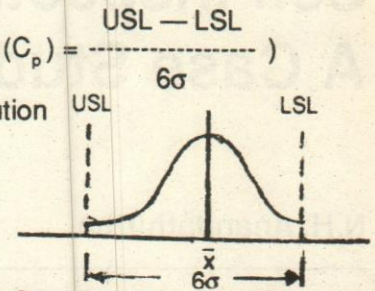
A run chart is drawn for each operation. Each run chart is taken as a sub-group denoted by 'n'. The sub-group size 'n' is taken as thirty (30) and no. of samples equal to no. of run charts. For each subgroup, Mean (\bar{X}), Standard Deviation (σ), Process Capability (C_p) and Achieved Capability (C_{pk}) are calculated.

Process Capability (C_p)

It is the inherent capability of the process. It is given by the following formula.

$$(\text{Process Capability } (C_p) = \frac{USL - LSL}{6\sigma})$$

assuming normal distribution



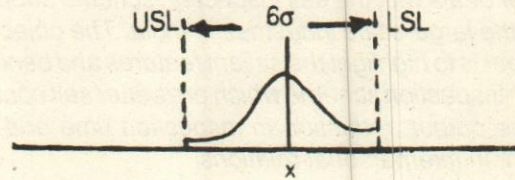
where USL is the Upper Specification Limit, LSL is the Lower Specification Limit and σ is the Standard Deviation.

Achieved Capability (C_{pk})

It is the actual capability achieved by the process/operator. It is given by the formula.

Assuming normal distribution

$$(\text{Achieved Capability } (C_{pk}) = \text{Min} \left\{ \frac{USL - \bar{x}}{3\sigma}, \frac{\bar{x} - LSL}{3\sigma} \right\})$$



As shown in the figure Achieved Capability is minimum of two spreads

$$\frac{USL - \bar{x}}{3\sigma} \text{ and } \frac{\bar{x} - LSL}{3\sigma}$$

- Each C_{pk} is taken as Y_i where $i = 1, 2, \dots, \tau$ where τ is equal to no. of run charts and calculation of Y_i and σ_{y_i} is done. This technique is applied for all the operators doing the same operation with the same dimension. The operator having higher value of Y_i with lower value of standard deviation. σ_{y_i} is comparatively better than other operators.
- The concurrent measure (CM) for each operator calculated by the following formula.

$$CM = -10 \log_{10} \left(\frac{1}{\tau} \sum_{i=1}^{\tau} \frac{1}{y_i^2} \right)$$
- The operators having higher concurrent measure than the nominal value are eligible for certification for the

corresponding operation in the self-inspection scheme. The nominal value is fixed based on relevant operational parameters.

Specimen Calculation

Operation : Spot facing. Dimension : 38.7 ± 0.2 mm

Operator : Ram Singh

Operator: Rajesh Kumar

Nominal value for spot facing : 8

For Operator Ram Singh

$$\Sigma y_i = 145.592 \quad n = 30$$

$$\bar{Y}_i = \frac{\Sigma y_i}{n} = \frac{145.592}{30} = 4.85$$

$$\sigma y_i = \sqrt{\frac{\Sigma (y_i - \bar{Y}_i)^2}{n-1}} = \sqrt{\frac{9.13}{29}} = 0.56$$

$$CM = 10 \log_{10} (1/30 \times 1.323) \\ = 13.56$$

For Operator Rajesh Kumar

$$\Sigma y_i = 130.35 \quad n = 30$$

$$\bar{y}_i = \frac{\Sigma y_i}{n} = \frac{130.35}{30} = 4.35$$

$$\sigma y_i = \sqrt{\frac{\Sigma (y_i - \bar{y}_i)^2}{n-1}} = \sqrt{\frac{135.415}{29}} = 2.16$$

$$CM = -10 \log_{10} (1/30 \times 3.6604) = 9.14$$

| Parameters | Operator-Ram Singh | Operator-Rajesh Kumar |
|--------------|--------------------|-----------------------|
| \bar{Y}_i | 4.85 | 4.35 |
| σy_i | 0.56 | 2.16 |
| CM | 13.56 | 9.14 |

For operator Ram Singh the value of \bar{Y}_i is more, σy_i is less and CM value is more compared to operator Rajesh Kumar. So operator Ram Singh is comparatively better than operator Rajesh Kumar.

Role and Functions of Quality Control after the Introduction of the Scheme

Quality control department conducts regular checking for a trial period of three months after the certification of task performers. After the trial period is over, random audit

checks are conducted by Q.C. Detailed analysis is done by Q.C. to help the Production in solving the problems observed. Q.C. also takes up quality improvement studies in coordination with Production and prepares Quality Status Report every month.

Revocation of Authorisation

- * The authorisation of a person in Self Inspection Scheme will be revoked, if it is found during cross checking that the person has not carried out his work in a satisfactory manner.
- * Revocation is done only if the mistakes persist even after the person concerned is informed of the short-comings in his work and has been given an opportunity to correct the deficiencies.
- * If there is transfer of persons from the work area, the authorisation of the person will be revoked after receiving the information from the concerned shop-incharge.

Benefits

- * The rating of the task-performers with regard to the quality of the products produced is done scientifically in this scheme. This acts as an effective feed back to the management as well as to the task-performers regarding the quality status of the products.
- * It demonstrates that, given the proper input, the task performer is capable of giving defect-free output.
- * There is savings in inspection time, which can now be productively used.
- * This scheme helps motivate the task-performers and improve interpersonal relations.

Conclusion

Self inspection scheme has been adopted in one of the large scale Engineering Industries. This scheme can be adopted in any Engineering Industry. Since this scheme involves task-performers, it is their irresponsibility to voluntarily involve themselves in the scheme. The organisation should also render full co-operation in adopting the scheme.

This scheme has helped to bring quality consciousness and awareness regarding defect-free output among the task-performers in the industry considered for case study. Initially the scheme was implemented in only one of the departments. The success of the scheme there led to its adoption in other departments also.

Planning for Industrialization in Indian Economy : An Outline

Bhaskar Majumder

The principal barrier to post-independent Indian industrialization happens to be an unbalanced industrial structure inherited from colonial times: policies have to be formulated to break that structure. Based on three propositions, viz., (i) production of commodities is a reflection of social cooperation, (ii) a process of growth visible to all has to be shared by all, (iii) the State has to ensure macro-economic growth, we chalk out our scheme that signals an output-employment-oriented home market dependent path. Success of planning for independent industrialization along this path depends on a strong State commitment to initiate the activities on a priority basis.

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The world economy today is distinctly divided between a few but dominant group of industrialized countries and a large but subordinate group of non-industrialized or newly industrializing countries (NICs). Most NICs are characterised by an unbalanced industrial structure. If the principal barrier to industrialization in post-independent Indian economy happens to be this unbalanced structure, which India is believed to have inherited from colonial times, policies have to be formulated to break that structure. Planning for industrialization aims to wipe out pre plan economic principles and social set-up in favour of formation of new ones (Gurley, 1975). This effort at reformation brings about new types of contradictions because the initial environment in which the social groups work, viz., national and international economic order in existence, dictates how the individuals and groups should participate in activities. The contradictions are derived also from the sponsorship of planning, e.g., planning initiated by the policy makers, internal (with or without taking into confidence the grass-root participants) or external¹.

The purpose of our paper, however, is a very limited one. Rather than exposing the internal and external constraints on post-independent Indian industrialization, we set the problem of industrialization in its proper perspective and summarize the problems of setting an alternative path of industrialization. We formulate a scheme based on product-cum-technology association and formation of a home market for industrialization, and narrate the implications of our scheme.

¹ "The use of Planning in Third World Countries to promote dependent capitalism may also be seen in the scramble for aid on the part of most countries apparently attempting to reach self-reliance, even though 'aid' generally inhibits efforts at gaining autonomy. Indeed, planning exercises are often carried out to make out a case for more aid from the World Bank and its soft-interest affiliate, IDA, the U.S. Government and other members of the OECD. Planning aimed at reinforcing capitalism in Third World Countries can only reinforce the tendency towards retardation...". (Bagchi, 1982: 250)

Market, State and Technology

Planning for industrialization has to incorporate a time phased ordering of consumer goods consistent with capital goods-cum-technology ordering, each of which has to be planned in an ascending order—from lower-order (socially higher priority) to higher order (socially lower priority)—Priority of commodity basket at any particular stage being determined by planning (Chakravarty, 1988: 112, 131; Lefebvre, 1974: 133-148). In other words, a rising standard of material well-being of the majority in a dominantly private enterprise economy with a political background of Parliamentary Democracy has to rest on provision, in sequence, of basic minimum necessities for survival, consumer goods for comfort and consumer luxuries. A hierarchy of products thus is embedded in the time-sequence of industrialization. This product hierarchy in sequence determines the pattern of distribution and consumption in an economy. In other words, the upward movement in consumption pattern has to rest on a dynamic process out of which new production possibilities are generated. Thus neither do we take a static (often supposed to be price determined) given demand pattern (market) nor a given state of technology (Rosenberg, 1982: 325)².

A rising standard of material well-being of the majority in a dominantly private enterprise economy with a political background of Parliamentary Democracy has to rest on provision, in sequence, of basic minimum necessities for survival, consumer goods for comfort and consumer luxuries.

We consider the State, in a society passing through capitalist transition, as a decision making authority trying, in principle, to ensure mutuality of interests of antagonistic social groups and individuals (Kurien, 1987 : AN-26; Bardhan, 1984 : 32-39; Patnaik, 1984: 1251-1260; Alavi, 1982 : 289-307). State is then the visible hand which directs the course of development.

We would like to stress on development of home market where its formation, if taken as a condition for industrialization, is dependent on the growth of money-

² To quote Rosenberg, "If we are concerned with the historical circumstances out of which new technologies emerged, then the availability of these technologies obviously becomes part of the explicandum and cannot be taken as given".

State is the visible hand which directs the course of development.

based exchange in final commodities, growth of employment based on wage-labour, and a developed money (credit) market.

Increasing monetization in a dominantly private enterprise economy characterized by inflation may be interpreted, as allowing the capitalists to accumulate. For accumulation, however, growth of money, banking and inflation (Reserve Bank of India, 1985 : 12, 109) are not enough, growth of output is necessary. This is where the question of money-based market formation and expansion is most relevant. While the capitalists are anxious for the appropriation of the surplus and market sharing, they as a group are indifferent so far as macro economic growth and market expansion are concerned. The paradox is not that the advantages of growth increasingly accrue to those who control material resources. But it lies in the formation of a very small market based on wage-labour when the rewards of inflation go to the capitalists since they pay in cash, or in the existence of a large unorganized sector in the economy. This is the context where the task of market formation and expansion for industrialization cannot be considered in isolation from the state.

Problems of Setting an Alternative Path

The problems of setting an alternative path of industrialization go deeper than merely viewing interacting 'Technology, Market and State'. The reason is simple. We have already had an experience of a long period of colonial de-industrialization (Bagchi, 1976 : 141-145). During post-independence period we accepted as ideal a process of planning for industrialization subject to an economic set-up of mixed capitalism and a political set-up of parliamentary democracy (Lakdawala, 1986 : 209). The pattern of pre-1966 industrial production shows rapid increase in luxury items (air-conditioners, refrigerators, passenger cars etc.) and slow expansion in mass consumer goods (kerosene, soap, sugar, cotton piece goods etc.) (Dasgupta, 1970 : 217). A perverse production (and growth) pattern is also evident from the pre-1966 high growth for non-essentials, e.g., like electric fans, electric consumer goods, automobiles etc., we find low rates in case of essential goods like food and beverages, cotton textiles, edible oils,

soaps etc. (Ahmad, 1988 : 362). An apparent inward-looking growth may be implicit in adoption of pre-1966 import-substituting industrialization (Majumder, 1990 : 130-134). If in such a situation, the pre-1966 growth could not be sustained during post-1966 period, it means that the same basis of growth can no longer be continued. This is where the path of industrialization needs reorientation.

The pattern of pre-1966 industrial production shows rapid increase in luxury items and slow expansion in mass consumer goods.

Product-cum-Technology Association and Formation of Home Market

Rather than concentrating on an infinite sequence of what cannot be done or what the alternative path of industrialization is not meant to be, we would like to say what it means and what can be done. In our analytical frame we assume that (i) production of commodities is a reflection of social cooperation, (ii) a process of growth visible to all has to be shared by all (iii) the State has to ensure macro-economic growth and balances.

The scheme we would like to construct includes the following variables in real terms:

- Q = National Output
- Q_A = Output relating rural economy centering agriculture
- Q_I = Output relating urban economy centering industry
- Q_F = Agricultural (Rural) consumer goods output
- Q_{NF} = Non-consumable agricultural (rural) output
- Q_C = Non-agricultural consumer goods output (Urban/Industrial)
- Q_K = Capital (Investment) goods output (Urban/Industrial)
- Y = National Income.
- C = National Consumption
- I = National Investment
- L = Total labour available
- L_A = Labour Employment (Rural/Agricultural)
- L_I = Labour Employment (Urban/Industrial)

The equations, by definition, are the following:

$$Q = Q_A + Q_I \quad (1)$$

$$Q_A = Q_F + Q_{NF} \quad (2)$$

$$Q_I = Q_C + Q_K \quad (3)$$

$$Y = C + I \quad (4)$$

$$C = Q_F + Q_C \quad (5)$$

$$I = Q_{NF} + Q_K \quad (6)$$

$$Y = Q \quad (7)$$

$$L \geq L_A + L_I \quad (8)$$

From either (4), (5) and (6), or, from (1), (2), (3) and (7), we get

$$Y = Q_F + Q_C + Q_K + Q_{NF} \quad (9)$$

Equation (9) shows an output composition of effective demand (Keynesian type) where the frame is taken to be autarkic. However, intervention by Government/Trade can be accommodated to keep our frame undisturbed. Let us look at the Leontief-type input-output frame (table 1):

Considering only final demand, from the table, we have

$$Q_F \geq Q_{FA} + Q_{FI} \quad (10)$$

$$Q_C \geq Q_{CA} + Q_{CI} \quad (11)$$

Equations (10) and (11) show supply-demand balance for consumer goods (agricultural & non-agricultural).

Thus, derived from Eqs. (5), (10), and (11), decomposition of consumption demand may be seen from Eq. (12);

$$C \geq Q_{FA} + Q_{CA} + Q_{FI} + Q_{CI} \quad (12),$$

where $Q_{FA} + Q_{CA}$ = Rural Consumption Demand.

$Q_{FI} + Q_{CI}$ = Urban Consumption Demand.

Similarly, from Eq. (6) and table 1 decomposition of investment demand may be seen from Eq (13):

$$I = Q_{NF1} + Q_{K1} + Q_{NF2} + Q_{K2} \quad (13),$$

where $Q_{NF1} + Q_{K1}$ = Rural (Input) Investment Demand

$Q_{NF2} + Q_{K2}$ = Urban (input) Investment Demand.

Obviously from Eqs (4), (12) and (13), we get :

$$Y \geq Q_{FA} + Q_{CA} + Q_{FI} + Q_{CI} + Q_{NF1} + Q_{K1} + Q_{NF2} + Q_{K2} \quad (14)$$

Table 1: Input-output frame

| Commodities to → Commodities from | Rural | Urban | Rural | Urban | Govt. purchase &/or Export | Total Output |
|--------------------------------------|------------------|------------------|-----------------|-----------------|--------------------------------------|-----------------|
| Rural | Q _{NF1} | Q _{NF2} | Q _{FA} | Q _{FI} | Q _{FG} &/or Q _{FX} | Q _A |
| Urban | Q _{K1} | Q _{K2} | Q _{CA} | Q _{CI} | Q _{IG} &/or Q _{IX} | Q _I |
| Labour | L _A | L _I | | | | L |

Again, considering alternative uses of output, we have, from Table 1:

$$Q_A \geq Q_{NF1} + Q_{NF2} + Q_{FA} + Q_{FI} \quad (15)$$

$$Q_I \geq Q_{K1} + Q_{K2} + Q_{CA} + Q_{CI} \quad (16)$$

Equations (15) and (16) show supply-demand balance equations for agricultural and industrial goods.

Equations (10), (11), (12), (14), (15), (16) are balanced by entry of Government/Trade.

The production functions in this system are:

$$Q_A = Q_A(Q_{NF1}, Q_{K1}, L_A) \quad (17)$$

$$Q_I = Q_I(Q_{NF2}, Q_{K2}, L_I) \quad (18)$$

The initial distribution of power (ownership power resources) determines the initial product and associated technology. The technology-in-use, in turn, specifies the nature of commodity and market (demand).

We may write Eqs (17) and (18) as :

$$Q_A = Q_A(T_A) \quad (19),$$

T_A denotes technology related to rural output.

$$Q_I = Q_I(T_I) \quad (20),$$

T_I denotes technology related to urban output.

Equations (19) and (20) actually exhibit a nature of association and not a one-way causation. Considering rural economy, e.g., T_A itself incorporates one specific type of, and it changing, output mix. T_A is dynamic (historically evolved via 'learning by doing') in the sense that at a particular point of time the 'best practised process' is adopted allowing for a better (budding) process at a later date, where by 'process' we mean the way of combining invisible and visible inputs, 'best practised' in the sense of having power to generate output by least possible time and allowing increasing labour absorption (via creation of more working hours). Similar is the case for T_I .

Actually Q_A and Q_I are output vectors :

$$Q_A = (Q_{Ai}), i = 1, 2, \dots, n; n \text{ denotes a set of agricultural products.}$$

$$Q_I = (Q_{Ij}), j = 1, 2, \dots, m; m \text{ denotes a set of industrial products.}$$

Similarly, T_A and T_I are technology vectors:

$$T_A = (T_{Ai}), T_I = (T_{Ij}),$$

There is no *a priori* technology ordering. Selection of technology is very much product-specific.

We may write (17) and (18), from the demand side, as :

$$Q_A = F(M_A) \quad (21),$$

M_A denotes market (demand) for Q_A .

$$Q_I = F(M_I) \quad (22),$$

M_I denotes market (demand) for Q_I .

Equations (21) and (22) show an association between demand and output and not a one-way causation. Adding foreign market does not alter the analytical frame.

Alternatively, by market we could have meant (i) Rural Market for Q_A and Q_I , (ii) Urban Market for Q_A and Q_I . Whichever way we look at these, from Eqs(19), (20), and (22), we find the nexus of 'product-technology-market' to generate results.

If the urban economy has already had necessary supply of industrial consumer goods and capital goods, i.e. if

$$\left. \begin{aligned} Q_{K2} &= \bar{Q}_{K2} \\ Q_{CI} &= \bar{Q}_{CI} \end{aligned} \right\} \text{and} \quad (23)$$

then the problem is to ensure industrial growth via raising the output of industrial consumer goods (Q_{CA}) and capital goods (Q_{K1}). These goods are to be sold to the rural economy. This is the point where rural market needs to be generated. If the State does not rely on relief (welfare approach) measures (which it cannot afford to for long) or on adhocism reflected in target-group oriented programmes (which necessarily fails), it has to rely on growth approach, in our context, via rising Q_A .

If the urban economy does not purchase any additional Q_A i.e. if rural output necessary for urban people is ensured (via public distribution system or otherwise), i.e., if

$$\left. \begin{aligned} Q_{NF2} &= \bar{Q}_{NF2} \\ Q_{FI} &= \bar{Q}_{FI} \end{aligned} \right\} \text{and} \quad (24)$$

then the process of output-income generation in rural economy is impeded (in absence of increasing income flowing to rural economy from urban economy). Then inter-rural economy, production and exchange work via Q_{NF1} and Q_{FA} .

Whether or not the total or truncated rural-urban flows work, we may get a product-cum-technology association

(in operation or planned) to be reflected in formation of rural market for (urban) industrial goods.

Let w denote wage rate; W , wage share.

This wage share can work as a proxy for rural income and wage rate as per capita rural income. Then the choice of product specific selection of technology leads to determination of wage-labour employment, in turn, formation of market.

$$\left. \begin{aligned} Q_{A_1}(T_{A_1}) &= (LA_{1i}, WA_{1i}) = (WA_{1i}) = (MA_{1i}) \\ Q_{A_2}(T_{A_2}) &= (LA_{2i}, WA_{2i}) = (WA_{2i}) = (MA_{2i}) \\ Q_{A_n}(T_{A_n}) &= (LA_{ni}, WA_{ni}) = (WA_{ni}) = (MA_{ni}) \end{aligned} \right\} \quad (25)$$

Once the rural market is formed (expanded) via product-embodied selection of technologies, it stimulates demand for Q_i (i.e., Q_{CA} and Q_{K_1}). The size of rural market for industrial goods corresponds to the pattern of wage-employment via the product-cum-technology specification. If this specification changes, size of rural market also will change (and vice versa) to alter the demand for industrial goods and industrial growth.

The size of rural market for industrial goods corresponds to the pattern of wage-employment via the product-cum-technology specification.

We have considered the possibility where, to start with, intra-urban flows are fixed at a predetermined level; also we considered the possibility where the urban economy does not purchase increasing rural output, as shown in Eqs. (23) and (24). Thus, from Eq. (14),

$$\begin{aligned} Y &\geq Q_{FA} + Q_{NF_1} + Q_{K_1} + Q_{CA} + Q_{NF_1} + Q_{K_2} + Q_{CI} \\ \text{or;} \quad Y &\geq (Q_{FA} + Q_{NF_1}) + (Q_{K_1} + Q_{CA}) + A, > 0 \\ \text{and fixed,} \end{aligned} \quad (14a)$$

Thus, following our scheme, an effect on Y (or Q) over time is felt via rising $(Q_{FA} + Q_{NF_1})$, associated with rising $(Q_{K_1} + Q_{CA})$.

From Eq. (15), taking equality

$$\begin{aligned} Q_A &= Q_{NF_1} + Q_{FA} + Q_{NF_2} + Q_{FI} \\ \text{or, } Q_A &= \alpha Q_A + k, \end{aligned} \quad (15a)$$

$k = Q_{NF_2} + \bar{Q}_{FI} > 0$ and fixed, and α is the proportion of Q_A used by rural mass. Taking total differential,

$$dQ_A = \alpha \cdot dQ_A + dk.$$

Subject to the constraints imposed by Eqs. (23) and (24), a mechanism of $Q_A - T_A - M_A$ association gets reflected in raising $(Q_{NF_1} + Q_{FA})$, operator being the parameter α . Increasing rural output gets reflected in increasing demand for industrial goods $(Q_{CA} + Q_{K_1})$.

Given Eqs. (18), (23) and (24), we get :

$$Q_i = Q_i(L_i) \quad (18a)$$

Increasing rural output gets reflected in increasing demand for industrial goods.

Equations (18a), (20) and (22) imply that Q_i is allowed to rise via $L_i - T_i - M_i$ association.

If then the urban (industrial) economy generates increasing demand for Q_A and/or the export frontier gets promising, that helps our scheme work better.

Implications of Our Scheme

The scheme we have chalked out aims at an output-employment oriented home-market dependent industrialization strategy. Assuming that the State is strongly committed in principle to generate rural market for industrial goods (as the breadth of home market is basically related to existence of market in rural India), we chalk out our scheme. The scheme being primarily on rural industrialization, the problem of rural-urban labour migration is ruled out.

The choice of products and technologies by rural people obviously aims at reducing working hours per labourer as well as raising wage (per hour). Planning in this context has to explore the possibilities of raising productivity per labour (hour), releasing a section of labourers from dependence on land and absorbing them in creation of rural infrastructure and related developmental works, there by maximizing the participation rate (the ratio of number of labourers employed to what is available). This, in turn, is expected to generate market. After the basic consumption necessities are met, the increasing income will chase

industrial goods (World Bank³, 1978 : 30; ILO, 1974 : 511; Griffin and Khan, 1978 : 29^c 300).

Our scheme aims at checking an initial leakage of purchasing power from the rural economy. For this, planning has to ensure the rural inhabitant's absorption in non-farm rural activities and create conditions favourable for removal of infrastructural constraints operating in Indian rural economy and in the same process maximize individual and collective income and commodity entitlements (United Nations, 1978 : 55)⁴. Since production and generation of income move together in order, if output-mix-cum technology decisions are taken by the lower strata of population, through, e.g., decentralized planning, inflation of any type is supposed not to neutralize the commodity entitlements of the participating agents (Streeten & Burki, 1978 : 414)⁵.

An initial investible money endowment is necessary to get the rural people absorbed in at least one vital activity which afterwards may propel to set the whole rural economy in motion. At this point, the demand-management policies and quantitative controls seem relevant. We should not, however, assume any paucity of finance for implem-

Planning has to ensure the rural inhabitant's absorption in non-farm rural activities and create conditions favourable for removal of infrastructural constraints operating in Indian rural economy and in the same process maximize individual and collective income and commodity entitlements.

entation of rural project in a State where the depositor's initial money endowment gets doubled by five years. Still there may come resistance from the privileged section, particularly rural oligarchy to frustrate any radical move for and by the bottom rural monetary institutions aimed to finance the rural projects independent of initial properties (Gerschenkron, 1968 : 137; Mbat, 1982 :145)⁶.

It is not surprising that the development strategy based on rural industrialization in the early phase will fail to generate rural demand for higher-order industrial goods, given the absolute extent of poverty and absence of infrastructure (e.g., electrification for domestic use) in rural India. But if industrial production is to have a rural market for its sustenance, initial product-technology ordering in rural India is to be need-based and socially-oriented. As soon as the first phase gets tested and passed comes the second phase where rural development schemes and expansion of rural market for industrial goods move together.

If industrial production is to have a rural market for its sustenance, initial product-technology ordering in rural India is to be need-based and socially-oriented.

The above mechanism of home market expansions, mainly the rural one, for industrial goods does by no means ignore export possibility. The worst effect the strategy can have on trade in the first phase is reduction in both exports which is not to be confused with a time-phasing convergence to a closed economy frame. In fact, our strategy aims at correcting the prevalent structural distortions via reorienting product-cum-technology ordering.

We stress rural need-based technology primarily because technology is useful to convert community/caste-based isolation into a production-based interdependence, thereby shattering a primitive belief structure rooted in a stagnant society. We stress rural resource-specific technology secondarily because the endemic nature of mass poverty and inequality is derived not only from differences

³ The income-elasticity of demand for non-food goods and services appears to be quite high in rural areas. A 1974 International Labour Organization (ILO) report on employment in the Philippines noted that the demands of rural consumers followed much the same patterns as urban consumers, e.g., in Philippines following increasing output-income in agriculture the farm households improved their houses, built new ones, purchased household furnishing and equipment. Indeed, the ILO study confirmed that 'consumption potential in rural areas is sizeable and easily stimulated when incomes rise'.

⁴ "... at any point in time, existing infrastructure constitutes a resource and its absence a constraint to rural development". This is the point which compels us to think of infrastructure as a variable rather than as a parameter in our analysis on rural led development strategy. While we talk about stopping a leakage of purchasing power from rural economy we, by no means, assume a town-country conflict.

⁵ Streeten & Burki, (1978) via provision of basic needs, emphasise both 'supply management' and 'generation and articulation of demand' so that increases in the incomes of the poor are not neutralized by increases in the prices of the goods and services on which they spend these increments, or increases in their productivity are not neutralized by lower money income...

⁶ Following Gerschenkron, (1968) "In Germany, the various incompetencies of the individual entrepreneurs were offset by the advice of splitting the entrepreneurial functions. The German Investment Banks—a powerful invention comparable in economic effect to that of the steam engine ... very often mapped out a firm's paths of growth, conceived far-sighted plans, decided on major technological and locational innovation and arrangement for mergers and capital increases". While mentioning the pioneering role of German Investment Banks, what we like to stress is an endogenous dynamism which the rural banking system in India can establish.

in initial private ownership over resources but also how the resources are being organised and used in the sphere of production. If public right over private property can not be ensured at this moment, the scheme we have chalked out may aim at opening the path for independent industrialization. A time-phased development of resource-specific products and product-specific resources, technology-specific products and product-specific technologies explains the nature of this path. Success of planning for independent industrialization along this path depends on a strong State commitment to initiate the activities, which, in turn, depends on conscious entry/exist of the majority of people in decision-making processes and centres.

Technology is useful to convert community/caste-based isolation into a production-based interdependence, thereby shattering primitive belief structure rooted in a stagnant society.

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AMT Financial Justification: Cases From the UK Industry

Mohamed Zairi

This paper examines issues on financial justification for the implementation of Advanced Manufacturing Technology. The paper is based on a research project which studied the implementation of AMT innovation in three sectors of manufacturing industry in the UK. The number of companies scrutinized amounted to 20 overall. The paper argues that financial justification was found to be very much related to the strategic approach adopted by the users concerned. The paper concludes by proposing a model of AMT implementation which incorporates financial justification as an essential element of strategic planning.

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The implementation of Advanced Manufacturing Technology (AMT) innovation brought with it various benefits but also a wide range of problems. Reports such as ACARD [1983] and NEDO [1985] which investigated the introduction of AMT in the U.K., concluded that there are various problems both internal and external in nature to the user organizations, amongst which is the issue of financial justification.

Financial justification, in many instances was reported to be the major inhibiting factor for the introduction of AMT projects. Many writers agree that the difficulty in quantifying many of the benefits which AMT is supposed to achieve and the inadequacy of existing accounting systems are at the heart of the problem of AMT introduction (ACARD 1983; Kaplan, 1984; Gold, 1982; Baer, 1988; Bolland & Goodwin 1988).

Existing financial systems fall short in embracing various aspects of manufacturing where contributions in adding value are of an intangible nature. Organizations which introduced AMT as a major competitive weapon, compete on criteria other than price, such as speed of response to changes in the market place, flexibility, quality and reliability, the degree of innovativeness amongst others.

Limitations of Conventional Financial Systems

Financial accounting systems such as Return on Investment (ROI) which were used in the past with great success as indicators of efficiency, as a means of evaluating proposals for capital investment and as overall assessors for companies' performance, can no longer be relied upon in the context of AMT, because of a variety of reasons. For instance, ROI tends to be more concerned with the encouragement of financial profits rather than the strategic gains in terms of increasing effectiveness and optimising the flexibility of AMT equipment.

In addition, ROI gives managers an incentive to reduce expenditure on intangibles such as R&D, customer services, employee development, quality improvements amongst others. When companies are not doing well, there is the possibility of distorting the economic reality by forging intangible assets in order to increase reported income and this creates a major flaw in conventional financial systems and therefore renders them inappropriate for AMT implementation [Kaplan, 1984].

Pay-back methods are even more difficult to apply when the primary reasons for investing in AMT are linked with increased flexibility and raising quality standards. As Bernard [1986] suggested, justification in this case becomes more an art than a science. Rather than relying on a creative accounting system that will reduce the impact of all the intangible aspects in order to maximise the economic benefits using imprecise and highly subjective data, it is better to develop an approach which relies on a structured methodology more concerned with the analysis of relative advantages and disadvantages to the companies concerned.

It is better to develop an approach which relies on a structured methodology more concerned with the analysis of relative advantages and disadvantages to the companies concerned.

Financial systems such as Net Present Value (NPV) have a negative bias in the evaluation of AMT projects in comparison to conventional projects. Many major AMT projects take years to build. They require debugging and a time allowance for the learning curve to take place. According to NPV rules, AMT projects will be ruled out from the start. NPV tends to encourage projects which are virtually without risks and which can lead to financial benefits in the short term. This approach according to Gold [1982] is very myopic because it overlooks the long-term competitive advantages at the detriment of short term financial returns. Gold suggests that there should be a shift from financial evaluation and control systems which tend to encourage maximisation of NPV to what is termed 'continuing horizon approach' which recognizes that the benefits are achieved incrementally through the learning curve, and through maximizing effectiveness in a gradual manner.

A further problem associated with conventional financial systems is related to management attitudes towards the appraisal of AMT projects. There seems to be a

tendency to lose interest in appraising AMT once it is implemented. According to Gold [1982], post-audits or 'make good evaluation' tend to take place 6 - 12 months after project completion. In view of the nature of AMT innovation and the achievement of its benefits, audits need to take place regularly over a long-term period, in order to establish true performance measures based on optimising the effectiveness of AMT utilisation in all aspects of business operations.

Financial Justification Approaches

There are three main justification categories that can be referred to in the context of AMT. In the case of stand alone equipment which is purchased primarily as a direct replacement to worn-out equipment, the expected benefits can usually be quantified and the approach taken therefore is purely economic. As more qualitative benefits are expected such as synergy and flexibility, economic justification techniques on their own will be inadequate. Analytical techniques such as probability distribution and subjective estimates are required in this case. Lastly, if AMT systems are implemented for total integration of various business activities, then clear competitive advantages have to be identified. In addition to the use of economic and analytical techniques, a step-by-step approach based on an assessment of incremental benefits in an 'outward' way has to be conducted. The three models which have been proposed by Meredith and Suresh [1986] are represented in figure 1.

The proposed models show that financial analysis needs to be based on a continuum of methodologies, each of which needs to be related to a continuum of technologies ranging from stand-alone equipment, cellular equipment and integrated business systems. The level of

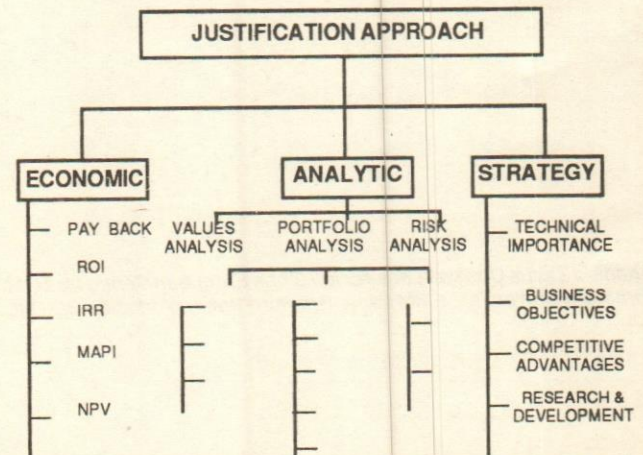


FIG. 1. CLASSIFICATION OF JUSTIFICATION METHODOLOGIES

Source : Meredith & Suresh 1986

risk and uncertainty increases with an increase in the level of complexity in the continuum of technologies. This consequently requires high commitment from senior management and the development of a business strategy based on a systems' approach towards competitiveness.

Investments in areas such as Computer Integrated Manufacture (CIM) will continue to be challenging in the 1990s. There are many systems which have been developed specifically to assist senior managers in making decisions on AMT proposals such as the Investment Analysis Computer Program (IVAN) developed by UMIST (Primrose & Leonard, 1985; 1986 a, 1986 b,) or simulation packages such as those described by Noble (1988).

The level of risk and uncertainty increases with an increase in the level of complexity in the continuum of technologies.

Future investments in AMT projects will still present senior managers with problems. This is mainly because adoption reasons are expected to be closely linked to gaining competitive advantages. In addition to seeking to quantify in all aspects of business operations, there is an urgent need to change attitudes, to rely more on teamwork and less on heroes and scape goats.

The Study of AMT Users

Financial justification for AMT was examined in 20 users representing three sectors of manufacturing industry (table 1). The study was part of a bigger project which looked at user-supplier interactions in the context of AMT innovation. The project studied various patterns of relationships based on the type of innovation being scrutinised.

The various users have been coded as Plastics Sector User (PSU) 1 to 4 Engineering Sector User (ESU) 1 to 9 and Automobile Sector User (ASU) 1 to 7, to protect identity. The various innovation projects linked with the 20 users, range from stand-alone equipment such as

Table 1: AMT users by industry sector

| Sector | No. of Companies | Code |
|-------------|------------------|-------------------------------------|
| Plastics | 04 | PSU ₁ - PSU ₄ |
| Engineering | 09 | ESU ₁ - ESU ₉ |
| Automobile | 07 | ASU ₁ - ASU ₇ |

injection moulding machinery to complete systems such as Flexible Manufacturing Systems (FMS) (table 2)

Table 2: Types of AMT Innovation Projects

| Innovation Type | No. of Companies |
|-----------------------------|------------------|
| Injection Moulding Machines | 04 |
| CNC, FMC Machinery | 05 |
| SFDC, CAD/CAM | 04 |
| AGV Systems | 03 |
| FMS | 02 |
| Computer Inspection Systems | 02 |

AMT Justification: Individual Cases

The various users of AMT were found to exhibit one of two strategic approaches:

An offensive approach: determined by aggressive strategies in order to attain competitive advantage;

A defensive approach: characterized by strategies more concerned with internal consistency of current performance behaviour.

Using Porter's generic strategies, (Economic Commission for Europe, 1986) the various users have been classified according to their competitive styles.

AMT Justification in Defensive Strategies

Five users were found to exhibit a defensive approach. They all rely on sub-contract work and tend to compete in home markets only. Plastic Sector User 1 (PSU₁) and User 2 (PSU₂) for instance are trade moulders with some big customers. PSU₃ manufactures various components which need to be assembled elsewhere. PSU₄ on the other hand operates at the higher end of the market. They supply various industries such as the domestic appliance market, the automobile sector and the computer industry. The Engineering Sector User 7 (ESU₇) is also a subcontractor to the automobile industry.

Financial justification in all five cases is very much related to the type of returns sought. In the case of PSU₄ financial justification was found to be problematic because of the type of machines required. This company tends to use big machines with high capability and engineering quality for the range of products required. Quantitative methods on their own have generally been found to be insufficient. This made the company rely on qualitative benefits as well. In the case of PSU₃, investment in AMT did not present a problem because nearly all the benefits have been identified. The justification process was also facilitated by the small size of the company and hence not having many people to convince. PSU₁ on the other hand

moved to injection moulding machinery with microprocessor controls fairly recently. Prior to that, the company tended to rely on the use of re-conditioned equipment. Although the need to invest in AMT equipment with quality and flexibility is recognised by everyone at PSU₃, senior managers have however expressed their reluctance to invest if capacity is not being utilised to the optimum.

In the case of ESU₇, investment in AMT did result from planning and assessing capacity requirements. Investment in new equipment has generally followed the winning of sizeable orders. For example, the company once purchased a lathe on a Friday and put it in full operation the following week. This ability to buy AMT equipment in such a short time was explained by one of the senior managers:

"The big move from manual to CNC machines was because of the type of jobs the company was asked to do (flywheels for Ford). Because of the nature of the sub-contract work, the company can buy more technological equipment which pays for itself in very short periods (the shortest period so far has been 10 months)."

AMT Justification in Offensive Strategies

Six companies were identified as having competitive strategies geared towards specific market segments. ASU₄ and ASU₆ are divisions of the same company, representing both the engine sub-assembly division and the parts manufacturing division, respectively. The company sells both utility cars (4X4) and luxury cars to specific worldwide markets. As part of an overall rationalisation strategy, the company decided to rely on AMT to achieve its goals. The adoption of an Automatic Guided Vehicle (AGV) system [ASU₄] and Computer Numerically Controlled (CNC) machines [ASU₆] was part of the rationalisation strategy.

ASU₇ is also a major competitor in the luxury car market and decided to invest in AMT to help them achieve their strategic goals. As a result of a major reorganisation plan, the company moved towards the FMS philosophy and Group Technology (GT) centres. ASU₃ competes in the world market by supplying both industrial and agricultural tractors. The adoption of an AGV system was to help the company solve infrastructural problems and to offer badly required flexibility.

ASU₂ is another luxury car manufacturer. The volumes produced by this company are even lower than those produced by ASU₄, ASU₆ and ASU₇. The strategy is to introduce AMT where it is most appropriate whilst preserving craftsmanship. The adoption of an Electrical Check-out System (ECOS) was not for the purpose of

rectifying faults but to maintain quality levels by offering a disciplined approach towards controlling all the electrical aspects of the motor car. ESU₂ is different from others in that it is only a small company but highly innovative. It is involved in service, maintenance, repair and re-conditioning of equipment in special industries. The adoption of a CAD/CAM system was to offer flexibility to tackle various designs and new works, reduce lead times, release extra machine time and get accuracy in machining by reducing human intervention.

Financial justification in the majority of cases was closely linked to the competitive strategies being pursued. In the case of ESU₂, the decision to introduce CAD/CAM was part of a policy to computerise the shopfloor and funding given by the parent company. Broad guidelines were given to ESU₂ who had to justify that technically there was need to computerise (bottom up approach) and that commercially computerisation will enhance its competitiveness. In the case of ASU₂, the introduction of the ECOS system was justified financially by various cost savings and the reduction in No checks conducted by car dealers who are paid up to £ 25 an hour to carry out these tasks (2 hour pre-delivery checks per car on 40 installations).

Financial justification in the majority of cases was closely linked to the competitive strategies being pursued.

Strategically, the intangible benefits were seen in the positive impact of ECOS in introducing a 'total discipline for inspection' where there is less reliance on inspectors' skills and judgements. The management of ECOS was perceived to be a step in regaining control.

In the case of ASU₃, the decision to introduce a new transmission facility was already taken. Financial justification was included in the company's five year strategic plan of consolidation. Many tangibles have been identified such as great reductions in labour force, the reduction in size and therefore reduction in overheads. For ASU₄ who implemented an AGV system similarly to ASU₃, financial justification was problematic. This is because any options considered had to be part of the rationalisation strategy of the company, intended to improve quality and efficiency. Many tangible benefits were however identified and contributed towards justification, such as the ability of the systems to tackle the amount of inventory on the shopfloor,

its ability to distribute work loads evenly and the ability to handle various volumes of work. For ASU₄, financial justification for the introduction of CNC machines was still problematic. Direct labour savings and pay back based on quantifiable benefits are not enough for justification. The introduction of any AMT equipment has to be part of the overall competitive strategy. ASU₇ has a policy which enables it to introduce any AMT equipment provided it is part of its overall competitive strategy. This was explained by one of the senior managers interviewed as follows:

"Any investment in this company has to be considered at three levels. If the investment is related to the company's quality strategy then there is no problem. We address the problem, investigate it and if it requires investment in AMT, we proceed with the plan to invest. If the investment is specifically for productivity reasons, we look at various contributory factors such as pay-back periods and cost savings. If the investment is for strategic reasons then because of the type of company we are, the type of models and volumes we produce and the types of markets we operate in, we use sheer guts and strategic incentives towards strategic investment."

Product Differentiation Strategies

Six AMT users were found to operate product differentiation strategies. ESU₈, a manufacturer of engine transmission systems implemented an FMS system to give it the flexibility required for manufacturing the right quantities with the right amount of labour content. ESU₉ adopted a similar approach to ESU₈. It is a manufacturer of valve systems for heating and ventilation systems in the construction industry. In view of the variety of options in its products and the variation in order sizes, the company's strategy was to introduce flexibility which will enable it to handle changes in the market place. The adoption decision was for an FMS system much more advanced and sophisticated than that of ESU₈.

ESU₄ and ESU₅ are major suppliers to the automobile industry. ESU₄ is a supplier of electric ignition systems and ESU₅, a supplier of brake systems. The adoption of AMT in both cases was to introduce flexibility and efficiency. In the case of ESU₄, the introduction of a Shopfloor Data Collection System was part of a business strategy geared towards increasing performance and efficiency through effective information flow. ESU₅ on the other hand, operates a competitive strategy based on Competitive Achievement Plans designed to increase the company's performance in the market place. The introduction of CNC machines was therefore part of the plan to increase overall

flexibility and to provide the ability to manufacture new products, deal with changes in customer specifications and batch sizes.

ASU₆ was the biggest volume car manufacturer in Britain. Its competitive strategy was to try and become the best volume car manufacturer in Europe. The pressure of being number one in the U.K. market was evident through the company's determination to sustain competitive advantage. Investment in AMT is therefore an on-going process. The adoption of an AGV system was part of this competitive strategy. It was introduced to improve quality, to give an environment with limited stocks, to give control and indication on the level of stock available on site, and to reduce the amount of checks.

ASU₁ is very much like ASU₆. It is a high volume car producer and competes on high quality and flexibility. Part of its competitive strategy is the battle against quality in order to reduce warranty which can amount to substantial sums of money and which can damage the company's reputation. The introduction of an Electrical Check-out System (ECOS) was part of the quality strategy. The strategy was to build the 'Cockpit Module System' as one unit, transport it onto the vehicle line and plug it in the car as a complete unit.

Financial justification in most cases was not perceived to be a problem because the implementation of AMT was part of an overall strategic plan. For ASU₆ for instance, the introduction of AGV system was part of a strategic plan which included the introduction of a new model. The identification of various areas of savings was a major contributory factor. Similarly, for ASU₁, the introduction of the ECOS system was part of a major project to put the 'cockpit module system' into operation. The cost of the project was already worked out and various savings from the utilisation of ECOS were identified such as reductions in warranty costs and costs of rectifications.

For ESU₅, financial justification is not a problem because this type of industry dictates that decisions regarding investment have to be made at relatively short notice. This is summed up by one of the senior managers interviewed as: "The nature of the motor industry is very competitive. The motor manufacturers decide on their strategies, then communicate the information to their suppliers. This takes place a bit late. Once you are committed to supply, you have to supply the products, hence it means investment in new machinery."

ESU₉ did not perceive that there were many options to choose from. In order to remain competitive in the valve industry, they had to invest in AMT. The FMS purchased

amounted to a total of 5.5 million but this was helped by a generous grant from the U.K. government. ESU₈ on the other hand, did find the justification of their FMS system to be problematic. This engineering sector relies on high capital equipment but competition is concentrated on low margins, therefore the returns are very limited. Similarly to ESU₉, a generous grant from the government facilitated the justification process.

The introduction of a Shopfloor Data Collection System was not a problem for ESU₄: Although the investment was part of an overall strategy to increase business/economic performance, the system was introduced mainly for functional reasons. Most savings were quantifiable, in areas such as labour reduction, increases in efficiency and information flow.

Overall cost leadership strategies

The last three users involved were found to compete on cost leadership strategies. ESU₆ is a major manufacturer and supplier of pneumatic products. The adoption of AMT equipment is part of an overall competitive strategy which aims to sustain the competitive advantage and maintain high productivity levels. The implementation of CNC machines was to improve cycle times. ESU₁ on the other hand is part of a large group. The company manufactures and sells fluid cylinders. The competitive strategy was to increase market share through a common approach adopted by all sister companies. The adoption of a CAD/CAM system was part of the competitive strategy intended to reduce costs. ESU₃ is also part of a large group. This company manufactures and supplies water treatment equipment worldwide. The adoption of a Shopfloor Data Collection System was part of a rationalisation strategy aimed at increasing efficiency and providing flexibility to deal with market changes.

The areas of investment are generally for internal efficiency, with quality and flexibility not necessarily as top priorities.

AMT justification in all three companies seems to be less problematic than other cases operating focus and differentiation strategies. This is because in most cases the identified areas of savings are major contributory factors in favour of investments. The areas of investment are generally for internal efficiency, with quality and flexibility not necessarily as top priorities.

AMT Justification: Overall Analysis

An overall analysis of the sets of data obtained indicates that users who found the AMT justification process to be problematic, tended on the whole to carry out project assessments using conventional means only. In these cases, the reasons for AMT implementation seemed to be mainly related to economic benefits. Analysis of the data suggests that there is generally a lack of knowledge on the strategic implications of AMT. This is explained by users' inability to relate appraisal processes to qualitative and intangible benefits and the heavy reliance on rigid and inflexible conventional analytical techniques. These findings are supported by arguments presented by Kaplan [1984], Gold [1982], European Economic Commission [1986] and many others.

Table 3 is a summary of the cases where AMT implementation proved to be difficult. The following points summarise the main arguments where AMT justification process was found to be problematic.

- * Many companies still use conventional financial analysis methods for the justification of AMT. In these cases, the main characteristics which are perceived to be important relate to economic and quantifiable benefits;
- * In many cases, there appears to be a lack of knowledge, appreciation and understanding of the strategic importance of AMT. Managerial attitudes in the appraisal of AMT seem to be limited to areas of cost savings and optimising profitability levels. The old scientific managerial principles practised

Table 3: AMT justification: Problems encountered

| Problems | Industry Sector | | |
|---|-----------------------|--------------------------|-------------------|
| | Plastics No. of Co | Engineering No. of Co | Auto No. of Co |
| Tight financial criteria. justification has to be based on quick returns | 1 | 2 | 3 |
| Direct labour savings not enough | | | 1 |
| Problem of identification of areas of cost savings | 1 | 1 | 3 |
| Company competing for low margins | | 1 | |
| Large complex machines required for type of product. Hence high capital investment required | 1 | | |
| Investment has to be part of a rationalisation strategy to improve quality and efficiency | | | 2 |

during the mass production era appear to be widely used still;

- * In some cases, the strategic impact of AMT may be recognised and the non-economic criteria considered during the implementation of AMT. The major hindrance however appears to be in gaining support for AMT proposals or in establishing the relationship between AMT and other business activities. In these cases, any investment programme has to be considered on a wider and outward context, as part of an overall business strategy.

AMT justification not problematic

In cases where AMT justification process was not considered too problematic, the main reasons reported were strategic. Benefits sought by the users concerned were found to relate mainly to areas of quality and flexibility. In these cases, there seemed to be a general conviction that in order to remain competitive, organizations have to invest adequately in capital equipment. This finding reinforces arguments presented by Meredith & Suresh (1986) who stated that AMT investment requires subjective judgement, vision and commitment towards competitiveness. The identification of major benefits and the ability to quantify them was found to be a major facilitating factor for many users. In cases where users were part of a large group, AMT justification was conducted at the corporate level thus sparing the burden on business units. For other companies, generous grants from the government facilitated the process of AMT introduction by making the risks acceptable.

Table 4 illustrates the major reasons why AMT justification was not considered to be too problematic. In addition the following summary contains the key points on major facilitating factors in the process of AMT justification.

- * AMT was seen as part of an overall competitive strategy. The main areas of competitiveness include quality and flexibility. AMT is therefore considered to offer the former competitive gains. Further, investment in AMT has to be part of a general commitment to sustain competitiveness
- * At the economic level, the identification of various cost savings aids AMT justification
- * The lack of cash flow problems and the level of demand for existing products make the process of AMT justification less problematic
- * Investment responsibility of parent company. The

Table 4: Reasons why AMT justification was not problematic

| Reasons | Industry Sector | | |
|---|-----------------------|--------------------------|-------------------|
| | Plastics No. of Co | Engineering No. of Co | Auto No. of Co |
| Part of strategic plan | 1 | 4 | 4 |
| Identification of savings contributory factor | 2 | 4 | 4 |
| Investment criteria is to remain competitive | 1 | 3 | 1 |
| Help from government schemes | 1 | 1 | |
| Calculated pay-back in a short period | 1 | 2 | 1 |
| Cheaper to upgrade than pay high maintenance cost | | 1 | |
| Benefits/gains in the areas of flexibility and quality improvements | | 6 | 3 |
| Parent company provides capital investment | | 2 | |

problem of AMT justification therefore, does not affect business units

- * In some cases, government grants facilitate the justification process and positively encourage AMT implementation.

Conclusions

This paper examined issues related to AMT financial justification in the U.K. manufacturing industry. We found that there are two major competitive behaviour modes adopted by users of AMT: A defensive competitive behaviour mode where AMT contributes mainly in tangible areas of economic benefits and an offensive behaviour mode where AMT becomes an integral part of competitive strategy, with specific goals in mind to enable the users concerned gain a competitive advantage by offering flexibility and quality benefits for example. The paper established that AMT justification could become problematic if there is sole reliance on economic analytical techniques. If however AMT is considered more widely, in the context of the overall business strategy, then financial justification becomes less problematic.

If however AMT is considered more widely, in the context of the overall business strategy, then financial justification becomes less problematic.

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- * To survive economically, Japan with lack of natural resources, had to find ways of enhancing their ability to export manufactured products; thus, eventually debuting into the world market place.
- * The breath taking and least expected historical changes in the erstwhile Soviet Union led by Mikhail Gorbachev, have strengthened the cause of productivity and quality in the world.
- * Problems of the future look gigantic today. It is something like what the sea was to us 5000 years ago as space is to us today.
- * Good ideas are hammered out by individuals but require a mass of people to implement them.
- * Productivity and quality are satisfying to the people who are in the pursuit of the never ending quest to improve life on this earth.

— M.R.Ramsay in QPM Vol. 10 No. 1 1992

Have Indian Firms any Manufacturing Strategy?

Ghansham J Kulkarni & Arun P Sinha

This study evaluates viable strategic patterns followed by Indian manufacturing units. For this purpose a questionnaire was designed and a survey of manufacturing units was conducted. The survey reveals that Indian firms have perceptibly distinct orientations towards manufacturing. They differ in the aspect of manufacturing they emphasize and in the action programmes. Their manufacturing strategies appear to be in different directions, indicating a lack of coherence and confusion in concept.

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Manufacturing strategy is contained in structural decisions about manufacturing taken over a time period that complement each other towards achieving the business goals. For instance if "Minimum cost to the customer" happens to be the intended strategy for the business, then many structural decisions should be taken in order to achieve this goal collectively. These decisions would be aimed at mass production, standardization of products, automation, just in time production, efficiency and productivity improvement, use of information technology and computers etc. The framework in table 1 identifies the classes of these structural decisions.

Manufacturing strategy is contained in structural decisions about manufacturing taken over a time period that complement each other towards achieving the business goals.

All these decisions must obviously be consistent over time and with the business strategy. They must be directed towards the achievement of a *distinctive competence* in manufacturing. A manufacturing designed to excel in one direction will be able to do so in another direction only with immense difficulty, with great strategic cost and probably poorly. A system designed for "cost minimization" cannot offer "product flexibility" or "volume flexibility" easily. At a

Table 1: Decision Categories in Manufacturing strategy

| | | |
|--------------------------------|---|---|
| Capacity | — | amount, type, timing |
| Facilities | — | size, location, focus |
| Technology | — | equipment, automation, connectedness |
| Vertical | — | direction, extent, balance |
| Integration | | |
| Workforce | — | skill level, pay, security |
| Quality | — | defect prevention, monitoring, intervention |
| Production | — | computerization, centralization, |
| planning/ materials control | | decision rules |
| Organisation | — | structure, reporting levels, support groups |

national level, the Japanese competitive edge of 'quality' is well known, as against the cost minimization by US industries. Now as the world is taking to 'quality' seriously (US and European industries included), Japanese industries are fast moving into another competitive gear of Manufacturing flexibility.'

The Survey

A survey of Indian manufacturing industries was conducted in order to ascertain their strategic aspects. The analysis here is based on 17 responses that were received from various industries such as cement, textiles, cosmetics, metals, engineering, chemicals, petrochemicals, laminates etc. The respondent business units have an annual sales ranging from Rs 20 cr. to Rs 1450 cr. Financial characteristics (median) of the respondents are shown in table 2.

Table 2. Median Financial Characteristics of the sample

| | | |
|------------------------------------|-----------|----|
| Sales | Rs. 202.7 | cr |
| Gross profits as % of net sales | 8.6 | |
| After tax Profit as % of net worth | 2.2 | |
| R&d as % of Sales | 0.7 | |
| % growth in net sales | 24.0 | |
| % growth in net profits | 88.9 | |

Qualified personnel (such as CAs, MBAs, Engineers) in the plants account for 20 per cent of total man power. The median number of employees and the breakup is shown in table 3.

Table 3. Median Number of Employees

| | |
|---------------------------|------|
| Total Number of employees | 1683 |
| Managerial | 130 |
| Staff | 237 |
| Others | 1316 |
| Manufacturing workforce | |
| Direct | 1284 |
| Indirect | 122 |

Most of the firms in this sample are public limited in nature and have foreign tie-ups. Most of them reported net profits after tax, however, a small fraction also reported losses.

The responses relate to "Business Unit" rather than entire company. The Chief Executive or the Head of manufacturing in these business units was asked to respond to the questionnaire. A set of 58 manufacturing action programmes was mentioned in the questionnaire. The respondents were asked to show the level of emphasis with which they are working on these action programmes or have plans to work on these within the next two years.

Consistent Aspects of Manufacturing Strategy

The responses on use of 58 manufacturing action programmes were subjected to cluster analysis. This resulted in seven clusters (table 4). Each cluster, (i) to (vii), contains a set of manufacturing action programmes that tend to go together. For example, in cluster (i) of table 4 SQC techniques in products tend to go together with use of value-analysis/product redesign.

Table 4 : Manufacturing Strategy Aspects Clustered together

- | | |
|------|---|
| i) | CONTROLLING QUALITY AND OUTPUT |
| | a) SQC techniques in process |
| | b) SQC techniques in products |
| | c) Use of value analysis/product redesign |
| | d) Improved spares policies |
| | e) Zero defect programmes |
| | f) Computerization of information/control |
| | g) Introduction of Just-in-time production |
| | h) Computerization of production/inventory control |
| | i) Reduction in manufacturing lead time. |
| ii) | IMPROVEMENTS IN HUMAN FACTORS |
| | a) Improved employee selection procedures |
| | b) Improved employee training procedures |
| | c) Reconditioning physical plants |
| | d) Worker safety improvements |
| | e) Use of quality circles |
| | f) Automating jobs/manufacturing mechanization |
| | g) Product standardization. |
| iii) | REDUCING ORGANIZATIONAL UNCERTAINTIES |
| | a) Reorganization of manufacturing facilities |
| | b) Improved purchase management |
| | c) Improved quality of vendorized products |
| | d) Improved labour/management relationships |
| | e) Direct labour motivation |
| | f) Integration of information system in manufacturing |
| | g) Developing new processes for new products |
| iv) | REALIGNMENTS IN PRODUCTS/PROCESS CONFIGURATION |
| | a) New product introduction |
| | b) Increased R & D efforts |
| | c) Broader range of tasks to the workers |
| | d) Buying equipments |
| | e) Capacity expansion |
| | f) Reducing size of workforce |
| | g) Developing new process for old products |
| | h) Improvements in preventive maintenance |
| | i) Energy management and efficiency |
| | j) Defining a manufacturing strategy |
| | k) Improved functioning of support groups |
| v) | ROBOTIZATION AND FLEXIBLE AUTOMATION |
| | a) Introducing robots |
| | b) introducing AGVs |
| | c) Introducing FMS |
| | d) Relocating plants and facilities |
| | e) Reducing size of manufacturing unit |
| | f) Closing plants |

VI) ORGANIZING AND PLANNING OF PRODUCTION

- a) More planning responsibility to workers
- b) Changing scheduling priority rules
- c) In house production of hitherto purchased items
- d) Changing organizational structure
- e) Use of special purpose machines
- f) Use of general purpose machines
- g) Capturing marketing and distribution channels
- h) Increasing number of vendors
- i) Improvement in vendor training
- j) Improvement in vendor financing
- k) Reduction in set up time for jobs
- l) Buying technology

viii) COMPUTER AIDED DESIGN, STRUCTURING AND PRODUCTION

- a) Computer Aided Manufacturing - CAM
- b) Computer Aided Design - CAD
- c) Computer integrated manufacturing - CIM
- d) Group Technology - GT
- e) Total Quality Control - TQC
- f) Improving manufacturability of design

As explained, these clusters represent broad empirically consistent aspects of achieving market competence through strength in manufacturing. A discussion of these seven aspects follows.

Controlling Quality and Output

The programmes listed in this cluster reflect an overall plan for better 'control' on aspects of quality and output. Statistical Quality Control, Zero defect programme, etc. emphasize the quality aspect where as computerization of information/control, computerization of production, inventory, reduction in manufacturing lead time, improved spares policy etc. emphasize the efficiency aspects. Just-in-time concept relates to both quality and efficiency suggesting a competitive priority of either quality or cost.

Improvements in Human Factors

The dimensions here suggest another managerial focal point in manufacturing, that of improving the human side. Improving employee selection and training, implementation of worker safety programmes and use of quality circles (which make workers an integral part of upgradation process) serve this end. Reconditioning the plants, manufacturing mechanization, product standardization are used to complement the workforce-oriented programmes to evolve a complete manufacturing organization.

Reducing Organizational Uncertainties

The dimensions clustered together suggest an orientation towards reducing organizational uncertainties. Im-

provements in purchase management and improvements in quality of vendorized products are aimed at reducing uncertainties from suppliers' side. Improvement in labour management relationships and direct labour motivation are used for tackling uncertainties within the organization. Reorganization of manufacturing facilities, integration among various information system also indicate efforts in this direction. Developing new processes for new products is an attempt to reduce uncertainty faced by the manufacturing from market forces. Firms operating in relatively uncertain environments are likely to emphasize this aspect.

Realignments in product/process configuration

Those firms which shift from their normal configuration (in terms of type of process such as jobshop/batch/production/assembly line/continuous line and product standardization such as one of a kind to mass production) due to either product proliferation or new process adoption try to realign themselves in terms of product process configuration.

New product introduction, increased R & D efforts, buying of equipments, capacity expansion, developing new processes for old products or laying off a part of workforce suggest such realignments, whereas giving broader range of tasks to workers, improvements in preventive maintenance, energy management, or improving the functioning of support groups suggest process changes of general nature.

Robotization & Flexible Automation

Dimensions leading to robotization and flexible automation along with those related to closing of plants, reducing size of manufacturing have been clustered together. This cluster has been made up of two very distinct aspects. The cluster lacks explainability. Some reflection on actual data showed very low emphasis attached by the most of firms on the factors listed in this cluster suggesting that robotization, introduction of flexible manufacturing or closing of plants are not regarded highly by Indian firms.

Organizing and Planning of production

Items related to reducing set-up time for jobs, changing scheduling rules, vertical integration, vendorization indicate the emphasis on production planning, opting for more special-purpose machines, or more general-purpose machines, changing organizational structure, giving more planning responsibilities to workers or buying technology suggest an underlying plan for making some

structural changes in the production set-up. Vertical integration and vendorization are two alternatives available at the opposite ends, similarly general purpose and special purpose machines present two extreme ends. The implications of vertical integration, technology buying, vendorization and changing organizational set-up are very crucial in organizing production. Changing scheduling rules, reducing set-up times for jobs, and planning responsibility to workers also have a crucial impact on production planning.

Computer Aided Design, Structuring & Production :

Introduction of computer aided designing, computer aided manufacturing, computer integrated manufacturing, group technology concepts, total quality control and improving manufacturability of designs have been clustered together. The developments in computer applications for production are seen as another competitive edge.

These new concepts and techniques can be used to derive manufacturing strength. Though use of CIM, CAM and TQC is not common in Indian industries, they are probably perceived as the next logical stage of manufacturing-strength enhancement.

Strategic Preferences of Indian Business Units

After clustering co-existing action programmes, we now cluster similar firms, viz. similar in the terms of their manufacturing strategy orientations. This results in four clusters, that is, four meaningful types of firms. Using the seven types of action programme-sets as criterion, Table 5 shows how the four clusters of firms differ on these criteria.

Cluster I emphasizes reducing organizational uncertainties and realigning the process and/or products, whereas cluster IV emphasizes heavily on improvements in human factors and reducing organizational uncertainties. In cluster II emphasis seems to be on many aspects whereas in cluster III no clear pattern of emphasis can be found.

Preferred Action Programmes In India

Out of the range of possible action programmes of manufacturing strategy, the sample firms give more importance to some rather than others. Table 6 shows the first 22 ranked programmes.

Table 6: Ranking on Manufacturing Action Programmes

| Rank | Action Programme |
|------|--|
| 1 | Improving labour management relationships |
| 2 | Energy management and efficiency improvement |
| 3 | Improving quality of vendorized product |
| 4 | Improvement in purchase management |
| 5 | Integration of information systems in manufacturing |
| 6 | Worker safety improvement |
| 7 | Reorganization of manufacturing facilities and structure |
| 8 | Direct labour motivation |
| 9 | Use of quality circles |
| 10 | Automating jobs and mechanization |
| 11 | Lead time reduction |
| 12 | Improving employee training |
| 13 | Improving preventive maintenance |
| 14 | Computerized production planning and inventory control |
| 15 | Defining manufacturing strategy |
| 15 | Improving functioning of support group |
| 16 | Improving employee selection procedures |
| 17 | Reconditioning of physical plants |
| 18 | New product introduction |
| 19 | Product standardization |
| 20 | New process development for new products |
| 21 | Spares policy improvement |
| 22 | Increasing R & D efforts |

Examination of the ranking suggests that the firms in this sample intend to pursue action plans relating to workforce, quality improvement, information and control,

Table 5: Firm clusters and their emphasis on different manufacturing strategy aspects

| Firm clusters | (% of firms) | Controlling quality and output | Improvement in human factors | Reducing Organizational uncertainties | Realignment in product/process | Robotization etc. | Organizing production | Computer Aided etc |
|---------------|--------------|--------------------------------|------------------------------|---------------------------------------|--------------------------------|-------------------|-----------------------|--------------------|
| I | (3) | Moderate | Moderate | High | High | Very low | Moderate | Very low |
| II | (5) | High | Moderate | High | High | Very low | High | Very high |
| III | (8) | Low | Moderate | Moderate | Moderate | Very low | Moderate | Moderate |
| IV | (1) | High | Very high | Very high | Low | Very low | Very low | Moderate |

reduction in manufacturing lead time, reorganization and operating efficiency improvement. There is visible absence of programmes related to "new technologies" in this list, suggesting either a lack of understanding of their implications or barriers that exist in adoption of advanced technologies.

There is visible absence of programmes related to "new technologies" suggesting either a lack of understanding of their implications or barriers that exist in adoption of advanced technologies.

Conclusions

Seven broad and empirically consistent "aspects" were identified amongst the various action programmes taken up by Indian firms in manufacturing. These are:

- * controlling quality and output
- * improvements in human factors
- * reducing organizational uncertainties
- * realignments in product/process configuration
- * robotization and flexible automation
- * organization and planning of production
- * computer aided design, structuring and production.

Each of these aspects of manufacturing strategy relates to different ways of building the inherent strength in manufacturing. As the aspects of manufacturing strategy are derived from confirmed action plan and not from

Manufacturing programmes conducted by Indian firms are basically for patching up some organizational inadequacies or for product/process realignments.

conceptual ideas of manufacturing managers, they essentially refer to different directions of manufacturing policy of a firm.

From the four clusters of firms, it however appears that no Indian firm attempts to follow a *directionalized* manufacturing strategy. Most have a mix of diverse aspects. Manufacturing does not yet take a strategic role as it ideally should. The efforts are diffused and non-directionalized.

Manufacturing programmes conducted by Indian firms are basically for patching up some organizational inadequacies or for product/process realignments. This is evident from the sizable cluster of Indian manufacturing units that bank on computerization of manufacturing, organizational uncertainty reduction, and product/process realignments.

A noticeable gap is the absence of a perspective plan for introducing new technologies. The implications of new technologies on competence do not seem to be clear to firms. Import happens to be the most popular source of technology and equipment. Absence of directionalized manufacturing strategies also is perhaps a result of less competition; hence the firms do not perceive a necessity to build a manufacturing strength in a particular direction.

□

Towards A Learning Organization

Between April 1 and 3, 1992, I attended the 24th International Human Resources Management Conference in Paris. This is an annual platform to study and discuss new approaches to contemporary problems in organization development. The meeting was attended by over 400 participants from more than 30 countries.

It was interesting to find that among the various topics discussed, many contributions were devoted to the concept of a "learning organization". It seems that it is being studied on a large scale whether this concept can be developed into a useful tool for organizational development. Before I briefly give my own conclusions about the importance of this concept in daily organizational practices, let me briefly summarize 3 contributions made during this conference, which can provide a conceptual framework, an overview of the contemporary thinking on "the learning organization".

First, Professor Ahmet Aykag of IMD, Lausanne (Switzerland) devoted a speech to the necessity of developing a new way of thinking to successfully approach the major organizational problems of today:

"There is no more need for more refined tools. What is going on is that the thinking in terms of causality, analytical thinking, is not the right way to solve many of the problems facing organizations. This thinking in causality implies that somewhere there is an objective truth to be found: the right solution. And that you have to find a way to get there, by analysing parts of the problem (reductionism). This is a mechanistic way of thinking".

Aykag then explained the origin of our contemporary "thinking in causalities". From Aristotle, St. Thomas Aquinas he came to the physicist Heisenberg, who was the first to prove that there is no such thing as objectivity; then Godel who proved that systems can never do the job they were designed for; then he came to the current chaos-theory on management. He concluded that this development means the end to the logical, analytical thinking so strongly advocated by Newton and Darwin.

He translated this to day-to-day management practice as

1. Don't try to find the right answer: every answer is right.

2. Define the reality which the organization can see and according to which it can act.
3. Give people the confidence to act in uncertain situations.

Management is not "decision-taking" but persuading people to observe and to act. Not through analysis, but by talking a lot to your people, in another language, in metaphors. Because language forms part of the linear thinking system.

He argued that the influence of a manager in attaining his goals is minimal: like roulette. And that in attaining his goals, wisdom in acting is superior to wisdom in thinking: "Look at a squash player: when the ball comes, he has no time to think, he has to make split second judgement about speed and direction, and split second decisions about how to hit, where, how fast. And many times this wisdom in acting proves to be perfectly adequate. In a rapidly changing environment it is important to stop trying to control behaviour. Look at the Viet-Cong, how they have beaten the well-organised and well-controlled US Army: they worked in semi-autonomous teams, decentralised, too far away from headquarters to be coordinated and to get instructions. The lesson is: those in the field, who have the information, they must act and make decisions. So you have to legitimise errors, mistakes, because people learn from it. Mostly, all energy is spent to prevent mistakes, but you then deprive people of the ability to learn. Above that, in situations of high uncertainty, control tends to become excessively expensive.

The higher you rise in organizations, the more important it becomes to transform your analytical skills into development skills: the image of the organization as a machine must be replaced by the image of the organization as a living organism.

The possibility to control social phenomena is minimal. Learning has to take its place in the management process: "Look how the ball is rolling and act!" Do some-

thing, don't stop the game, because the situation will become paralysed." Apply double-loop learning:

Not:

actionsfeedback.....corrective action (single loop)

but

action.....feedback.....review your expectations (double loop)

The higher you rise in organizations, the more important it becomes to transform your analytical skills into development skills: the image of the organization as a machine must be replaced by the image of the organization as a living organism.

Second is Professor Daniel Quinn Mills of Harvard University (USA). His view on the learning organization:

"All organizations learn. But the question is: do they learn effectively? Success has many parents, failure none.

An organization learns in 3 ways:

1. Through individuals who learn.
2. By including what individuals learn into policy and procedures and structures in computer and software programmes that make decisions for people.
3. Through mergers and acquisitions, new knowledge is introduced in organizations.

Item 1) The disadvantage is that this learning is not always transferred to the organization. It is important to feedback your learning from seminars and the like to the organization.

For a learning organization, the number of hierarchical levels is certainly to be reduced!

Item 3) Another disadvantage is that people often do not want to learn from each other. 70% of mergers fail!

What are the features of a learning organization:

- * There is a commitment to learn
- * There is a mechanism to transfer the learning of the individual into the procedures
- * There is openness

- * Last but not the least: for a learning organization, the number of hierarchical levels is certainly to be reduced!

Third is Mr. Garham Galer, Corporate Planner of Shell International Petroleum Company in London. His observation as to the learning organization:

"To err is human, to forgive is not company policy"

Mr Galer has made extensive efforts to transform his periodical planning processes into learning processes, and talks about his experience in doing so:

"Organizational learning is a fashionable theme. It is important to find out what we can do with it in practice. Successes in companies directly relate to learning processes in people, but there are many obstacles for learning in an organization:

- * not enough awareness of the outside world
- * using traditional patterns of thinking
- * time-pressure

"To err is human, to forgive is not company policy"

In my work as a planner, I try to develop various scenarios and then conduct workshops with line managers to discuss these and make decisions. The leading of these workshops, the art of organizational conversation, is very important: the orchestration of these processes. Half of the managers at Shell look at planning in this way that they expect the planning to be reduced. And to control if they do. The other half especially wants to learn from them, "from the deviations". The main characteristics of a learning organization are:

- * the management makes clear, by observable action, that it is committed to learning as a goal
- * openness is encouraged with regard to ideas from outside
- * the desire to do better
- * freedom to experiment
- * tolerance towards mistakes
- * trust in the judgement of colleagues
- * follow-up on initiatives to learn from them;
- * a continuous effort."

I would like to give some conclusions on "the learning organization" based on my experience as a consultant: The learning organization, as a fashionable concept, is typical of the need to find answers to many contemporary organizational problems. Especially to those that seem to be of a structural nature. It is important that this concept does not claim to be a ready-made answer: it suggests that a learning process is the way that can lead to finding useful answers. This approach I consider more realistic than the many ideas that are suggested to managers to be able to solve all their problems.

It suggests that a learning process is the way that can lead to finding useful answers.

But, as is the case with many of these fashionable waves in management many people are active in the sphere of concepts, ideas, but few are putting them into practice. Graham Galer is one of the exceptions, but in our NPI Institute for Organizational Development we have introduced learning processes in organizations for many years now, and gained interesting experience. The reasons that it is so difficult to put the concept of a learning organization into practice are the following :

Managers and consultants are not often specialists on the question of how people learn, how one can make them learn and how one can make this learning happen on a collective as well as at an individual level. This requires study and understanding of learning processes and teaching skills; and this, in turn, requires thorough knowledge of the human nature. In my view, managers and consultants still have to improve on this side of their profession.

The rewards are large once they enter this path, once they invest not only in management and organizational know-how but also in knowledge and skills concerning learning processes in people. In combining these two aspects in practice, creative answers and approaches can be found that really bring some of the structural problems in organizations a big step forward. And combining the organizational aspect and the learning aspect, that is in fact what the concept of a learning organization suggests to do. Who dares?

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Sources of Leadership Success: Lessons from a Peach Tree

One of the most important lessons I've ever learned about leadership success came from my peach tree. The lesson was:

"You can't have the fruit unless you take care of the roots."

It was a small peach tree growing in my front yard, but it produced lots of fruit. Beautiful, golden, sweet, juicy peaches. As with most crops, the peaches didn't just appear suddenly; they grew gradually through a process. Spring leaves first appeared on the tree, then blossoms, and finally tiny beginnings of the fruit. The tiny nubbins steadily grew larger until the whole tree was covered with mature fruit. I had to prune and spray the tree occasionally, but other than that I just picked and ate the fruit. And every spring it produced a new crop.

Then one spring something different happened. The leaves came out as usual; the blossoms appeared; some of the tiny fruit nubbins even appeared. But then everything changed. The leaves that had always been so green and lush began to turn yellow and wilt. And the fruit stopped growing larger. I assumed it was a problem of water. I quickly soaked the tree. It continued to wilt. Alarmed, I called a tree specialist. He said it sounded like peach bores. He told me to check just under the soil. I'd never heard of peach bores, but I followed his instruction and checked. Sure enough, just a few inches under the soil, where the trunk ended and the root system began, I found them; little white peach bores. They had eaten all around the base of the tree—not clear through the trunk, just through the outer layer. But since the nourishment from the roots flows through the outer layer, these little bores had effectively cut the tree off from its roots.

I tried everything I could to save the tree. But it was too late. Severed from its roots, the tree died. And with it, my fruit. I was left with only dead wood, and a message:

"You can't have the fruit unless you take care of the roots."

"You can't have the fruit unless you take care of the roots."

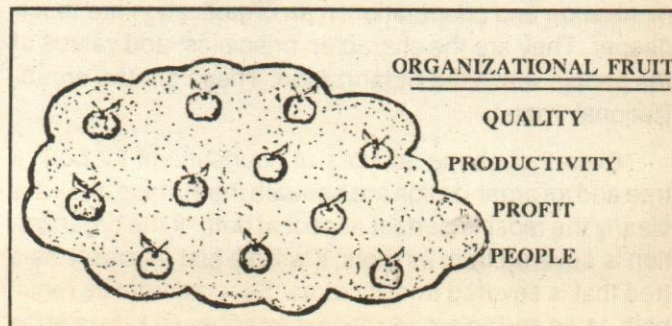
The Organizational Tree

The same message applies to leadership: You can't have the fruit (the results) unless you take care of the roots (the sources). An effective organization is a lot like a tree; an organization also has three parts:

- * A purpose for which it exists (the fruit)
- * The means to nourish that purpose (the trunk and branches)
- * A source that supports both the purpose and the means (the roots)

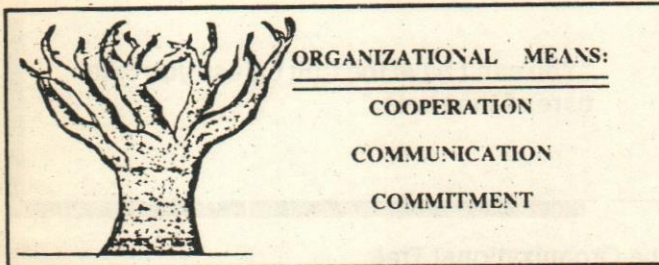
Let's look at each of these in more detail.

For an organization, the purpose almost always includes quality, productivity, and profit. These constitute the organizational fruit. I personally believe that people should also be here. People are not only the means of achieving quality, productivity and profit, but people—happy, growing, productive people—are one of the most desirable results, perhaps the most important "fruit."



The means through which the tree receives nourishment is its trunk and branches. This is so obvious that sometimes we miss its significance. Unless there is nourishment flowing from the trunk and branches into the tree, there will be no fruit.

In the case of an organization, the means are the people. Results are achieved by people working together. Thus, the three C's of cooperation, communication, and commitment are essential. Without these three C's, the organizational results of quality, productivity, profit and people will not be achieved.



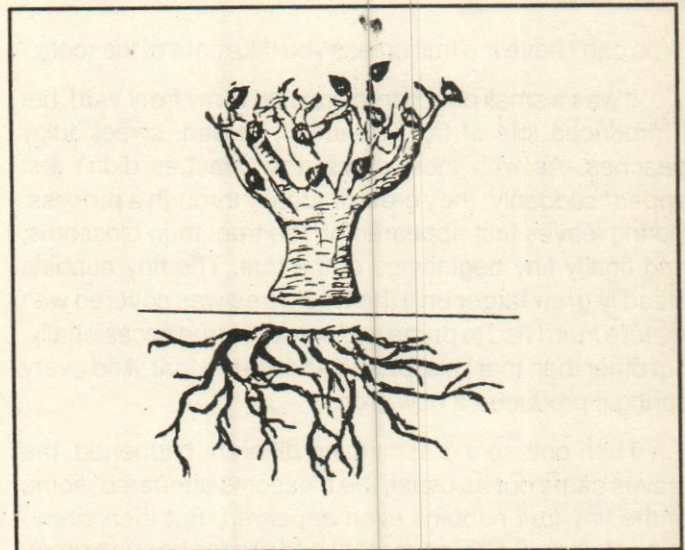
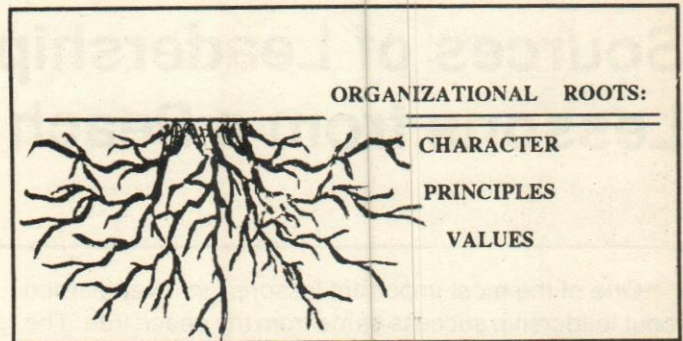
But here is the point we often forget: the trunk and branches of the tree are not the sources of nourishment. They are only conduits. They are the means through which the nourishment flows. The real sources of the nourishment are not visible. They are below the surface. They are the roots. Even though we don't see the roots, if we want the fruit, we must attend to them.

They are the character, principles, and values of the people within the organization. These are the organizational "roots".

It's the same in an organization. Teamwork, communication, and cooperation are not the sources of an effective organization. They are the means or conduit. The sources that nourish and feed the flow of teamwork, communication and cooperation in an organization are much deeper. They are the character, principles, and values of the people within the organization. These are the organizational "roots".

Even though the sources of nourishment for both a tree and an organization are beneath the surface, they are clearly the most important aspect of both. If the organization is severed from its roots, it will die just as surely as a tree that is severed from its roots. Severed from its roots, both a tree and an organization may appear o.k. for a short

period of time (like a cut Christmas tree does), but both will cease to receive nourishment, and soon wither and die.

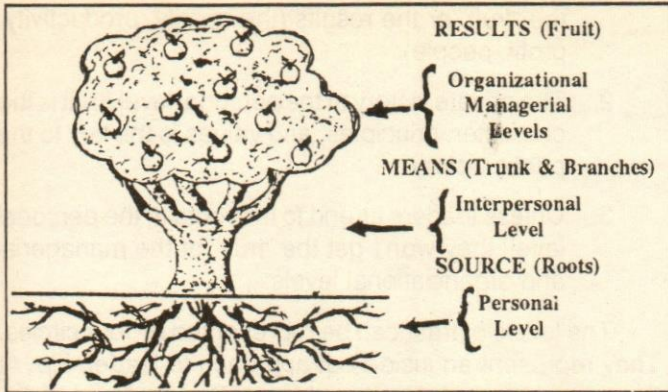


Successful Leadership

What does this have to do with leadership success? Simply this: In order to obtain the results (fruit), leader must take care of the sources (roots). In order to better understand why and how a leader should take care of the roots, let's look at the three parts of an organization in terms of their levels.

In an organization, the fruit or the results (which include quality, productivity, profit, and people) are *organizational* and *managerial* concerns. This means that at this level, the leader's primary concerns are for results, either

In order to obtain the results (fruit), leader must take care of the sources (roots).



of the organization as a whole, or of separate divisions, departments, or work groups. And how does a leader get these results? Through the level just below it.

The level below consists of the trunk and branches, or the means. Items such as cooperation, communication, and commitment are the means through which the leader achieves results. These are *interpersonal* concerns—how people work together. No matter how much leaders want or demand quality, productivity, and profit, they can only get them through the cooperation, communication, and commitment of their people. These are the only lasting means. And getting these depends on the bottom level.

The bottom level is the root system or the source of nourishment. In an organization, roots consist of character, principles, and values. These are personal characteristics. Because they are personal and below the surface, it is easy to forget about them. But not considering them is as risky to an organization as not considering the roots of my peach tree. Because they are the source of everything else, this is the highest leveraged area that a leader can work.

For the items at each level it's not usually a matter of having them or not having them. It's a matter of degree. At each of these three levels, one might have a little or a lot. For example, with the tree, one might have a little or a lot of fruit. With an organization, one might have little quality, productivity, and profit, or a lot.

With a tree, the trunk might have only a small restricted conduit through which only a little nourishment flows, or it may have a wide, free-flowing conduit through which a lot of nourishment flows. With an organization, there might be a little or a lot of communication, cooperation, and commitment. A lot of it will lead to a lot of "fruit"—that is, quality, productivity, and profit—while a little of it will lead to only a little "fruit".

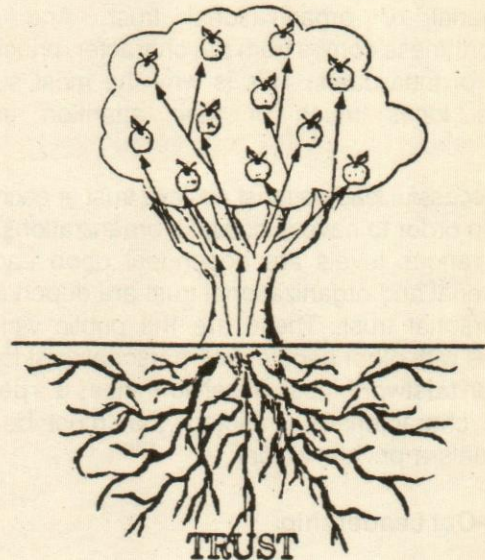
At the source, there might be a little or a lot of nourishment flowing from the roots of the tree and the fruit will depend on the nourishment received. So is the case with an organization.

The Flow of Trust

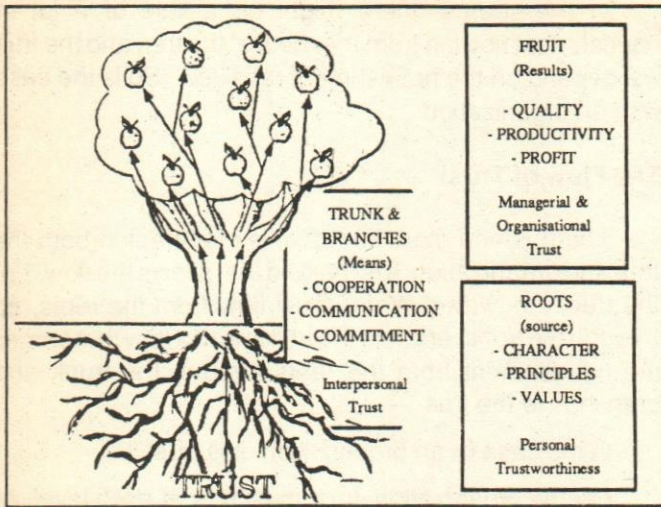
There is one more item that is important in both the tree and organization. It is the fluid that allows the flow. For the tree, it is water. Water must flow from the roots, up through the trunk, and into the fruit. It is this flow that carries the nourishment from the roots through the trunk and branches to the fruit.

In the case of an organization, it is trust.

For the organization, trust must flow at each level. At the managerial/ organizational level, the degree of trust is a reflection of the degree of control enforced by management styles, systems, structures, etc. High external control usually indicates that there is little trust; low external control, on the other hand, usually means that there is a high degree of trust. Without high trust at the managerial and organizational levels there will be little "fruit" or results. The most successful leaders work to nurture this trust by attending to the level just below it.



At the intermediate level, there must be interpersonal trust. Interpersonal trust is evidenced by open communication, cooperation and teamwork. Without interpersonal trust, there will be little managerial or organizational trust. And little results. Interpersonal trust—that is people trust-



ing each other—is the key to managerial and organizational trust. This is why the most successful leaders work to nurture interpersonal trust. And how do they do it? By nurturing its source.

And what is the source of interpersonal trust? Where does it come from? It is the inevitable counterpart of trust at a personal level termed "Personal trustworthiness."

At the source there must be personal trustworthiness. Personal trustworthiness is evidenced by integrity, honesty, personal responsibility, follow-through, etc. Without personal trustworthiness, there can be little interpersonal, managerial or organizational trust. And personal trustworthiness comes from the character, principles and values of individuals. This is why the most successful leaders focus much of their attention on these items.

Successful leaders must achieve trust at each of these levels in order to have successful organizations. Trust at these various levels are dependent upon each other. Managerial and organizational trust are dependent upon interpersonal trust. These are the public victories, or victories with other people. Interpersonal trust is dependent upon trustworthiness. Trustworthiness is a personal or private characteristic, a victory that must be won by individuals—a private victory.

Inside-Out Leadership

There are three things we can conclude about the relationship between these levels:

1. The public victory at the Interpersonal level (that is cooperation, communication and commitment) is the key to organizational effectiveness. It produces

the "fruit" or the results (the quality, productivity, profit, people).

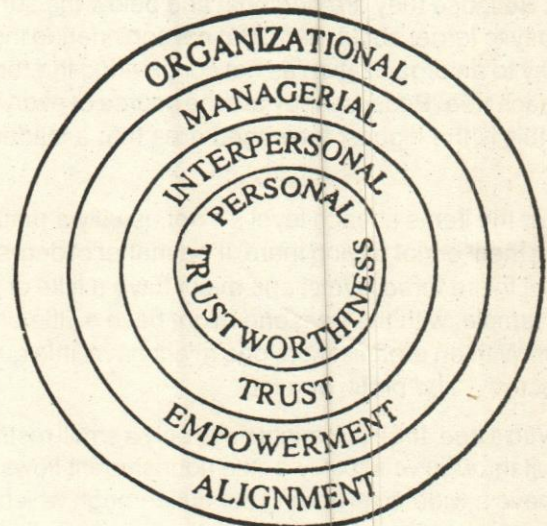
2. The private victory at the personal level (that is the character, principles, and values is the key to the public victory.
3. Unless leaders attend to the roots at the personal level, they won't get the "fruit" at the managerial and organizational levels.

The levels of trust can be represented by four circles. They represent an inside-out approach to leadership. At the centre is personal trustworthiness. Personal trustworthiness leads to interpersonal trust, which in turn leads to managerial trust (or empowerment), and organizational trust (or alignment).

Taking a Personal Look

Using this organizational tree example and the four circles, analyze your own organization and your leadership within it by asking:

1. What results are most important to me, my work group, department, organization? What "fruit" do I want? (Consider quality, productivity, profit, people, etc.) To what degree am I getting it?



2. What are the means needed to get these results? (Consider the importance of cooperation, communication, commitment, and so forth, as ways to achieve the results.) To what degree do we have them?
3. What are the sources that nourish these means? (Consider character, principles, values, etc.) To what degree do we have them?

If you want to increase your own leadership success, the key is to increase the flow of trust that leads to success. And the way to increase that flow is to nourish the sources. The sources can only be nourished at the roots by developing character around principles and values. And the best place for leaders to start—perhaps the only place—is with themselves. Peter Senge, author of *The fifth Discipline* put it best:

“The core leadership strategy is simple: Be a model, commit yourself to your own personal mastery. Talking about personal mastery may open people’s minds somewhat, but actions always speak louder than words. There’s nothing more powerful you can do to encourage others in their quest for personal mastery than to be serious in your own quest.”

Lasting Leadership Success

Only the personal character, principles and the values of the leader can nourish and produce lasting success. By compromising character, principles and values, leaders may achieve temporary results, but they may destroy themselves in the process. James Michener illustrates this in his book, *The eagle and the Raven*.

Michener describes the results achieved by two rival generals, Sam Houston and Santa Anna. The two men were similar in many ways. Both were egotistical, brave, ambitious, moody, clever, quick to make decisions, and so forth. Both were generals and presidents of their respective countries. But, in spite of the similarities, they produced vastly different results. Though it was not always immediately achieved, Sam Houston witnessed the final victory of almost everything he tried to accomplish. In the words of Michener,

“He left everything he touched somewhat better than it had been before he assumed responsibility for it.”

As a result, Sam Houston is now “enthroned in Texan hearts.”

The opposite is true of Santa Anna. Michener writes :

“...when he finally departed the national scene, he left Mexico infinitely worse off than it had been when he had assumed control...As a political leader, he was not only a disaster, but what was worse, an embarrassment.”

As a result, in Mexico today, “there is no grand national monument honoring him even though he was the dominant figure of his era. Mexicans try to forget him.”

What made the vast difference in the results of these two men who were so similar in so many ways?

Michener concludes,

“Similar in much, they differed in one crucial dimension. Houston had a heart of oak forever loyal to the principles to which he had been bred and which he had nurtured during his embattled career. Santa Anna was a bending willow, subservient to every storm, elegant and daring but never faithful to any principle, not even those of his own devising.

Michener summarizes the lesson that my peach tree taught me:

“A national leader may accumulate a spectacular chain of temporary results but unless his character has been forged in the fire of integrity and his actions in the crucible of hard-edged reason, history will refuse to stamp him with the seal of greatness.

Like the roots of tree, the sources of leadership success lie below the surface. They are the personal character, principles, and values of the leader. The most successful leaders work to develop these “roots” in themselves, in others, and in the organization they lead. They do it because they’ve learned the lesson from the peach tree:

“You can’t have the fruit unless you take care of the roots.”

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Role of Managers in the Age of Internationalization

Katsuhiro Utada

Internationalization involves current policies in Japan for promoting a nation wide awareness on the roles Japan must play in the world in cultural, business and other terms. It is anticipated that globalization and the liberalized market will be further promoted towards the 21st century. Japanese managers are expected to fulfill a crucial role in this context according to Katsuhiro Utada, Honorary Chairman, Ajinomoto Co. Inc Tokyo, Japan

Excerpts from Utada's address at the 34th session of the Asian Productivity Organisation Governing Body on July 21 - 24, 1992, Tokyo.

The business environment of the Japanese corporations today, involves the following issues :

- Globalization and Liberalized Market,
- Maturing Societies,
- Changes in Work Concepts and Attitudes (Ageing and Diminishing Work Force),
- Global Environmental Problems, and
- Progress of Technology and Advanced Communication.

Globalization & Liberalized Market

It is anticipated that globalization and the liberalized market will be further promoted towards the 21st Century. There will be more emphasis on the following: 1) Developing and maintaining free market trade, 2) contributing to the betterment of society on a worldwide scale, including the establishment of more harmonious international relations, and 3) furthering interdependence on a worldwide scale.

Effort must be directed towards developing, maintaining, and consolidating free market trade for the betterment of economy on a worldwide scale.

Free Market Trade

Effort must be directed towards developing, maintaining, and consolidating free market trade for the betterment of economy on a worldwide scale. The economy will have to be improved based on free trade principles. This will involve enlarging the scope of liberalization by GATT (General Agreement on Tariffs and Trade) and executing effective trade policies in the former Eastern-Block nations. Each nation should enthusiastically extend their

efforts for maintaining free trade and establishing an appropriate worldwide free trade system. Members of regionaleconomic zones such as those belonging to NAFTA, EC, and AFTA, should collaborate in this effort.

Contributing for the Betterment of Society

To attain a high degree of reliability in the international market—it becomes necessary for a corporation to develop internationally-accepted concepts and values. This involves carrying out corporate activities based on a worldwide perspective, with consideration on factors such as freedom and liberty, democracy, peace, human rights, market economy, environmental protection and preservation, and so on. Japan, which has greatly benefitted from free trade, must not only work towards liberalization of its market, but also amend and modify its domestic regulations and standards for enabling harmonious business transactions with each nation of the world, in terms of procurement of parts, sale of commodities, financing, and the like.

Consumer consciousness is becoming more diversified these days and individualistic life-styles are being pursued with rising demand for increased personal comfort, prosperity, enjoyment, and satisfaction.

Worldwide Interdependence

It is anticipated that the exchanges among corporations of the world, in terms of products, finance, and technologies, will become more active and that a global market will emerge. There are many Japanese consumer industries doing business overseas, in an attempt to attain a foothold on the international scene. Other Asian nations should also develop and become capable of playing leading roles in contributing to world growth; a mutual interdependence between such nations and Japan can be established for achieving more lucrative prospects.

Maturing Societies

Consumer consciousness is becoming more diversified these days and individualistic life-styles are being pursued with rising demand for increased personal comfort, prosperity, enjoyment, and satisfaction. We also anticipate a trend towards more stabilized life-styles, both in material and spiritual terms, with emphasis on family and regional factors.

In view of such a situation, conventional businesses and products have reached a state of saturated growth. We have entered an age where there is more emphasis on quantitative stability of a product than on its qualitative productivity. There is a pressing need for active deployment of management systems and personnel in new production techniques and product development which match this trend. Future corporations will direct corporate activities, and concepts, to match social concepts and needs apart from improving their efficiencies and business capabilities.

Changes in Work Concepts & Attitudes

It is forecasted that there will be a significant decrease in the young work force in Japan in the latter 90s. Decline in birth rate is leading to an age where there will be a high ratio of aged people. Japan will inevitably experience a serious shortage of professional workers, not just the young. There will be a shortage of technical staff for achieving corporate growth and carrying out overseas projects.

Concepts and attitudes towards work are becoming complex. The attitudes of employees are becoming diversified, each employee having his or her own work objective, work-consciousness, and demand in work conditions. The personnel departments of corporations will have to devote exceptional effort in employing and retaining personnel.

Global Environmental Problems

The earth's environment is a valuable asset of the entire human race. Solving its problem is a global issue. Environmental problems include the global greenhouse effect, disruption of the ozone layer, acid-rain causing NOx and SOx contaminants, disposal of various waste, desertification, and the deforestation of tropical rain forests. We must establish and carry out effective measures to solve these problems. This involves all levels of concerns, the state, corporations, consumers, each and everyone of us. Pollution preventive techniques must be developed and put to use on a worldwide basis. The use of the Earth's

The Earth's environment is a valuable asset of the entire human race, Solving its problem is a global issue.

resources must be economized, energy-saving established, and reduction made on waste generation, not only in the industrial level, but also in the general consumer level. Life styles should be modified to achieve such goals.

Progress of Technology and Advanced Communication

Creative technologies must be researched and developed for future industrial progress. On the other hand, our cost-consciousness is expected to become more levelled off on a global sense, owing to the provision of various information provided by advanced communication. The 90s is an age of advanced communication capabilities where the information media is shared by many on an unprecedented scale. The development of technological innovations and advanced communication is not merely providing new business opportunities, but solutions for various business issues, such as improving productivity, reducing costs, saving labor and energy, and preserving our environment. Technological capabilities, including data-processing capabilities of a corporation will have great impact on a corporation's growth.

Creative technologies must be researched and developed for future industrial progress.

Japanese Corporations - Competitiveness

Japanese corporations frequently have to face severe competition involving free trade and market economy issues. Changes in the business environment are met adequately, by persistent effort made by the management and labour force. This consolidated effort is making it possible to meet market demands, by providing high quality products and services, timely and at low cost. Consequently, Japan has attained not only a powerful managerial capability, including its technological expertise but has also emerged as a world financial power.

Driving Force

A corporation's competitiveness in the international market varies with the type of its business. Accordingly, the driving force between such competitiveness also depends on the type of business, as well as on current trends. The six factors which have supported the competi-

tiveness of Japanese corporations, in particular during the time following the Second World War are as follows :

Management based on Long-term Perspective

The first factor is management based on a long-term perspective. An important characteristic of the Japanese corporate society is that effort is directed towards achieving long-term prospectives, rather than short-term profit. Production, sales activities, intense capital investment, and training of personnel are all carried out in view of long-term perspectives. The money spent for capital investment per capita is twice that of the United states. Japan is the biggest investor of capital in the world. Investment is made not only for attaining competitiveness in the market, but also for health and welfare, pollution prevention, and other factors which implicate a lasting development of a corporation.

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Superior Labor Quality & Stable Management/Labor Relations

The labor force of Japanese corporations is sufficiently motivated and the quality of work is superior in world standards. The main reason for this is that Japanese employees are hardworking. Corporations offer on incentives and this is the impetus for eager participation in work. From a long-term perspective, corporations provide their employees with various education and training programmes and this leads to favorable results. The excellent cooperation between management and work force is another significant factor. Labour unions are in most cases in-house, a practice that helps maintain a long term harmonious and well-balanced management/labor relations.

User oriented Policies

Japanese corporations are customer oriented. Product development, production, sales, distribution, and after-sales services, are all carried out with full consideration given to customer needs. There is emphasis on the quality and safety of products. Care is taken to maintain a good delivery service, installation, after-sales services, and so

From a long-term perspective, corporations provide their employees with various education and training programmes and this leads to favorable results.

on. Competition between manufacturers is very severe in Japan, to the extent that a corporation successful in the Japanese market is capable of competing in the world market.

Dual Effect of Quality Control & Cost Reduction

Japanese corporations have not only accomplished cost reduction, but have also dealt with social and consumer demands, such as those involving environmental protection issues and assurance of product quality. Quality control circles and other employee participation groups have greatly contributed to this success. Intense quality control and pollution prevention measures themselves are factors which increase cost. However, overall cost reduction and higher productivity can be achieved by reducing the inventory of materials, parts, and intermediate products; preventing the occurrence of defective items; and stabilizing quality control.

Business Network & In-house Communication

Japanese corporations maintain continued and stabilized dealings with relevant industries, such as those involving procurement of materials, parts, capital, equipment and facilities. Information on the business environment, and market trends, is exchanged. Technology is shared for co-development of products. Such practice has led to significant saving of inventory and helped establish technical progress. Good in-house communication and cooperation between different departments and divisions, including all personnel involved in sales, manufacturing, production (including testing and evaluation), design, research and development enable the corporation to ob-

Japanese corporations have not only accomplished cost reduction, but have also dealt with social and consumer demands, such as those involving environmental protection issues and assurance of product quality.

tain an overall picture of current customer needs and demands.

Medium - & Long-term Factors

The following are some major factors which influence Japanese competitiveness in the international market, both in medium - and long-term perspectives. The following 4 factors are domestic-orientated.

Diminishing Labor Force

In Japan shortage of labour force is expected in the latter part of the 90s with a big impact on the domestic economy. This labor shortage will bring about the hiring of the aged and more female workers. This labor shortage will also constitute an incentive for establishing production and sales systems with less dependence on human labor.

Trends in R & D and Capital Investment

Maintaining a high technology for competing in the international market depends on the improvement of research and development capabilities. Sufficient number of researchers and adequate funds should be available for R&D projects and facilities. The objectives of capital investment have conventionally included increase of productivity and sales, energy-saving, research and development. Being competitive in the international market will depend on achieving higher productivity based on labor-saving investment, in view of the labor shortage and higher labor cost.

Current Trends in Fund Raising

Ever since the disruption of Japan's so-called bubble economy, it is becoming more and more difficult to raise funds from the money market. There is increased demand for investment directed at Japan, due to the worldwide demand for funds. An increase in fund raising costs is anticipated.

Trends in Globalization

The following are the three foreign-orientated factors which affect Japanese competitiveness in the international market.

Recovery of the U. S. Industry

There are a number of major U.S. corporations, in particular industries which are enjoying favorable growth.

These employ higher capital investment and earn higher profit than top-class Japanese corporations. However, the overall competitiveness of the U.S. industry in the international market is said to be declining. It is reported that the U.S. industry is adopting Japanese business practices, in particular the *Keiretsu*—Japanese company groups formed by interlocking share-holdings for increasing productivity and considerations are also being made on large-scale reduction of investment tax. If the U. S. military budget will continue to be shifted for commercial use, U.S. corporations will regain and revitalize their former competitiveness and become a high contender in the international market.

It is reported that the U.S. industry is adopting Japanese business practices, in particular the *Keiretsu*—Japanese company groups formed by interlocking share-holdings—for increasing productivity.

EC Unification & Reorganization Power

There is currently a trend of corporate mergers in the world, whereby a corporation of one country merges with that of another. Market unification is also in progress in the EC. Liberalization of trade is under way in many parts of the world. If such trends lead to the establishment of independent economic blocks and isolated economies, this will have unfavorable consequences on Japanese corporations.

Interdependence among Asian Nations

Many Asian nations, particularly in the Far East, are currently experiencing significant economic growth. Such growth has already led to serious competition in a few Japanese markets. This means increased procurement of parts and purchase of products from these Asian nations. Consequently, Japanese corporations and consumers will be more dependent on corporations representing these nations. Japanese corporations can provide regional economies in Asian nations, with technology, capital, and services. This will enhance interdependence and lead to a mutual gain for competing in the international market.

The Age of “*Kyosei*” (Mutualism)

The word “*Kyosei*” can be used to describe the concept of the coming age where a paradigmatic reform will be necessary, both domestically and internationally. *Kyosei*

can be expressed as “Symbiosis” or “living together in harmony” Three elements constitute *Kyosei*: mutualism between corporation and society; between corporation and individuals; and between corporation and the world.

The *Kyosei* between corporation and society is a problem yet to be solved because of the distinct separation between corporate and social theories. The upstream and downstream theory, (the idea that a manufacturer is situated in an ‘upstream’ position, while the consumer is somewhere ‘downstream’) should be reversed if a business wants to survive in the competition. In the previous era of significant economic growth, demand exceeded supply. The situation is currently reversed and today many similar products are stacked in retail stores. Hence corporations must conduct business under the concept that consumer and distributors are upstream and the manufacturers downstream.

For example, a primary concern of the Japanese consumers is that a food product should be fresh. Supermarkets and convenience stores will not stock any food products unless they indicate a recent date of manufacture. The normal practice is to return to the supplier any food product that remains unsold after a designated date. Small-stock frequent deliveries are often stipulated. Manufacturers and wholesalers have to cope with this situation. If this situation remains unchanged, not only will there be cost increases in social terms, but also environmental problems due to ever-accumulating waste. Corporate actions must be taken after deciding firm directions, not merely by making judgement based on specific circumstances and needs of a corporation, but in full view of social and public perspectives. ‘*Kyosei* between corporation and society’ is a state where both the manufacturer and consumer have to compensate in order to lead a mutually harmonious life.

As for the *Kyosei* between corporation and individuals, a corporation must provide for the personal needs of its employees. Disputes involving work hours and vacations should be solved amicably. A diligent worker reaching retirement age finds that he cannot afford to buy a house in the city. Meanwhile, the company he had worked for is prosperous. Something is definitely wrong here.

A diligent worker reaching retirement age finds that he cannot afford to buy a house in the city. Meanwhile, the company he had worked for is prosperous. Something is definitely wrong here.

***Kyosei* involves respecting each other's individualism and culture, and coming up with mutual points of agreement while criticizing, disputing and competing with each other.**

As for the last element, the *Kyosei* between corporation and the world, Japanese industrial products are used in every corner of the world, including the U.S.A. and Europe. Reasons for this can be given as the quality and low cost of such products. However, the issue often arises whether Japan is competing in the world market following the same standards of other developed nations, in terms of work ratio and hours. Japan is also an outstanding creditor nation, with its ODA rating alternating between first and second. Direct investment overseas has significantly increased; simultaneously problems are surfacing consequent to fiction in terms of social, cultural, and humanitarian values. We hear frequent complaints that Japanese going overseas tend to create their own communities and avoid mingling with local people; that Japanese do not engage in local community and volunteer activities. The Japanese, especially those going overseas, must exhibit and exercise good corporate citizenship. *Kyosei* involves respecting each other's individualism and culture, and coming up with mutual points of agreement while criticizing, disputing and competing with each other.

Accepted & Trustworthy Corporations

A corporation in an age of *Kyosei* will not be able to develop or continue business unless it is accepted, both domestically and internationally, and is capable of winning trust.

Harmonious Relationship with Individual & Society

Primarily, a corporation must attempt to establish a harmonious relationship with individuals and society. It must practise activities which match social services, based on self-responsible principle. It must consider the natural environment, regional and social issues, provide for its

Primarily, a corporation must attempt to establish a harmonious relationship with individuals and society.

employees, consider consumer benefits. Useful products and services must be provided with sincerity.

Corporate Concept of Coexistence & Co-prosperity

A corporate concept should be based on coexistence. In particular, corporations involved in overseas business must consider a harmonious coexistence with local corporations. In the domestic business scene, corporation must hold their subcontractors and business associates as equal partners, indispensable for mutual development. Industries will also have to build up closer relationships among themselves.

A corporate concept should be based on coexistence.

Basis for Stable Revenue

A corporation needs to have a firm basis by which it is assured a stable revenue if it wants to adequately meet rapid changes in the business environment of today. It is essential to be creative, to be swift in assessing changes in the business environment, and to set up a system to adequately respond to such changes.

Priorities in Corporation Assessment

To attain the position of an accepted and trustworthy corporation, it becomes necessary to attempt innovations from within. For this, a corporation must assess itself based on new standards founded upon the following three priorities.

Qualitative as well as Quantitative Growth

The first priority would be qualitative as well as quantitative growth. It will become necessary to pursue a harmonious and well-balanced growth together with employees, share-holders, consumers, business associates, and regional communities.

Value Added Productivity Per Hour

The second priority would be growth based on value added productivity per hour than on physical productivity.

Social Incentives

The third and final priority involves social incentives. An assessment of a corporation made by society has great impact. It influences a corporation's capability of retaining personnel and customers, and acquiring capital. The corporate image will have to reflect individuality and originality, not only in terms of its products and technology, but also convey its social, ethical values and must be well respected. Regional features, both domestic and overseas, must be fully considered and care taken not to disrupt the harmony. There should be a deep empathy which makes it possible to respect multi-dimensional values and coexist in a different culture.

Managerial Leadership

A corporate manager must be capable of making decisions with a vision of the future. He should be responsible for any consequences from his decision making. In an age where intense changes take place, it is difficult to make decisions by referring to past managerial data. It is up to the manager to decide on priorities of investment. He must determine initiatives for grasping business opportunities and meet changes in the managerial environment. It is the manager's duty to navigate the corporation in favourable directions. A corporate manager must tackle major problems in a compound manner, he must lead corporate activities which feature socially sound judgement and are practical in the international sense. Tomorrow's corporate manager will definitely need to play the role of a corporate reformer.

The first priority would be qualitative as well as quantitative growth.

For a corporation to take root in the international community, its corporate activities must match the coming age of *Kyosei*.

Attaining & Maintaining Competitiveness

The prerequisite of a corporation to become a successful contender in the international market is to attain and maintain competitiveness which follows international rules.

Competition under Equal Terms

A Japanese corporation trying to compete in the international market has to follow business rules effective in the international market. Only on equal terms can the competitiveness of a Japanese corporation be justified. In particular, the reduction of work hours in a Japanese corporation should be considered. Such reduction will lead to reduction in profits. However, there is no way this can be avoided, especially considering humanitarian concepts. Less working hours will provide the workers with more rest and relaxation in their daily lives. This will also induce more creativity from them during their working hours. Corporations should upgrade work efficiency. They should deploy more labor-saving systems and equipment, and set working schedules with minimized night shifts and occasions of continued day/mid shifts. Work setups and systems should be improved as well. Doing so will achieve cost reduction and improvement in value added productivity by the hour consequently building up a highly efficient business.

Japanese business practices are often regarded as peculiar. It is necessary to make reforms in Japanese business practices to be more accepted internationally, in particular to simplify the currently complex rebate system and establish systems for the return of products. At the same time, the fairness and transparency of the Japanese network system, which features harmonious in-house cooperation and that between partnerships, should be extended.

Fair Competition

Competition in a business market involves cost reduction, upgrading technical expertise, and providing appealing products. However, the quality of business competitiveness itself should be improved. Japanese corporations have been competing in a market where competition is regarded as being too excessive. They have conventionally put more emphasis on their share than on cost and profit ratios. It has now become necessary for corporations to establish a pricing system which reasonably reflects the technology used, and the product quality. There will be more discussion on factors such as profit distribution based on international rules and shorter working hours. Corporations must also develop profitable high value added products; exclusive products of an unrivalled nature. This is one solution for retaining customers, who have become dispersed due to the conventional practice of stock-piling identical goods made by different manufacturers.

Competition in a business market involves cost reduction, upgrading technical expertise, and providing appealing products.

Research & Development

There is recently an increase in the demand for high technological information. Demand is also rising for upgrading the capability of solving technical problems at the research stages. Japanese corporations are well known for their capability in improving the workability at work sites. However, for the coming age, they will have to make dramatic reforms by developing products for creating new markets and scheming cost reduction.

Incidentally, disputes over patent rights are increasing. On one hand, patent rights and other rights to intangible property must be respected as they induce technological progress and economic development. The infringement of such rights is in no way feasible for a society. Developed technologies must be spread according to clear contract terms. A corporation must improve its adaptability in the business environment for maintaining competitiveness in the international market. Foresight enables timely and appropriate response to changes in the business. This would include active and multilateral use of business resources, reassessment of existing businesses, clarification of business regions, development of products and know-how associated with the main line of business, segregation in peripheral business fields, and establishment in new business.

Worldwide Cooperation

The vital prerequisite for becoming a global corporation would be to create a mutually interdependent relationship by promoting horizontal and vertical business divisions on an international scale. It would be necessary to extend industrial assistance, such as establishing overseas plants, and extending technical transfers and assistances. In case of procurement from overseas, such as parts, assistance must be extended from the development stage. In projects involving commissioning of production to overseas corporations technical assistance will have to be given from the development stage as well on new products and technologies.

When Japanese products are exported, Japanese corporations must follow local rules and attempt to develop the local economy. It will be necessary to develop and establish *Kyosei* with the local consumers and corporations. For achieving this, local capital and work force must be actively used. The exported products must be those used in daily lives, create new life-styles, contribute for the local community and create new markets.

The vital prerequisite for becoming a global corporation would be to create a mutually interdependent relationship by promoting horizontal and vertical business divisions on an international scale.

In the course of promoting a world wide harmony, mutual exchange of personnel should be promoted. Japan must reshuffle and improve its immigration and foreign resident administration system to allow a disciplined and smooth reception of foreigners entering Japan. Increasing local job opportunities, will involve governmental development aid, and financial aid by commercial concerns.

Localization

Japanese corporations doing business overseas, would have to become vital for local economies, contributing to the benefit of the local community. Technology transfers must be done, improvements made, and business know-how introduced. Furthermore, the local subsidiary must see to it that R&D, design, manufacture, and sales activities are carried out on a consistent basis. One ultimate goal of a local subsidiary would be to establish self-dependency, thus taking the burden off the parent company. It would be necessary to establish a transparent personnel policy which would not be biased and help maintain a just and harmonious relation between the Japanese and local staff.

A Japanese relocated to overseas subsidiaries must be well prepared to take in the local culture, language, religion, and life-style. He must develop and adapt himself to be able to fully contribute for localization. He must also enthusiastically participate in local activities to be accepted by the local community.

Measures of Global Issue

Corporations must involve themselves in global issues with coordination from government channels. Some

global issues that need to be solved are global environmental protection, giving aid to developing nations, economic development of the former-USSR and East Block nations, the drug problem, and AIDS. As for global environmental protection, it is imperative that measures be taken against air and water pollution, the global greenhouse effect, the problem of industrial waste, and desertification. Corporations must reflect environmental protection, resources- and energy-saving, and recycling in their overall business activities. Lack of savings is anticipated worldwide and it is necessary for Japan to return its earnings to foreign nations in one way or another. It would become necessary for Japanese corporations to provide the financing and promote business with countries that cannot successfully conduct business due to lack of capital.

Corporations must involve themselves in global issues with coordination from government channels.

Fair Distribution of Profit

A current issue involves securing profit earned through fair competition in the international market, and sharing such profit with shareholders and employees. Distributing the profit is not a matter which can be uniformly handled. Current financial situations, social environment, a corporation's growth cycle and future perspectives must be fully considered. Each corporation should determine a fair distribution of profit that follows its corporate concept and is based on its own principle of duty and responsibility. Loans, improvement of labor situations—such as reduced working hours, and paying dividends to share-holders will have to be considered as well.

Distribution of Profit to Employees

There is currently increased discussion regarding labor distribution ratios. As labor distribution ratios are back-to-back with capital asset ratios, this decision must consider financial situations and future perspectives. Japan's loans may be the highest in the world, judging by the foreign exchange rate which is based on current competition in the international market. The terms of employment in Japanese corporations cannot be said to be inferior to that of developed countries, namely those of Europe and the U.S.A. This is so considering factors such

as the stable employment rate in Japan at times of economic depression, raises in salary which show very small effect due to economic situations (prosperity/depression), education and training of personnel, improving the work environment, comprehensive health care provision, etc. However, the high salary in Japan does not necessarily reflect an increase in material terms. Economic factors in Japan such as exorbitant land prices should be considered. Swift reform should be made by the authorities to better situations, by liberalizing markets, easing regulation, and establishing more reasonable measures regarding real estate. Corporations must create better work environments to enable workers to become favorably motivated.

Distribution of Profit to Share-Holders

Conventionally, profit sharing by Japanese corporations has been lower than that of U.S. and European corporations. Profit is generally put aside as internal reserve to be used as funds for future corporate development. This practice is based on the principle that corporate growth leads to a rise in its stock values, and that a stock-holder earns profits by such rise. Share-holders have earned profit under this principle. However, it is forecasted that demand will rise that profit distribution be according to stages of corporate growth, and that sufficient disclosures be made on the measures of distributions which were applied. It will become necessary to modify the conventional stabilized profit distribution method and direct more profit for distribution. U.S. corporations prioritize profit distribution to share-holders is leading to short-term profit. Consequently, there is a delay in capital investment and development of new products. Such a situation leads to a decline in competitiveness in the international market, and consumers and share-holders will not necessarily earn profit on a long-term basis.

It will become necessary to modify the conventional stabilized profit distribution method and direct more profit for distribution.

Kyosei with Consumers and Society

Public concern today is directed on issues regarding social justice, the living environment, work environment, and the social environment. This is because the society has matured. It is time for corporations to reaffirm their

social status. An important objective of corporations involves meeting sound consumer demands, including the demands of their employees. Another objective is to determine product prices which satisfy social demand. Corporate existence can be assured as long as it provides for the prosperity and well-being of society. The duty of a corporation is to provide goods and services at a price acceptable in the market, and to maintain a system which contributes to make a sound and healthy life within the sphere of society, both domestically and internationally.

An important objective of corporations involves meeting sound consumer demands, including the demands of their employees.

There is a demand today for reconsidering the use of excessive functions and features in products, the practices of short-term model changes, and excessive services as well. It will become necessary to precisely grasp market needs; reinforce the main links in the business

system which are development, production, and sales; and provide material affluence through reliable and real workmanship. Maintaining favourable customer relations would be equally important. Consumer opinions should be well considered and they should be encouraged to participate in activities which would be mutually beneficial. Product data should be made fully available and the realities of corporate activities should be explained precisely in a simple manner. All in all, a sincere response should be directed to customer demand. The effects corporate activities will have on society should be studied. Appropriate and overt response should be made to meet social and consumer demands. Top priority should be given for following corporate concepts and fulfillment of corporate responsibilities. Corporate and social concepts should be integrated; business competitions must be carried out in moderation and under the sound judgement of society.

The above aspects cover the role of managers in the intense business environment of today. The environment that encompasses society varies according to the country. However, there is no big difference in the duties of a manager.

DEFECT PREVENTION

Defect prevention is the main function of modern quality control, but many companies are not up to date. When, mass production began the main way of keeping bad products from the customer was to inspect the items and weed out the defectives. Today, a century and three quarters later, many companies still emphasize the inspection and removal of bad parts. They don't concentrate on making them right the first time.

Experience can help. As Oliver Wendell Holmes, Jr. (1841-1935) said "... a page of history is worth a volume of logic" "What is history if not experience?"

Source: Edward M. Schock & Henry L. Lefevre
The Good & Bad About Quality,
Marel Dekker,
New York, 1988.

Skill Requirements by 2000 AD.

The Secretary's Commission on Achieving Necessary Skills (SCANS) of the United States was asked to examine the demands of the workplace and whether young people are capable of meeting those demands. The commission held discussions and meetings with business owners, public employees, unions and workers and supervisors in shops, plants and stores. The commission established six special panels to examine jobs from manufacturing to government employment. They also commissioned researchers to conduct lengthy interviews with workers in a wide range of jobs. Because of the relevance of the commission's findings for educational planning we present here the Commission's Report: Executive summary.

Excerpts from the Report quoted in Manufacturing Competitiveness Frontiers Jan. 1992.

The Secretary's Commission on Achieving Necessary Skills (SCANS) was asked to examine the demands of the workplace and whether young people are capable of meeting those demands. Specially, the Commission was directed to advise the Secretary on the level of skills required to enter employment. In carrying out this charge the Commission was asked to:

- * Define the skills needed for employment;
- * Propose acceptable levels of proficiency;
- * Suggest effective ways to assess proficiency; and
- * Develop a dissemination strategy for the nation's schools, businesses, and homes.

This report results from discussions and meetings with business owners, public employers, unions, and workers and supervisors in shops, plants, and stores. It builds on the work of six special panels established to examine all manner of jobs from manufacturing to government employment. Researchers also conducted lengthy interviews with workers in a wide range of jobs.

The message was universal: good jobs will increasingly depend on people who can put knowledge to work. What was found was disturbing: more than half the young people leave school without the knowledge or foundation required to find and hold a good job. These young people will pay a very high price. They face the bleak prospects of dead-end work interrupted only by periods of unemployment.

Two conditions that arose in the last quarter of the 20th Century have changed the terms for young people's entry into the world of work: the globalization of commerce and industry and the explosive growth of technology on the job. These developments have barely been reflected in how young people are prepared for work or in how many of the workplaces are organized. Schools need to do a better job and so do employers. Students and workers must work smarter. Unless they do, neither schools, and students, nor businesses can prosper.

SCANS research verifies that workplace know-how defines effective job performance today. This know-how

Two conditions that arose in the last quarter of the 20th Century have changed the terms for young people's entry into the world of work: the globalization of commerce and industry and the explosive growth of technology on the job.

has two elements. competencies and a foundation. This report identifies five competencies and a three-part foundation of skills and personal qualities that lie at the heart of job-performance. These eight requirements are essential preparation for all students—those going directly to work and those planning further education. Thus, the competencies and the foundation should be taught and understood in an integrated fashion that reflects the workplace contexts in which they are applied.

Five Competencies

Resources: Identifies, organizes, plans, and allocates resources

- A. *Time*—Selects goal-relevant activities, ranks them; allocates time, and prepares and follows schedules
- B. *Money*—Uses or prepares budgets, makes forecasts, keeps records, and makes adjustments to meet objectives.
- C. *Material and Facilities*—Acquires, stores, allocates, and uses materials or space efficiently
- D. *Human Resources*—Assesses skills and distributes work accordingly, evaluates performance and provides feedback.

Interpersonal: Works with others

- A. *Participates as Member of a Team*—contributes to group effort
- B. *Teaches Others New Skills*
- C. *Serves Clients/Customers*—works to satisfy customers' expectations
- D. *Exercises Leadership*—communicates ideas to justify position, persuades and convinces others, responsibly challenges existing procedures and policies
- E. *Negotiates*—works towards agreements involving exchange of resources, resolves divergent interests.
- F. *Works with Diversity*—works well with men and women from diverse backgrounds

Information: Acquires and uses information

- A. *Acquires and Evaluates Information*
- B. *Organizes and Maintains Information*
- C. *Interprets and Communicates Information*
- D. *Uses Computers to Process Information*

Systems: Understands complex inter-relationships

- A. *Understands Systems*—knows how social, organizational, and technological systems work and operates effectively with them
- B. *Monitors and Corrects Performance*—distinguishes trends, predicts impacts on system operations, diagnoses deviations in systems' performance and corrects malfunctions
- C. *Improves or Designs Systems*—suggests modifications to existing systems and develops new or alternative systems to improve performance.

Technology: Works with a variety of technologies

- A. *Selects Technology*—chooses procedures, tools or equipment including computers and related technologies
- B. *Applies Technology to Task*—Understands overall intent and proper procedures for setup and operation of equipment
- C. *Maintains and Troubleshoots Equipment*—Prevents, identifies, or solves problems, with equipment, including computers and other technologies

A Three-part Foundation

Basic Skills: Reads, writes, performs arithmetic and mathematical operations, listens and speaks

- A. *Reading*—locates, understands, and interprets written information in prose and in documents such as manuals, graphs, and schedules
- B. *Writing*—communicates thoughts, ideas, information, and messages in writing; and creates documents such as letter, directions, manuals, reports, graphs, and flow charts
- C. *Arithmetic/Mathematics*—performs basic computations and approaches practical problems by choosing appropriately from a variety of mathematical techniques

- D. *Listening*—receives, attends to, interprets, and responds to verbal messages and other cues
- E. *Speaking*—organizes ideas and communicates orally

Thinking Skill: Thinks creatively, makes decision, solves problems, visualizes, knows how to learn, and reason

- A. *Creative Thinking*—generates new ideas
- B. *Decision Making*—specifies goals and constraints, generates alternatives, considers risks, and evaluates and chooses best alternative
- C. *Problem Solving*—recognizes problems and devises and implements plan of action
- D. *Seeing Things in the Mind's Eye*—organizes, and processes symbols, pictures, graphs, objects, and other information
- E. *Knowing How to Learn*—uses efficient learning techniques to acquire and apply new knowledge and skills
- F. *Reasoning*—discovers the rule or principle underlying the relationship between two or more objects and applies it when solving a problem

Personal Qualities: Displays responsibility, self-esteem, sociability, self-management, and integrity and honesty

- A. *Responsibility*—exerts a high level of effort and perseveres towards goal attainment
- B. *Self-Esteem*—believes in own self-worth and maintains a positive view of self
- C. *Sociability*—demonstrates understanding, friendliness, adaptability, empathy, and politeness in group settings.
- D. *Self Management*—assesses self accurately, sets personal goals, monitors progress., and exhibits self-control
- E. *Integrity/Honesty*—chooses ethical courses of action

We believe, after examining the findings of cognitive science, that the most effective way of learning skills is “in context”, placing learning objectives within a real environment rather than insisting that students first learn in the abstract what they will be expected to apply.

The five SCANS competencies span the chasm between school and the workplace. Because they are needed in workplaces dedicated to excellence, they are hallmarks

of today's expert worker. And they lie behind the quality of every product and service offered on today's market.

The most effective way of learning skills is “in context”, placing learning objectives within a real environment rather than insisting that students first learn in the abstract what they will be expected to apply.

The competencies differ from a person's technical knowledge. For example, both accountants and engineers manage resources, information, systems, and technology. They require competence in these areas even though building a bridge has little to do with balancing a set of books. But in each profession, the competencies are at least as important as technical expertise. The members of the Commission believe these competencies are applicable from the shop floor to the executive suite. In the broadest sense, the competencies represent the attributes that today's high-performance employer seeks in tomorrow's employee.

To describe how this know-how is used on the job, our report provides a series of five scenarios that portray work requirements in the context of the real world. The scenarios show that work involves a complex interplay among the five competencies we have identified and the three elements of the foundation—the *basic* skills, higher order *thinking skills*, and diligent application of *personal qualities*.

The scenarios make clear that tomorrow's career ladders require even the basic skills—the old 3 Rs—to take on a new meaning. First, all employees will have to read well enough to understand and interpret diagrams, directories, correspondence, manuals, records, charts, graphs, tables, and specifications. Without the ability to read a **diverse** set of materials, workers cannot locate the **descriptive** and **quantitative** information needed to make **decisions** or to **recommend** courses of action. **Reading requirements on the job might involve:**

- * interpreting blueprints and materials catalogues;
- * dealing with letters and written policy on complaints;
- * reading patients' medical records and medication instructions and
- * reading the text of technical manuals from equipment vendors.

At the same time, most jobs will call for *writing skills* to prepare correspondence, instructions, charts, graphs, and proposals, in order to make requests, explain, illustrate, and convince. On the job this might require:

- * writing memoranda to justify resources or explain plans;
- * preparing instructions for operating simple machines;
- * developing a narrative to explain graphs or tables; and
- * drafting suggested modifications in company procedures.

Mathematics and computational skills will also be essential. Virtually all employees will be required to maintain records, estimate results, use spreadsheets, or apply statistical process controls as they negotiate, identify trends, or suggest new courses of action. Mathematics will be used on the job, for example to:

- * reconcile differences between inventory and financial records;
- * estimate discounts on the spot while negotiating sales;
- * use spreadsheet programs to monitor expenditures;
- * employ statistical process control procedures to check quality; and
- * project resource needs over the next planning period.

More and more, work involves listening carefully to clients and co-workers and clearly articulating one's own point of view.

Finally, very few will work totally by themselves. More and more, work involves listening carefully to clients and co-workers and clearly articulating one's own point of view. Today's worker has to listen and speak well enough to explain schedules and procedures, communicate with customers, work in teams, understand customer concerns, describe complex systems and procedures, probe for hidden meanings, teach others, and solve problems. On the job these skills may translate into:

- * training new workers or explaining new schedules to a work team;

- * describing plans to supervisors or clients;
- * questioning customers to diagnose malfunctions; and
- * answering questions from customers about post-sales service.

SCANS estimates that less than half of all young adults have achieved these reading and writing minimums; even fewer can handle the mathematics; and, schools today only indirectly address listening and speaking skills.

Defining the minimum levels of proficiency in the SCANS competencies is also a crucial part of the Commission's task. It requires imagining what the workplaces of the year 2000 could and should look like.

Initial estimates of work-ready levels of proficiency in the five competencies are as given in Annexure 1. Proficiency in each competency requires proficiency in the foundations. Young people leaving school should have both a sufficient foundation and level of understanding of the competencies to exhibit performances like those illustrated.

The minimums define what makes a young person ready for work at entry levels on career ladders. They represent neither the first nor last step in a process of life-long learning. Instead, the minimums will be a second step in a progression of skills acquisition. For example, consider scheduling time, part of the SCANS *resources* competency. A young student (at the preparatory stage) might be expected to make a schedule for him or herself. Being work-ready would require making a schedule for others. At the extreme, a specialist might develop schedules for an airline. (Annexure 2)

Our work pertains directly to National Goals #3 and #5 which state:

Goal #3 American students will leave grades four, eight, and twelve having demonstrated competency in challenging subject matter including English, mathematics, science, history, and geography; and every school in America will ensure that all students learn to use their minds well, so they may be prepared for responsible citizenship, further learning and productive employment in our modern economy.

Goal#5 Every adult American will be literate and will possess the knowledge and skills necessary to compete in a global economy and exercise the rights and responsibilities of citizenship.

Our report is intended to contribute to all four parts of the strategy put forth by President Bush in America 2000 as shown below.

Excerpts from America 2000's Four-Part Strategy

Part 1.

For Today's Students: Better and More Accountable Schools—World Class Standards:... These standards will incorporate both knowledge and skills, to ensure that, when they leave schools, young Americans are prepared for further study and the work force."

Part 2.

"For Tomorrow's Students: A New Generation of American Schools. New American Schools: help communities create schools that will reach the national education goals, including World Class Standards."

Part 3.

"For the Rest of Us (Yesterday's Students/Today's Work Force): A Nation of Students—Private Sector Skills and Standards: Business and labor will be asked ... to establish job-related skill standards, built around core proficiencies..."

Part 4.

"Communities Where Learning Can Happen." America 2000 Communities. The president is challenging every city, town, and neighbourhood.. to adopt the six national education goals...[and] develop a report card for measuring progress.

For over 200 years Americans have worked to make education part of their national vision, indispensable to democracy and to individual freedom. For at least the last 40 years, we have worked to further the ideal of equity—for minority Americans, for the disabled, and for immigrants. With that work still incomplete, we are called to still another revolution—to create an entire people trained to think and equipped with the know-how to make their knowledge productive.

This new revolution is no less exciting or challenging than those we have already completed. Nor is its outcome more certain. All that is certain is that we must begin.

Workforce know-how will be part of the new World Class Standards. However, defining competencies and a foundation is not enough. Schools must teach them. Students must learn them. And, they should be assessed as part of the AMERICA 2000 agenda. Among the concrete steps SCANS will take in the future are efforts to:

- * examine how to create an assessment system that helps students understand what they have to learn and certifies that they have mastered the competencies so that employers and colleges will honor their record of high school performance;
- * consider the implications of the SCANS findings for curriculum development, school organization, teacher training, and instructional materials and technology; and
- * help the Administration establish the public-private partnership called for in the education strategy, "AMERICA 2000."



ANNEXURE 1 — KNOW-HOW : WORK-READY LEVEL OF PROFICIENCY

| COMPETENCE | EXAMPLE OF LEVEL |
|----------------------|--|
| RESOURCES | Develop cost estimates and write proposals to justify the expense of replacing kitchen equipment. Develop schedule for equipment delivery to avoid closing restaurant. Read construction blueprints and manufacturer's installation requirements to place and install equipment in the kitchen.* |
| INTERPERSONAL | Participate in team training and problem-solving session with multi-cultural staff of waiters and waitresses. Focus on upcoming Saturday night when local club has reserved restaurant after midnight for party. Three people cannot work and team has to address the staffing problem and prepare for handling possible complaints about prices, food quality, or service.* |
| INFORMATION | Analyze statistical control charts to monitor error rate. Develop, with other team members, a way to bring performance in production line up to that of best practice in competing plants.** |
| SYSTEMS | As part of information analysis above, analyze painting system and suggest how improvements can be made to minimize system downtime and improve paint finish. |
| TEHCNOLOGY | Evaluate three new paint spray guns from the point of view of costs, health and safety, and speed. Vendors describe performance with charts and written specifications. Call vendors' representatives to clarify claims and seek the names of others using their equipment. Call and interview references before preparing a report on the spray guns and making a presentation to management.** |

* Competence as demonstrated in a service sector application.

** Competence as demonstrated in a manufacturing sector application.

ANNEXURE 2 :PROGRESS IN ACQUIRING SKILLS

| PROFICIENCY LEVEL | PERFORMANCE BENCHMARK |
|---------------------|--|
| PREPARATORY | Scheduling oneself |
| WORK-READY | Scheduling small work team |
| INTERMEDIATE | Scheduling a production line or substantial construction project |
| ADVANCED | Developing roll-out schedule for new product or production plant |
| SPECIALIST | Develop algorithm for scheduling airline |

Resource Productivity Under Different Risk Averse Farming Situations

T.R. Shanmugam

The present study deals with productivity of fertilizer under different risk averse farming situations. The farm's acquisition and use of nitrogen adjusted well to changes in different components of risk. An analysis was made to prove the quadratic response of fertilizer in rice production. The demand for nitrogen supported the demand law of economic theory. Marginal value products showed diminishing returns with increased aversion to risk.

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Knight (1933) distinguished between risk and uncertainty based on the empirical information available for generating probabilities. If the decision maker faces a situation similar to others which have occurred in the past and information about outcomes of previous choices could be used to estimate probability functions, the situation is risky. A unique situation with little or no empirical basis for the formation of probability distributions is considered uncertain. The present study deals with optimal input use in producing rice under risky situations. The farm's acquisition and use of nitrogen adjusted well to changes in risk. The farm's sources of risk for this study included

- Change in price of product;
- Change in price of nitrogen
- Availability of fertilizer/nitrogen
- Technology
- Environment and rainfall, and
- Input - Output relationship

Other sources of risk were attributed to the reliability and availability of information about the probability density functions for random events and about the utility function of the decision maker. This paper resolves the risky decisions by maximising a single input-output function over utility function given by Binswanger & Sillers (1983).

Materials and Methods

The data for the study were taken from the survey conducted in thirty rice farms which are commanded under Watrap tank, Kamarajar district of Tamil Nadu. The farms were chosen randomly and the data related to the year 1990-91. Rice yield (paddy terms) in kgs per hectare was taken as a dependent variable. Nitrogen and N^2 in kgs per hectare were used as explanatory variables in the regres-

sion model. Quadratic regression function was fitted for the data assuming all other inputs were used at normal level. This led to the following model of Nitrogen response;

$$Y = a_1 + b_1 N + b_2 N^2 + U_1$$

Certain conditions which an economic model should satisfy for optimizing input use under risky situation were suggested by Just & Pope (1978) :

- i) $E(Y) > 0$; the expected value of output is positive;
- ii) $dY/dX > 0$; input provides positive contribution to the production process;
- iii) $d^2Y/dX^2 < 0$; the marginal product of input should diminish at some point.
- iv) $d\sigma^2/dX > 0$; the change in variance associated with a change in the input is not constant in sign.
- v) $d\sigma^2(dY/dX)/dX < 0$; the change in variance of a marginal product is not constant in sign.

Assuming the above conditions, quadratic function was specified and fitted for the study.

$$\hat{Y} = a_1 + b_2 N + b_2 N^2 \quad (1)$$

Differentiating Y with respect to N, marginal product was given :

$$d\hat{Y}/dN = b_1 + 2 b_2 N$$

Equating marginal product to inverse price ratio ;

$$\frac{P_N}{P_Y} = \frac{dY}{dN} = P_N$$

$$P_Y \{ b_1 + 2 b_2 N \} = P_N$$

Optimality was achieved when factor price was equated to the value of marginal product under risk neutral situations. This relationship was not true when the production process involved risk. Anderson, Dillon & Hardaker (1977) derived "one-factor", "one-product" production function under risky situation. They established the following relationship to derive the optimal input use under risk:

$$P_N = P_Y \frac{d\hat{Y}}{dN} - \text{REDQ} \left[P_Y^2 \frac{d^2V(y)}{dN^2} \right] \quad (2)$$

The optimal input level occurred when the marginal factor cost was equal to the value of marginal product minus a marginal risk deduction that depended on the utility function.

REDQ term in equation (2) referred to risk evaluation differential quotient and $V(Y)$ denoted variance of rice yield.

According to Koutsoyiannis (1977), the variance of a dependent variable could be estimated as

$$\begin{aligned} V(Y) &= E \{ Y - \hat{Y} \}^2 \\ &= E \{ Y - (a + b_1 N + b_2 N^2) \}^2 \\ &= \sigma^2 \end{aligned}$$

where Y is the observed value and \hat{Y} is the estimated value of rice yield (paddy terms).

The following regression function was estimated to incorporate risk in the model.

$$V(Y) = a_2 + b_3 N + b_4 N^2 + U_2 \quad (3)$$

where V (Y) is the variance of rice yield in (paddy terms) kgs per hectare.

N is nitrogen use in kgs per hectare and

N^2 is the square term of nitrogen per hectare.

Estimates of Quadratic function

The estimated quadratic function was given as :

$$\hat{Y} = 3765.0850 + 17.0422 N - 0.0805 N^2$$

$$t = 2.1830 \quad 3.4830 \quad -2.5080$$

$$R^2 = 0.72$$

$$\bar{R}^2 = 0.70$$

$$N = 30$$

$$F = 35.68$$

The average rice (paddy terms) yield per hectare was 4580 Kgs. The average nitrogen use per hectare was 82.83 kgs. The average price per kg of paddy was Rs. 2.20. The subsidy price of nitrogen per kg was taken for the analysis and it was Rs. 4.50 per kg. The estimated production function revealed the law of diminishing return for nitrogen application as evidenced from the sign of square term. The estimated marginal product of nitrogen was

$$\frac{dY}{dN} = 17.0422 - 0.1610 N$$

$$MVP = 2.20 \{ 17.0422 - 0.1610 N \}$$

The optimal input use under normal condition (neutral risk) was worked out to 93.15 kgs per hectare. The demand function was estimated as

$$N = 105.85 - 2.82 P_N$$

As expected, the price and quantity of nitrogen demanded were inversely related. As price of nitrogen increased by one rupee, keeping other things constant, the demand for nitrogen decreased by 2.82 kgs. The optimal input under neutral risk situation (93.15 kgs) was higher than the average nitrogen use per hectare (82.83 kgs). The elasticity of production worked out to 1.12.

Quadratic function incorporating risk

The variance of rice yield as a function of explanatory variables nitrogen and N^2 was estimated :

$$V(Y) = 1088.053 + 4.2043 N - 0.0198 N^2$$

(425.20) (1.2170) (0.0069)

$$t = 2.5590 \quad 3.4540 \quad -2.8710$$

$$R^2 = 0.69$$

$$\bar{R}^2 = 0.67$$

$$N = 30$$

$$F = 30.23$$

The profit maximum level incorporating risk could be

$$P_N = P_y \frac{d\hat{Y}}{dN} - REDQ \left[P_y^2 \frac{dV(y)}{dN} \right] \quad (2)$$

Differentiating $V(Y)$ with respect to N

$$\frac{dV(Y)}{dN} = 17.0422 - 0.1610 N$$

This result was used to derive the optimal input by substituting in Eq. (2).

Binswanger & Sillers defined the values of risk evaluation quotient for rural India :

| | | |
|-------------------|---|----------------|
| neutral | : | zero |
| slight aversion | : | 0.316 to zero |
| moderate aversion | : | 0.812 to 0.316 |

These values (upper limits) have been used in the present study to derive the optimal input use under risk.

Optimal input use under slight averse to risk

The equation to derive optimal input was

$$P_N = P_y \frac{d\hat{Y}}{dN} - REDQ \left[P_y^2 \frac{dV(y)}{dN} \right] \quad (2)$$

$$4.50 = 2.20 \{ 17.0422 - 0.1610 N \} - 0.316 \{ (2.20)^2 (4.2043 - 0.0396 N) \}$$

$$N = 90.44 \text{ kgs}$$

The optimal input use was reduced from 93.15 to 90.44 kgs since the decision maker was slightly averse to risk. Demand function under slight aversion to risk was

$$N = 105.76 - 3.41 P_N$$

This equation followed the *a priori* expectation. Comparing demand under neutral risk situation, the demand under slight aversion to risk was more elastic. As price of nitrogen increased by one rupee, *ceteris paribus*, the quantity demanded decreased by 3.41 kgs.

Optimal input use under moderate risk

The equation for optimality was

$$P_N = P_y \frac{d\hat{Y}}{dN} - REDQ \left[P_y^2 \frac{dV(y)}{dN} \right]$$

$$4.50 = 2.20 \{ 17.0422 - 0.1610 N \} - 0.812 \{ (2.20)^2 (4.2043 - 0.0396 N) \}$$

$$N = 82.93 \text{ kgs}$$

Comparing this value to optimal input use under slight aversion to risk, the input application was decreased as the coefficient of risk aversion increased.

The estimated demand function was

$$N = 105.58 - 5.03 P_N$$

This derivation explained the law of demand. The decision maker was highly elastic to input price rise under moderate risky situations. As the price of nitrogen rose by one rupee, other things remaining constant, the demand for nitrogen decreased by 5.03 kgs.

Derivation of marginal value products/resource productivity

The marginal value products were worked out from 81 to 100 kgs of nitrogen at various risk aversion levels. (table. 1). The marginal value products were positive and gener-

ally decreased with increased use of nitrogen at all levels of risk. The MVP for risk neutral farm was Rs. 8.80 at 81 kg of N use and decreased to Rs. 2.07 when fertilizer was used at 100 kg per hectare. The MVP for slight risk average farm was Rs. 7.27 at 81 kg of N and reduced to Rs. 1.69 when nitrogen application was 100 kg per hectare. As the value of risk evaluation coefficient increased the MVP got reduced. Similar trend was noticed, when risk averse situation changed from slight aversion to moderate aversion.

The decline in the MVP was due to the marginal risk deduction of decision maker which depended on the utility function.

Table 1 : Derivation of Marginal Value Products

| Nitrogen Kgs | MVP for Neutral risk (Rs.) | MVP for Slight risk aversion | MVP for moderate risk aversion | MFC |
|--------------|----------------------------|------------------------------|--------------------------------|------|
| 81 | 8.80 | 7.27 | 4.88 | 4.50 |
| 82 | 8.45 | 6.98 | 4.68 | 4.50 |
| 83 | 8.09 | 6.69 | 4.49 | 4.50 |
| 84 | 7.74 | 6.39 | 4.29 | 4.50 |
| 85 | 7.39 | 6.10 | 4.09 | 4.50 |
| 86 | 7.03 | 5.80 | 3.89 | 4.50 |
| 87 | 6.68 | 5.51 | 3.69 | 4.50 |
| 88 | 6.32 | 5.22 | 3.49 | 4.50 |
| 89 | 5.97 | 4.92 | 3.29 | 4.50 |
| 90 | 5.61 | 4.63 | 3.10 | 4.50 |
| 91 | 5.26 | 4.34 | 2.90 | 4.50 |
| 92 | 4.91 | 4.04 | 2.70 | 4.50 |
| 93 | 4.55 | 3.75 | 2.50 | 4.50 |
| 94 | 4.20 | 3.45 | 2.30 | 4.50 |
| 95 | 3.84 | 3.16 | 2.10 | 4.50 |
| 96 | 3.49 | 2.87 | 1.90 | 4.50 |
| 97 | 3.14 | 2.57 | 1.71 | 4.50 |
| 98 | 2.78 | 2.28 | 1.51 | 4.50 |
| 99 | 2.43 | 1.99 | 1.31 | 4.50 |
| 100 | 2.07 | 1.69 | 1.11 | 4.50 |

Conclusion

The farmer's acquisition and use of input adjusted to changes in risk. As the coefficient of risk evaluation increased, the optimal input use decreased. Higher the risk aversion, the more elastic would be the demand for input. The rice yield response to nitrogen application was tried in this study. The quadratic function revealed diminishing returns at higher doses of fertilizer application. Demand functions for nitrogen in all situations revealed the inverse relationship between price and demand following the economic theory. Marginal Value Product (MVP) was derived at various levels of risk aversion. MVP was positive and generally decreased with increased aversion to risk. At each risk aversion level, MVP has been reduced with higher input application.

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The best leaders are apt to be found among those executives who have a strong component of unorthodoxy in their character. Instead of resisting innovation, they symbolize it.

—David Ogilvy, on Advertising

The reasonable man adapts himself to the world. The unreasonable one persists in trying to adapt the world to himself. Therefore all progress depends on the unreasonable man.

—George Bernard Shaw

Inter-sectoral Differentials Between Electrified & Non Electrified Areas

S.K. Pant

The term 'inter-sectoral linkages' refers to the extent of dependence one sector has on the others and vice versa. With the introduction of new technology, every sector has undergone revolutionary changes. Change in one sector has its repercussions on the other sectors too. This study examines the role of rural electrification in three districts of Uttar Pradesh namely Agra, Hardoi and Mirzapur, to what extent the increasing use of electricity has affected the inter-sectoral flow of goods and services. It also works out the forward and backward linkages between the prevalent sectors.

The Concept

In the present context of planning with the advent of modern technology, almost every sector of the economy has undergone a sea change. The change, at times, has varied not only between sectors but also within the sectors. The continuous change thus experienced has a strong bearing on the inter-sectoral linkages which are crucial for ascertaining the level of development. The term "inter-sectoral linkages" refers to the extent or degree of dependence one sector has on the other and vice-versa; which means that the inter-sectoral dependence could be both forward as well as backwards. The term forward linkage refers to that proportion of output of one sector which is used as an input by the other sectors. Similarly, backward linkage denotes that proportion of total output which is used as an input either for intermediate or final use, by the first sector. The study of inter-relationship between two or more sectors is of vital significance and the inter-sectoral movement is essentially a function of the pace or level of development.

If a_i and b_i represent the forward and backward linkage coefficients of the i th sector respectively then mathematically it could be expressed as

$$a_i = \frac{\sum_j X_{ij}}{X_i} \dots\dots\dots(i)$$

$$b_i = \frac{\sum_j X_{ji}}{X_j} \dots\dots\dots(ii)$$

where, $\sum_j X_{ij}$ = total amount of output of the i th sector that is used as an input by the j th sector

$\sum_j X_{ji}$ = total amount of output of the j th sector that is being used as an input by the i th sector, and

X_i = total amount of output of the i th sector, respectively.

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Objectives

The study attempts to evaluate the impact of electrification on the inter-sectoral linkages in three districts of Uttar Pradesh. It examines to what extent the increasing use of rural electrification has a bearing on the inter-sectoral flow of goods and services and also works out their forward as well as backward linkage coefficients.

Methodology

In order to study the impact of the use of electricity on the inter-sectoral linkages as a whole, three districts of Uttar Pradesh, one each belonging to Western, Central, and Eastern regions which depict alien levels of development, were chosen. Accordingly Agra, Hardoi and Mirzapur formed the sample districts. In these identified districts, a sum of eighteen villages per district were randomly selected. Of these eighteen villages, twelve villages belonged to the electrified category (hereafter called the 'target group') and the remaining six consisted of non electrified group, (hereafter called the 'controlled group') in each of the sample district. Thus, in all, the total sample consisted of fifty-four villages of which thirty six belonged to target group and the remaining eighteen came from the controlled group. In the absence of data pertaining to the usage of electricity, the target group villages were further classified on the basis of their period of electrification. Thus, the villages which had been electrified only five years ago were termed 'phase I' set of villages, the villages where period of electrification ranged between five years and ten years were termed 'phase II' set of villages and the villages where the period of electrification exceeded ten years were called 'phase III' set of villages.

In these identified set of villages, a complete list of households was prepared with the help of Gram Pradhan and a set of thirty to forty households were randomly selected for personal interview. Of the total sample which contained a set of 2047 households, the number of belonging to the target group as well as the controlled group set of villages was 1352 and 695 respectively.

In order to eliminate the impact of heterogeneous factors and also provide a homogeneous base for cross-sectional data in the ultimate analysis, care was taken to select those villages in close proximity to one another.

Sectoral Classification

These sample villages were classified as (i) agricultural sector, (ii) non agricultural sector, and (iii) external economy sector. The non agricultural sector comprised

the service as well as the manufacturing sectors. Further, in some cases, these two sectors were so closely knitted that it became virtually impossible to segregate them. Thus, the higher proportionate income generated by the sectors became the criteria for the classification. The study is related to the period 1985-86.

The Analysis

Analysis of the data has been attempted at the following two stages: (i) intra district levels, and (ii) inter district levels. The preliminary exercise showed that the impact of the use of electricity was mostly conspicuous in the phase III category of target group of villages, therefore, at the intra district level comparison of phase III set of target group of villages, their respective controlled group of villages in each of the sample district was attempted. However, in the second category viz. the inter district level the comparison of the summation of each phase of the target group of villages in all the three sample districts with the summation of the controlled group set of villages in all the three sample districts was made.

Intra -District Level

Mirzapur:

The resource flow of goods and services and the technical coefficient between the sectors of the households belonging to the target group the controlled group set of villages in this sample district has been summarised in table 1 and table 2 respectively. The comparison of the two sectors viz. agriculture and non-agriculture shows that rural electrification has pushed up the level of per capita input use in the agriculture sector though it has declined in the non agriculture sector in the target group of villages. Similarly, the per capita input use from the external economy sector also inclined which clearly demonstrates the increasing level of inter-play. The analysis further reveals that the per capita intake level of agriculture which was Rs. 1504.96 in the controlled group inclined to Rs. 4619.67 in the target group category. The incline, however, was not found to be statistically significant at any level of probability. In the case of non-agriculture sector, the study shows that the per capita intake level from other sectors declined

Rural electrification has pushed up the level of per capita input use in the agriculture sector though it has declined in the non agriculture sector in the target group of villages.

Table 1 : Per capita resource flow of goods and services—Mirzapur (In Rs.)

| Sectors | Phase - III | | | | | Controlled Group | | | | |
|------------------|-------------|-----------------|------------------|--------------|--------------|------------------|-----------------|------------------|--------------|--------------|
| | Agriculture | Non-Agriculture | External economy | Final demand | Total output | Agriculture | Non-agriculture | External economy | Final demand | Total output |
| Agriculture | 544.06 | 675.65 | 1508.49 | 2229.14 | 4957.34 NS | 268.42 | 910.12 | 313.42 | 582.81 | 2074.77 |
| Non-agriculture | 160.39 | 200.28 | 2339.46 | 3457.65 | 6157.77 NS | 98.19 | 332.76 | 2307.66 | 4291.98 | 7030.59 |
| External Economy | 1716.40 | 2131.54 | - | - | 3847.95 NS | 597.27 | 2023.81 | - | - | 2621.08 |
| Primary Inputs | 2198.82 | 3410.80 | - | - | - | 541.08 | 3984.39 | - | - | - |
| Total Inputs | 4619.67 NS | 6418.27 NS | 3847.95 NS | - | - | 1504.96 | 7251.09 | 2621.08 | - | - |

Note: NS refers to Statistically not significant.

Table 2 : Technical coefficient between sectors

| Sectors | Phase III | | | Controlled Group | | |
|------------------|-------------|-----------------|------------------|------------------|-----------------|------------------|
| | Agriculture | Non-agriculture | External-Economy | Agriculture | Non-Agriculture | External-Economy |
| Agriculture | 0.11 | 0.11 | 0.39 | 0.13 | 0.12 | |
| Non-Agriculture | 0.03 | 0.03 | 0.61 | 0.05 | 0.05 | 0.88 |
| External-Economy | 0.35 | 0.35 | - | 0.29 | 0.29 | - |

from Rs. 7251.09 in the controlled group and further down to Rs. 6418.27 in the target group. The drop was, once again, not found to be statistically significant at any level of probability. Further, agriculture's per capita output level which was Rs. 2074.77 in the controlled group enhanced to Rs. 4957.34 in the target group. Once again the increase was not found to be statistically significant. The per capita output level of non-agriculture sector also dropped from Rs. 7030.59 in the controlled group to Rs. 6157.77 in the target group. The drop was, however, not statistically significant at any level of probability.

The comparison of technical coefficient also shows that the forward linkages between agriculture and external economy sector increased from 0.12 in the controlled group to 0.39 in the target group of villages, which means that the external economy sector was taking away the output from agricultural sector 0.39 times higher in the target group villages as compared to that of the controlled group set of villages, though there appeared to be a drop in the forward linkage pattern between agriculture and non-agriculture sector from 0.13 in the controlled group to 0.11 in the target group, thereby implying that the enhanced agriculture output was being taken away by the external economy sector as the flow of resources between agriculture and non agriculture sector has lessened. On the other hand, the weakening of the forward linkage coefficient between nonagricultural and agriculture sector

also spells the adverse impact on this sector. Thus, the impact of rural electrification on the agriculture sector was quite positive, though a bit marginal but it has adversely affected the scope of non-agriculture sector. The increasing influence of external economy sector could also be gauged from the fact that its total per capita

input contribution to these sectors inclined from Rs. 2621.08 in the controlled group to Rs. 3847.75 in the target group set of villages. The increase, though, was statistically insignificant at any level of probability. Similarly, the study of backward linkage coefficients between agriculture, non agriculture and external economy which were computed to be 0.05, 0.29 and 0.13, 0.29 in the controlled group subsequently were computed to be 0.13, 0.35 and 0.11, 0.35 respectively in the target group of villages, thereby showing an increasing reliance on the external economy sector. The forward linkage coefficient of external economy to these two sectors viz. agriculture and non-agriculture sector which were 0.29 each in the controlled group enhanced to 0.35 each for the corresponding sectors in the target group respectively.

Hardoi:

The study of resource flow of goods and services and their technical co-efficient between the two sets of households in the second sample district which have been summarised in tables 3 and 4 shows that the impact of rural electrification has not been significant though it has succeeded in pushing up the level of input use in agriculture. It also reveals that the input use level for non-agriculture sector declined in the target group. Similarly, the per capita output level of agriculture was higher in the target

Table 3: Per capita Resource Flow of Goods and Services—Hardoi (In Rs.)

| Sectors | Phase - III | | | | | Controlled Group | | | | | |
|------------------|-------------|-----------------|------------------|--------------|--------------|------------------|-----------------|------------------|--------------|--------------|---------|
| | Agriculture | Non-Agriculture | External economy | Final demand | Total output | Agriculture | Non-Agriculture | External economy | Final demand | Total output | |
| Agriculture | 660.21 | 383.26 | 1622.77 | 2870.35 | 5536.58 | NS | 479.19 | 386.76 | 1352.76 | 1950.69 | 4169.41 |
| Non-Agriculture | 188.05 | 109.35 | 1052.07 | 1860.51 | 3209.98 | NS | 191.31 | 154.13 | 1234.47 | 1779.05 | 3358.86 |
| External economy | 1693.37 | 981.47 | - | - | 2674.84 | NS | 1432.78 | 1154.36 | - | - | 2587.13 |
| Primary inputs | 988.49 | 641.51 | - | - | - | - | 1369.02 | 1248.35 | - | - | - |
| Total inputs | 3530.12 | 2115.58 | 2674.84 | - | - | - | 3472.30 | 2944.10 | 2587.13 | - | - |
| | NS | NS | NS | | | | | | | | |

Note: NS refers to Statistically not significant

Table 4: Technical coefficients between sectors—Hardoi (In Rs.)

| Sectors | Phase - III | | | Controlled Group | | |
|------------------|-------------|-----------------|------------------|------------------|-----------------|------------------|
| | Agriculture | Non-agriculture | External Economy | Agriculture | Non-agriculture | External Economy |
| Agriculture | 0.12 | 0.12 | 0.61 | 0.11 | 0.12 | 0.52 |
| Non-agriculture | 0.03 | 0.03 | 0.39 | 0.05 | 0.05 | 0.48 |
| External economy | 0.31 | 0.31 | - | 0.34 | 0.34 | - |

group though there was a drop in the per capita output level in the non-agriculture sector. The comparison between the target group and the controlled group of villages, on the cross-sectional frame work shows that the per unit input use level for agriculture which was reported to be Rs. 3472.39 in the controlled group inclined to Rs. 3530.12 in target group category. Further, the per capita output contributed by agriculture sector inclined from Rs. 4169.41 in the controlled group to Rs. 5536.58 in the target group of villages. The increase in both these cases was not found to be statistically significant at any level of probability. In the case of non-agriculture sector, the study shows that rural electrification has adversely affected its scope. The comparison of input use pattern shows that the per capita input use level which was Rs. 2944.10 in the controlled group declined to Rs. 2115.58 in the target group of villages and so has the per capita output level contributed by this sector which was Rs. 3258.66 in the controlled group which declined to Rs. 3209.98 in the target group. The decrease in the level of per capita input use or the per capita output contributed was, however, not found to be statistically significant at any level of probability. The external economy's increasing role could be seen from the fact that its per capita contribution which was Rs. 2587.13 in the controlled group further inclined to Rs. 2674.84 in the target group of villages.

The study of the technical coefficient in the district shows that the forward linkages between agriculture and

non-agriculture sector has remained practically the same viz. 0.12 in both the controlled as well as target group of villages, however, the level of forward linkage coefficients inclined from 0.52 in the controlled group to 0.61 in the target group which implies that bulk of the so-called enhanced output is being subsequently taken away by the active inter-play of external economy sector. Similarly, the comparison of forward linkages pattern between the non-agriculture sector and the agriculture sector declined from 0.05 in the controlled group to 0.03 in the target group of villages. Similarly the level of forward linkage pattern between non-agriculture and the external economy sector also declined from 0.48 in the controlled group category to 0.39 in the target group which shows that the impact of rural electrification, how-so-ever small, has largely been felt on agriculture and it has adversely affected the scope of non-agriculture sector. Similarly the study of forward linkage coefficients between the external economy sector and the non-agriculture sector which was 0.34 each in the controlled group subsequently dropped to 0.31 each for the corresponding sectors in the target group set of villages, which projects the external economy's growing and counter-productive role as it was contributing very little to the rural economy of the sample district and was taking away practically all of the enhanced agricultural output. The study also shows the drop in the backward linkage coefficients level between agriculture and non-agriculture sector, agriculture—external economy sector from 0.05 and 0.34 in the controlled group to 0.03 and 0.31 in the target group of villages. This trend, more or less, continued in the non-agriculture-agriculture and non-agriculture-external economy sectors spelling out the extent of adversity the external economy sector was casting on these two sectors respectively.

Table 5: Per capita resource flow of goods and services—Agra (In Rs.)

| Sectors | Phase III | | | | | Controlled group | | | | |
|------------------|-------------|-----------------|------------------|--------------|--------------|------------------|-----------------|------------------|--------------|--------------|
| | Agriculture | Non-Agriculture | External economy | Final demand | Total output | Agriculture | Non-Agriculture | External economy | Final demand | Total output |
| Agriculture | 564.57 | 250.12 | 1966.07 | 6058.37 | 8839.12 NS | 817.59 | 694.59 | 1842.52 | 2953.98 | 6307.56 |
| Non-agriculture | 255.22 | 113.79 | 871.79 | 2686.00 | 3926.80 NS | 175.55 | 149.99 | 1931.68 | 3100.03 | 5358.27 |
| External economy | 1964.27 | 873.09 | - | - | 2837.86 NS | 2040.38 | 2732.81 | - | - | 3773.20 |
| Primary inputs | 4429.16 | 1963.15 | - | - | - | 1221.91 | 1281.92 | - | - | - |
| Total inputs | 7213.72 NS | 3200.15 NS | 2837.86 NS | - | - | 4256.44 | 3859.21 | 3773.20 | - | - |

Note: Ns refers to Statistically not significant

Agra

The resource flow of goods and services of households belonging to the target group and the controlled group of villages in the third sample district (table 5) shows that rural electrification has not only enhanced the per capita input use level but has also enhanced the per capita output level in the agriculture sector of the target group and in the process has adversely affected the non-agriculture sector's scope. The impact on both the sectors, however, is marginal. The comparison of the two sets of villages shows that the per capita input use level of agriculture inclined from Rs. 4256.44 in the controlled group to Rs. 7213.72 in the target group of villages. Similarly, the per capita output level inclined from Rs. 6307.56 in the controlled group to Rs. 8839.12 in the target group of villages. Here also, the increase in both the cases was not found to be statistically significant at any level of probability. In the case of non-agriculture sector, the comparison between the two categories shows that the per capita input use level which was Rs. 3859.21 in the controlled group subsequently declined to Rs. 3200.15 in the target group category, likewise the per capita output generated by this sector also dropped from Rs. 5358.27 in the controlled group to Rs. 3926.80 in the target group of villages. The drop, in both the cases, was once again not found to be statistically significant at any level of probability.

The study of inter-sectoral linkages (table 6) or the technical coefficients also shows that rural electrification

Table 6: Technical coefficients between sectors—Agra

| Sectors | Phase - III | | | Controlled Group | | |
|------------------|-------------|-----------------|------------------|------------------|-----------------|------------------|
| | Agriculture | Non-agriculture | External economy | Agriculture | Non-agriculture | External economy |
| Agriculture | 0.06 | 0.06 | 0.69 | 0.13 | 0.13 | 0.49 |
| Non-agriculture | 0.03 | 0.03 | 0.31 | 0.03 | 0.03 | 0.51 |
| External economy | 0.22 | 0.22 | - | 0.32 | 0.32 | - |

has strengthened the forward linkages between agriculture and external economy sector while the level of forward linkage coefficients agriculture has weakened over the same period. The comparison shows that the forward linkage coefficients in agriculture and non-agriculture declined from 0.13 in the controlled group to 0.06 in the target group of villages while the forward linkage coefficients between agriculture and the external economy sector inclined from 0.49 in the controlled group to 0.69 in the target group. Similarly, the forward linkage coefficients between non-agriculture sector and agriculture sector remained practically the same, viz. 0.03 and between non-agriculture sector and the external economy sector declined from 0.51 to 0.31, thereby showing an adverse impact. The forward linkage coefficients between the external economy and the agriculture sector and agriculture and the non-agriculture sector which was 0.31 each in the controlled group subsequently declined to 0.22 each for the corresponding sectors in target group set of villages, thereby implying that the amount contributed as input by the external economy sector to these two sectors had declined while its backward linkages especially with agriculture (where bulk of the rural electrification's impact was discernible) had enhanced. The decline of the backward linkages in both agriculture as well as non-agriculture sector with the external economy sector in the target group of villages once again shows the extent of adverse impact these sectors have undergone.

Inter District Level

Summation Group

The study of the resource flow of goods and services of the households belonging to various electrified phases of target group and their respective controlled group category in the summation

group (tables 7, 8, 9, 10 respectively) shows that rural electrification's impact, by and large, has been felt on the agriculture sector only. The comparison of target group with the controlled group shows that the per capita input use level of agriculture sector which, in the controlled group, was Rs. 3085.27 inclined to Rs. 4179.47 in phase I, then dropped to Rs. 3423.89 in phase II and finally to Rs. 5167.33 in phase III category of target group of villages. Similarly the per capita output generated by this sector also inclined from Rs. 4186.76 in the controlled group to Rs. 5231.27 in phase I, Rs. 4736.12 in phase II and finally to Rs. 5933.66 in phase III set of target group. The per capita increase in the input use or the output contributed was, however, not found to be statistically significant at any level of probability. However, in the case of non-agriculture sector, the analysis reveals that the level of per capita input use which was Rs. 4658.56 in the controlled group declined to Rs. 3609.16 in phase I then further down to Rs. 2416.34 in phase II before inclining to Rs. 5337.64 in the phase III category of target group of villages; similarly the per capita output contributed by this sector declined from Rs. 4485.89 in phase I further down to Rs. 3029.81 in phase II before recovering to Rs. 5411.11 in phase III set of target group of villages. This drop, in the initial stages, and incline in the later stage of per capita use or the output contributed, was not found to be statistically significant at any level of probability. The study also shows that the per capita output contribution of external economy which was Rs. 2989.07 in the controlled group marginally inclined to Rs. 3162.01 in phase I and ultimately to Rs. 3521.38 in phase III category of target group of villages, reflecting the growing influence of this sector in these sample districts.

Table 7: Per capita Resource Flow of Goods and Services—Summation Group (In Rs.)

| Sectors | Phase -I | | | | |
|------------------|-------------|-----------------|------------------|--------------|--------------|
| | Agriculture | Non-Agriculture | External Economy | Final Demand | Total Output |
| Agriculture | 656.66 | 561.27 | 1525.36 | 2487.98 | 5231.27 NS |
| Non-agriculture | 176.96 | 158.60 | 1636.66 | 2513.57 | 4485.89 NS |
| External economy | 1682.84 | 1479.18 | - | - | 3162.01 NS |
| Primary Inputs | 1663.00 | 1410.11 | - | - | - |
| Total Inputs | 4179.47 | 3609.16 | 3162.01 | - | - |

Note : NS refers to Statistically not significant

Table 8: Per Capita Resource Flow of Goods and Services—Summation Group (In Rs.)

| Sectors | Phase -I | | | | |
|------------------|---------------|-----------------|------------------|--------------|--------------|
| | Agriculture | Non-Agriculture | External Economy | Final Demand | Total Output |
| Agriculture | 738.17 | 483.47 | 129.93 | 2215.20 | 4736.12 NS |
| Non-agriculture | 163.32 | 107.60 | 1064.41 | 17.04.48 | 3029.81 NS |
| External economy | 1429.31 | 934.38 | - | - | 2363.68 ** |
| Primary Inputs | 1093.09 | 890.88 | - | - | - |
| Total Inputs | 3423.89 NS | 2416.34 NS | 2363.68 ** | - | - |

Note : NS refers to Statistically not significant.

** refers to Statistically significant at 5 percent level.

Table 9: Per Capita Resource Flow of Goods and Services—Summation Group (In Rs.)

| Sectors | Phase-III | | | | |
|------------------|---------------|-----------------|------------------|--------------|--------------|
| | Agriculture | Non-agriculture | External economy | Final demand | Total output |
| Agriculture | 557.24 | 552.38 | 1626.84 | 3197.19 | 5933.66 NS |
| Non-agriculture | 185.20 | 172.99 | 1894.51 | 3158.41 | 5411.11 NS |
| External Economy | 1774.61 | 1746.74 | - | - | 3521.35 NS |
| Primary inputs | 2650.28 | 2865.53 | - | - | - |
| Total inputs | 5167.33 NS | 5337.64 NS | 3521.38 NS | - | - |

Note: NS refers to Statistically not significant

Table 10. Per Capita Resource Flow of Goods and Services—Summation Group (In Rs.)

| Sectors | CONTROLLED GROUP | | | | |
|------------------|------------------|-----------------|------------------|--------------|--------------|
| | Agriculture | Non-Agriculture | External economy | Final demand | Total output |
| Agriculture | 521.55 | 659.84 | 1172.84 | 1832.53 | 4186.72 |
| Non-agriculture | 155.90 | 211.37 | 1816.23 | 3038.69 | 5222.20 |
| External economy | 1358.89 | 1630.19 | - | - | 2989.67 |
| Primary Inputs | 1048.94 | 2157.16 | - | - | - |
| Total inputs | 3085.27 | 4658.56 | 2989.07 | - | - |

The comparison of forward and backward linkages or the technical coefficients (tables 11, 12, 13 and 14) also demonstrates the growing agriculture-external economy sectors bond. The comparison also shows that the forward linkage coefficient between agriculture-nonagriculture sector which was 0.13 in the controlled group, practically remained the same in the phase I category before marginally inclining to 0.16 in the phase III set of target group of villages respectively, whereas the forward linkage coefficient between agriculture-external economy progressively inclined from 0.39 in the controlled group to 0.48 in phase I, then to 0.55 in phase II and 0.46 in phase III set of villages, upholding the fact that practically all of the enhanced primary output is being taken away by the external economy sector. However, in the case of non-ag-

riculture sector, the comparison of forward linkage coefficient between non-agriculture sector and agriculture sector shows that it has marginally declined from 0.04 in the controlled group to 0.03 in phase-I, phase-II and phase-III category of the target group of villages, reflecting an adverse impact of rural electrification on this sector.

Likewise the comparative study of the forward linkage coefficients between non-agriculture and external economy sector declined from 0.61 in the controlled group to 0.52 in phase-I, then further down to 0.45 in phase-II and finally to 0.54 in phase-III category of the target group of villages. In other words, the drop in the forward linkage coefficients of this sector shows the declining performance of this sector in the target group of villages respectively. Further, the study of forward linkage coefficients between the external economy-agriculture sector and the external economy-non agriculture sector shows that its level has either remained practically the same or has marginally changed, thereby, implying that the amount contributed by this sector has either remained the same or has marginally changed while the amount taken away by it from the primary sector kept on progressively enhancing in the subsequent phases of the target group of villages. Similarly, the comparison of backward linkage pattern between agriculture-non agriculture sector in the controlled group and the target group of villages has declined from 0.04 to 0.03 in all the three phases of target group of villages whereas in agriculture-external economy sectors it has come down from 0.32 in the controlled to 0.30 in the phase-II and phase-III category of the target set of villages. The study of backward linkage coefficients between non-agriculture and agriculture, and non agriculture-external economy once again shows that the nexus between non-agriculture and agriculture which was 0.13 in the controlled group remained 0.13 in the phase-I category and then climbed to 0.16 in the phase-II category before settling for 0.10 in the phase-III set of villages, whereas the backward coefficients between non-agriculture and external economy remained more or less the same, viz. 0.31 in all the four specified categories of the sample which shows that there has been practically very little change in the amount taken as input by this sector from the external economy. In other words, this sector has remained, more or less, isolated from the impact of rural electrification.

Table 11: Technical Coefficients Between Sectors—Summation Group

| Phase-I | | | |
|------------------|-------------|-----------------|------------------|
| Sectors | Agriculture | Non-agriculture | External Economy |
| Agriculture | 0.13 | 0.13 | 0.48 |
| Non-agriculture | 0.03 | 0.03 | 0.52 |
| External economy | 0.30 | 0.33 | - |

Table 12: Technical Coefficients Between Sectors—Summation Group

| Phase-II | | | |
|------------------|-------------|-----------------|------------------|
| Sectors | Agriculture | Non-agriculture | External economy |
| Agriculture | 0.16 | 0.16 | 0.55 |
| Non-agriculture | 0.03 | 0.04 | 0.45 |
| External economy | 0.30 | 0.31 | - |

Table 13: Technical Coefficients Between Sectors—Summation Group

| Phase-III | | | |
|------------------|-------------|-----------------|------------------|
| Sectors | Agriculture | Non-agriculture | External economy |
| Agriculture | 0.09 | 0.10 | 0.46 |
| Non-agriculture | 0.03 | 0.03 | 0.54 |
| External economy | 0.30 | 0.32 | - |

Table 14: Technical Coefficients Between Sectors—Summation Group

| Controlled Group | | | |
|------------------|-------------|-----------------|------------------|
| Sectors | Agriculture | Non-agriculture | External economy |
| Agriculture | 0.12 | 0.13 | 0.39 |
| Non-agriculture | 0.04 | 0.04 | 0.61 |
| External economy | 0.32 | 0.31 | - |

Overall Assessment

The study of forward and backward linkages in both the target as well as controlled group of villages clearly shows that the impact of rural electrification, though not statistically insignificant, has been felt largely on the pri-

mary sector, the per capita output level of this sector distinctly grew in each subsequent phase of electrification in the target group of villages; however, rural electrification failed to promote non-agriculture sector which comprises mainly service and manufacturing class. The study also shows that the adverse impact of rural electrification on this sector was, however, not statistically significant at any level of probability.

Probable Factors

The study demonstrates that rural electrification has succeeded in enhancing the agricultural output, though not as expected, clearly indicating that it has been unable to reach out to the masses. Secondly, the external economy sector is siphoning off bulk of the enhanced agricultural output, which is so vital for the development of agro-processing units and agro-based industries outside the region thereby seriously limiting the scope of rural indus-

tries. Another factor militating against the scope of economic growth in these regions has been the lack of basic infrastructure which is so vital for the promotion of regional development.

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The Branch Manager as King

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Attributes of Rural Women & Productivity of Dairy Animals

Hema Tripathi & O.N. Kunzru

A study of the attributes of rural women was conducted with a view to analysing their relationship with the productivity of dairy animals. Data was collected through a personal interview schedule, from 192 randomly selected rural women of 12 villages of Bareilly district. The results showed a positive and significant correlation between family education status, family land holding, information sources utilization, input availability and adoption behaviour of rural women and productivity of dairy animals. Amongst the socio-psychological characteristics, productivity of dairy animals was found to be positively and significantly associated with innovation, level of aspiration, management orientation and orientation towards competition. Significant and positive relationships were also found between attitudinal characteristics of rural women, (except attitude towards income generation) and productivity of dairy animals.

In Indian rural social system, women play an important part in sustaining the socio-economic status of their families. Their active participation in all major rural sectors of production, especially in agriculture and animal husbandry production (Puri, 1971; Bhatt, 1975; Dey, 1977; Devi, 1983; Sharma & Mathuria, 1985; Dak et al., 1986; and Jamal, 1989) also generates additional family income. Previous studies have shown that many of the socio-personal characteristics are positively and significantly correlated with the adoption of dairy farm technologies (John, 1974; Mahipal, 1983; Hundal, 1976; Chauhan, 1979, Bhangoo, 1984; Kunzru et al., 1987; Jamal, 1989). Similarly, socio-psychological characteristics are reported to have positive effect on adoption behaviour (Beal & Silbey, 1967; Jaiswal, 1965; Nair, 1967; Ramachandran, 1974; Singh, 1975; Chandra, 1979; Mahipal, 1983; Tyagi & Sohal, 1984 and Kunzru et al., 1987). Despite high participation by women in rural animal husbandry, studies are scanty about socio-personal and socio-psychological characteristics affecting the productivity of dairy animals or vice-versa. In the present paper, various parameters have been studied to see their relationship with productivity of dairy animals. For the purpose of the study, productivity was defined as manifestation of obtaining total fluid milk from per unit of dairy animals through the adoption of scientific dairy farm technologies with available manpower and financial resources.

Methodology

The study was conducted in Bareilly district (Uttar Pradesh) because Bareilly Dugdh Utpadak Sahkari Sang Ltd. (BDUSSL), a dairy cooperative, was situated in this region. Six of the 15 blocks of this district are covered by BDUSSL. Two blocks contributing maximum milk per member were selected for this study. Further, three villages from each block which were member of the cooperative, were selected on the basis of average per member contribution to dairy cooperative. Thus 6 villages under

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cooperative umbrella (MC) were selected. In addition, 6 villages which were not members of dairy cooperative (NMC) which were located at an appropriate distance from MC villages in order to eliminate any direct or indirect overflow of influence were selected randomly as respondents. Thus, the total respondents of the study consisted of 192 rural women.

The data were collected through personal interview schedule and coefficients of correlation were computed in order to study the association of some attributes with productivity of dairy animals.

Table 1 : Association of socio-personal characteristics of rural women with productivity of dairy animals (N =192)

| Socio-personal characteristics | Productivity of dairy animals (r) |
|---|--------------------------------------|
| X ₁ Family land holding | 0.14' |
| X ₂ Caste | 0.09 |
| X ₃ Family education status | 0.20'' |
| X ₄ Information source utilization | 0.22'' |
| X ₅ Adoption behaviour | 0.25'' |
| X ₆ Number of dairy animals | 0.14' |
| X ₇ Input availability | 0.23'' |

Table value of r = 0.13 at 5 and 1 per cent level of significance.

' = P < .05, '' = < .01.

Table 1 indicates that family education status, information source utilization, adoption behaviour and input availability highly and significantly ($p < 0.01$) contributed to productivity of dairy animals. All these four characteristics are strongly interrelated and thus have a positive relationship with increasing milk production of dairy animals. Hundal (1976) had also found a strong and positive relationship between higher educational level and higher extension contact and higher milk production. Availability of technical inputs (Thakur, 1975), total family resources and efforts of family members have been reported to enhance the productivity of dairy animals (Jamal, 1989). High cost of inputs as well as lack of technical knowledge and guidance (Singh, 1984) have been responsible for non adoption of improved dairy farming practices (Bhuiyan, 1988). Table I also points out the positive and significant

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relationship between total number of dairy animals ($P < 0.05$) and productivity of dairy animals. The findings of the study are in consonance with those reported by Kapse (1976), Hundal (1976) and Chauhan (1979).

A perusal of table 2 reveals that the socio-psychological characteristics of rural women, except their knowledge level, were positive and significantly associated with productivity of dairy animals.

Table 2 : Socio-psychological characteristics of rural women associated with productivity of dairy animals. (N =192)

| Socio-psychological characteristics | Productivity of dairy animals (r) |
|--|--------------------------------------|
| X ₁ Information proneness | 0.28'' |
| X ₂ Orientation towards competition | 0.19'' |
| X ₃ Risk orientation | 0.30'' |
| X ₄ Management orientation | 0.17' |
| X ₅ Level of aspiration | 0.30'' |
| X ₆ Knowledge level | 0.09' |

' = P < .05, '' = < .01.

The data indicate that milk productivity of dairy animals increases with increase in the level of aspiration of rural women and their proneness to adopt innovations for productivity augmentation. Besides these, their orientation towards competition with neighbours, management orientation with regard to planning, production and marketing as well as their willingness to take risks to adopt dairy farm innovations play a significant role in augmenting milk productivity of dairy animals. Jaiswal (1965), Beal & Silbey (1967) Ramachandran (1974) and Singh (1975) also reported the positive association between risk orientation and adoption of innovations, which in turn augment productivity. In the present study, no significant relationship could be observed between knowledge level of rural women pertaining to dairy farm technologies and productivity of milk in contrast to the previous report (Singh, 1980). This may be because of the poor educational status of the rural women depriving them of the benefits of modern technologies to raise productivity and to generate income as reported by Srivastava (1988).

Milk productivity of dairy animals increases with increase in the level of aspiration of rural women and their proneness to adopt innovations for productivity augmentation.

Positive and favourable attitude is a pre-requisite for ultimate adoption of improved dairy farm practices (Singh, 1975; Gupta, 1976; Singh, 1975 and Mandape, 1988). In

the present study also, table 3 indicates the positive and significant correlation between attitude of rural women towards productivity, dairy farming, and dairy cooperative societies with the productivity of dairy animals.

Table 3 : Attitudinal characteristics of rural women associated with productivity of dairy animals. (N =192)

| Attitudinal characteristics | Productivity of dairy animals (r) |
|---|--------------------------------------|
| X ₁ Attitude towards dairy farming | 0.17* |
| X ₂ Attitude towards dairy cooperative | 0.26** |
| X ₃ Attitude towards productivity | 0.14** |
| X ₄ Attitude towards income generation | 0.01 |

* = P <.05, ** = <.01.

However, no relationship could be observed between attitude of rural women towards income generation and productivity of dairy animals. It may be because the rural women of the studied area were more inclined towards improving the nutritional status of family members than earning cash income through surplus milk available through higher production.

Conclusion & Implications

The study shows that socio-personal and socio-psychological characteristics of rural women, including attitudinal variables, have a palpable impact on productivity of dairy animals requiring them to be a strong component of our dairy extension programmes including training. These characteristics of rural women thus need to be suitably exploited by extension scientists and planners in order to help the rural livestock owners augment the productivity of their dairy animals for generating additional income and employment.

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Mini Steel Sector in India

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There are now 216 licensed Electric Arc Furnace Units in the country with a total capacity of about 9 million tonnes per year of which 175 are in actual operation. With some of the larger MSPs going in for expansion upto one million tonnes, their role as a source for steel & steel products could receive further impetus in the coming years. The present study attempts to review the performance of the Mini Steel sector with a view to identifying major problem areas and also arriving at the corresponding solutions.

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Despite its unquestioned importance in the industrial growth of the country, steel has remained in perpetual shortage over the past four decades of planned economic development. The integrated steel plants, both in public & private sectors, currently meet a little over half of the country's requirements of steel, the balance being supplied by the secondary sector or by import.

When the acute steel shortage continued to persist even after massive investments in the public sector steel plants, the government encouraged setting up Mini Steel Plants (MSPs) in the seventies to alleviate the situation. There are now 216 licensed Electric Arc Furnace (EAF) units with a total capacity of about 9 million tonnes per year (table 1) of which 175 units are in operation (July 1991) with an installed capacity of 6.9 million tonnes of steel. The secondary sector contributes about 46% of finished steel output. Although MSPs are spread throughout the country, the states of Maharashtra, Uttar Pradesh, & West Bengal account for about 42% of the total MSP capacity.

Table 1: Statewise distribution of MSPs (EAF Units)

| State | No. of units | Total capacity (000 metric tonnes) |
|----------------|--------------|------------------------------------|
| Andhra | 8 | 429.0 |
| Assam | 2 | 159.0 |
| Bihar | 7 | 316.0 |
| Chandigarh | 1 | 40.0 |
| Delhi | 1 | 9.0 |
| Gujarat | 6 | 335.0 |
| Haryana | 13 | 554.5 |
| H.P. | 4 | 176.7 |
| Kerala | 1 | 50.0 |
| J & K | 2 | 68.0 |
| Karnataka | 11 | 670.0 |
| Madhya Pradesh | 14 | 1268.5 |
| Maharashtra | 30 | 2015.1 |
| Orissa | 1 | 50.0 |
| Punjab | 9 | 607.7 |
| Pondicherry | 3 | 318.0 |
| Rajasthan | 7 | 217.2 |
| Tamil Nadu | 6 | 363.0 |
| U.P. | 26 | 809.8 |
| W. Bengal | 23 | 751.9 |
| Total | 175 | 9208.4 |

Source : SAIL(1992)

With the support of sufficient infrastructural facilities MSPs can be a useful and reliable adjunct of the larger plants to meet the country's growing demand for steel. With some of the larger MSPs going in for expansion upto one million tonnes capacity, their role as a source for steel and steel products should receive further impetus in the coming years.

Capacity & Performance

MSPs, as small labour intensive enterprises, are the appropriate mechanisms for dealing with the perennial shortage of steel & steel products. Large integrated steel plants, no doubt, are essential in a huge country like India but with scarcity of capital, long gestation periods involved and the environmental problems associated with such plants, the widespread proliferation of MSPs is perhaps unavoidable. An EAF unit becomes an appropriate alternative proposition when:

- The local demand for MS alloys & carbon steels is not large enough for economical production through blast furnace route.
- The main inputs like coke, limestone and high grade ores are not available at economically transportable locations.
- The scrap and power supplies are readily available at a reasonable cost.
- Rolling/re-rolling units are located in the vicinity or as integral part of the MSP itself.
- Sale of ingots/billets or rolled products does not pose any special difficulty and distribution costs are reasonable.

Initial proliferation of MSPs in India was largely the result of an unprecedented growth in the re-rolling industry during the post-independence era. These re-rolling units were not getting adequate supplies of billets or discarded steel items by the railways and other heavy engineering industries. This posed a serious threat to their survival. The government, therefore, allowed the then existing EAF units to produce MS ingots and also delicensed them upto an investment of Rs. one crore. This led to the quick growth of MSP units all over the country (table 2). The installed capacity of MSPs which grew rapidly in the first few years, however, became somewhat sluggish later. Although there are several EAF units functioning in different regions their mortality rate has gone up in recent years, the principal reason being inadequate supplies of scrap and shortage of electric power. The output of MSPs (table 3) also shows an unstable growth over the years. While the bulk of output of

MSPs continues to be mild steel, alloy steels and stainless steels have also now become items of regular production in the mini steel sector.

Table 2 : Growth of EAF Units (MSPs)

(million tonnes)

| Year | Total Capacity | % growth |
|---------|----------------|----------|
| 1988-89 | 4.86 | |
| 1989-90 | 5.63 | 15.8 |
| 1990-91 | 6.20 | 10.0 |
| 1991-92 | 6.80 | 9.7 |

Source : Deptt. of Steel Annual Reports, SAIL, (1990, 1992)

Table 3 : Out put of MSPs 1970-71 onwards

(OOO'mt)

| Year | Mild steel | Alloy & castings | Med./ High Carbon | Stainless steel | Total | % Growth |
|---------|------------|------------------|-------------------|-----------------|-------|----------|
| 1970-71 | 430 | 280 | - | - | 710 | - |
| 1971-72 | 530 | 300 | - | - | 830 | 17 |
| 1972-73 | 670 | 320 | - | - | 990 | 19 |
| 1973-74 | 670 | 360 | - | - | 1030 | 4 |
| 1974-75 | 530 | 260 | - | - | 720 | -23 |
| 1975-76 | 720 | 320 | - | - | 1020 | 29 |
| 1976-77 | 910 | 330 | - | - | 1240 | 22 |
| 1977-78 | 990 | 340 | - | - | 1330 | 7 |
| 1978-79 | 490 | 350 | - | - | 1840 | 38 |
| 1979-80 | 450 | 340 | - | - | 790 | -57 |
| 1980-81 | NA | NA | - | - | NA | - |
| 1981-82 | 1430 | 437 | 294 | - | 2161 | 173 |
| 1982-83 | 1590 | 368 | 276 | - | 2234 | 3.4 |
| 1983-84 | 1674 | 382 | 368 | - | 2424 | 8.5 |
| 1984-85 | 1620 | 389 | 321 | - | 2330 | -4 |
| 1985-86 | 2173 | 459 | 312 | - | 2944 | 26 |
| 1986-87 | 2214 | 440 | 364 | 102 | 3120 | 6 |
| 1987-88 | 2194 | 421 | 380 | 112 | 3110 | -0.3 |
| 1988-89 | 2058 | 502 | 485 | 135 | 3180 | 2.3 |
| 1989-90 | 2041 | 533 | 394 | 154 | 3122 | -2 |
| 1990-91 | 2363 | 590 | 372 | 175 | 3509 | 12 |
| 1991-92 | - | - | - | - | 3700 | 5.4 |

Source : Deptt. of Steel Annual Reports; Sidhu (1983); CIER Data book 1991-92

Current deterioration in the performance of MSPs is attributable to the unstable operating conditions and resources difficulties which made the quick profits of the earlier years somewhat difficult to obtain. A study of the profit earnings of 8 steel companies in the private corporate sector shows a clear declining trend (table 4). What has happened in these 8 companies is also generally true

of the MSP sector as a whole with earnings of some units having gone down more rapidly than that of others.

Table 4 : Select financial data of some Mini Steel Plants

(Rs. lakhs)

| Com-pany | Year | Total Ending Capital | Net Worth | Net Sales | Gross Profits | Profit before tax | Profit after tax | Divi-dend | Re-tained profits |
|---------------------|---------|----------------------|-----------|-----------|---------------|-------------------|------------------|-----------|-------------------|
| Mukand Iron & Steel | 1990 | 38755 | 10750 | 50170 | 5014 | 2316 | 1926 | 442 | 1484 |
| | 1989 | 33020 | 9496 | 30357 | 3308 | 2039 | 1754 | 295 | 1459 |
| | | (17.4) | (13.2) | (23.9) | (13.7) | (-14.8) | (-17.6) | (12.4) | (-23.7) |
| Mahindra UGINE | 1990 | 13915 | 3552 | 12045 | 1284 | 579 | 496 | 230 | 266 |
| | 1989 | 9995 | 3311 | 8423 | 1357 | 1035 | 800 | 189 | 611 |
| | | (39.2) | (7.3) | (7.3) | (-29.0) | (-58.0) | (-53.5) | (-8.7) | (-67.3) |
| Special Steels | 1990 | 10824 | 4093 | 19090 | 2815 | 2336 | 1516 | 285 | 1231 |
| | 1989 | 9667 | 2917 | 19253 | 2502 | 1954 | 1489 | 194 | 1295 |
| | | (12.0) | (40.3) | (23.9) | (40.6) | (49.4) | (27.3) | (83.6) | (18.8) |
| Shri Ishar Alloys | 1990 | 5641 | 1164 | 6544 | 467 | 167 | 143 | 68 | 75 |
| | 1989 | 3819 | 1107 | 5035 | 334 | 238 | 200 | 66 | 134 |
| | | (47.7) | (5.1) | (30.0) | (39.8) | (-29.8) | (-28.5) | (3.0) | (-44.0) |
| Western Ministil | 1990 | 2129 | 423 | 5722 | 155 | 62 | 52 | 29 | 23 |
| | 1989 | 1610 | 400 | 4694 | 141 | 65 | 59 | 24 | 35 |
| | | (32.2) | (5.8) | (52.4) | (37.4) | (19.2) | (10.2) | (51.0) | (-17.9) |
| Sanghvi Steels | 1989 | 1781 | 177 | 3238 | 109 | -12 | -12 | 0 | -2 |
| | 1988 | 15970 | 189 | 2600 | 57 | -36 | -36 | 0 | -36 |
| | | (11.5) | (-6.3) | (24.5) | (91.2) | (-) | (-) | (0.0) | (-) |
| Rathi Ispat | 1990 | 1423 | 97 | 4810 | 157 | 1 | 1 | 0 | 1 |
| | 1988 | 1288 | 96 | 3982 | 119 | 1 | 1 | 0 | 1 |
| | | (10.5) | (1.0) | (45.0) | (58.3) | (20.0) | (20.0) | (0.0) | (20.0) |
| Modella Steels | 1990 | 1106 | -65 | 2386 | -120 | -243 | -243 | 0 | -24 |
| | 1989 | 1138 | 178 | 2451 | 34 | -50 | -50 | 0 | -50 |
| | | (-2.8) | (..) | (21.7) | (..) | (-) | (-) | (00) | (-) |
| Total | 1989.90 | 75574 | 20191 | 104005 | 9881 | 5206 | 3879 | 1054 | 2825 |
| | 1988.89 | 62134 | 17694 | 76795 | 7352 | 5246 | 4217 | 768 | 3449 |

Source : CMIE (1991, 1992)

Economic Times, Nov. 21, 1990

Note : Figures in brackets are percent changes.

In the early rush for setting up MSPs which promised easy gains to the investors, the entrepreneurs seemed to have lost sight of the need to plan a well integrated unit. Of the 107 units existing in 1970, 87 had nothing more than pitside casting as the sole utility outlet for the liquid metal produced by them (Sidhu, 1983). A very small number of units had installed modern facilities such as continuous casting or set up captive rolling capability. Most of them were largely dependent on the market or other industrial users for the sale of pencil ingots produced by them for which in many cases they had to compete with integrated steel plants who possessed much greater flexibility to absorb market fluctuations. Although some capacity additions in later years have improved the position of several EAF units and some of them have since changed over to alloy, high carbon & special steels, experience shows that a split system EAF cannot do as well economically as a properly planned integrated unit.

In the Western countries small electric arc furnaces are set up primarily to cater to limited requirements of special high quality steels. There are a large number of EAFs, in other countries (table 5) which are still playing the kind of supplementary role they were originally meant for. Although many such EAFs originally conceived as a production source for special grade steels are now producing tonnage steel as well in several countries, their primary role as producers of special steels remains the main basis for their continued existence.

Table 5 : Some of the large steel producing countries by EAF route

(million tonnes)

| Country | % of country's total steel production | | |
|-------------|---------------------------------------|-------|-------|
| | 1987 | 1988 | 1989 |
| Switzerland | 100.0 | 100.0 | 100.0 |
| USSR | 13.4 | 13.6 | 13.1 |
| Italy | 53.7 | 56.2 | 34 |
| Mexico | 43.5 | 45.9 | NA |
| Sweden | 49.4 | 48.1 | NA |
| Spain | 57.8 | 60.0 | NA |
| UK | 25.6 | 26.1 | NA |
| Brazil | 23.4 | 23.9 | 22 |
| Canada | 29.9 | 31.6 | NA |
| USA | 38.1 | 36.9 | 35.5 |
| Japan | 29.8 | 29.7 | 30.6 |
| S. Korea | 32.4 | 31.6 | 30.0 |
| France | 25.2 | 26.3 | 27.5 |
| India | 27.7 | 26.5 | 24.3 |
| W. Germany | 17.5 | 17.3 | 23.0 |
| World | 26.7 | 26.4 | NA |

Source : Soundarajan (1991)
SAIL (1990)

The melting capacity of arc furnaces in India generally ranges from 5 tonnes to 40 tonnes but most MSPs have installed furnaces of below 15 tonnes capacity (table 6) Out of a total of 169 EAF units in the mini sector in 1980, 35% were of 5 tonnes capacity, 8% of 6-8 tonnes, 10% of 8-10 tonnes and 38% of 10-14 tonnes, the balance 9% being in the range of 15 tonnes & above. In 1987, the position does not seem to have changed much either. Of the 269 furnaces installed, 95 were of 10/12 tonne capacity, accounting for a maximum share of 35% followed by 4/5 tonne capacity with a share of 28%. Only 20% were of higher capacity of 15 tonnes and above, balance of the furnace population being of a capacity below 6/8 tonnes. It would appear that the mini sector's preference lies between 5 and 15 tonnes capacity furnaces, the higher sizes being preferred by integrated mini mills which have

higher overall output per annum ranging between 40 and 50 thousand tonnes. Smaller size furnaces are less energy efficient as the following figures would show :

| Furnace Capacity | Power requirement |
|------------------------|-----------------------|
| 5 tonnes liquid steel | 880 KWH/per tonne |
| 25 tonnes liquid steel | 450-500 KWH/per tonne |

Table : 6 Number of EAFs according to capacity

| Region/ State | Upto 4 tonnes | 4/5 tonnes | 6/8 tonnes | 10/12 tonnes | 15/17 tonnes | 20/25 tonnes | 30/35 tonnes | 40t tonnes | Total No. |
|------------------------|------------------|---------------|---------------|-----------------|-----------------|-----------------|-----------------|---------------|--------------|
| Northern Region | | | | | | | | | |
| Delhi | - | 1 | - | - | - | - | - | - | 1 |
| Haryana | 2 | 8 | 5 | 5 | 5 | - | - | - | 25 |
| M.P. | 1 | 2 | - | - | - | - | - | - | 3 |
| J & K | - | 1 | - | 1 | - | - | - | - | 2 |
| Punjab | 1 | 12 | 3 | 6 | 4 | - | - | - | 26 |
| Rajasthan | - | 2 | 1 | 5 | 1 | 1 | - | - | 10 |
| U.P. | 2 | 16 | 4 | 20 | 2 | - | - | - | 44 |
| Total | 6 | 42 | 13 | 37 | 12 | 1 | - | - | 111 |
| Eastern Region | | | | | | | | | |
| Bihar | 1 | 1 | - | 3 | 1 | - | 3 | - | 9 |
| Orissa | - | - | - | - | 1 | - | - | - | 1 |
| West Bengal | 7 | 7 | 2 | 10 | 4 | 5 | - | - | 35 |
| Total | 8 | 8 | 2 | 13 | 6 | 5 | 3 | - | 45 |
| Western Region | | | | | | | | | |
| Gujarat | 1 | 2 | - | 8 | - | - | - | - | 11 |
| M.P. | 2 | 1 | 3 | 9 | 1 | - | - | - | 16 |
| Maharashtra | 6 | 9 | 5 | 11 | 9 | 1 | 3 | 2 | 46 |
| Total | 9 | 12 | 8 | 28 | 10 | 1 | 3 | 2 | 73 |
| Southern Region | | | | | | | | | |
| Andhra | - | 5 | - | 3 | 4 | 1 | - | - | 13 |
| Karnataka | - | 2 | - | 9 | 3 | 1 | - | - | 15 |
| Kerala | - | - | - | 3 | - | - | - | - | 3 |
| Tamil Nadu | 1 | 5 | - | 2 | - | 1 | - | - | 9 |
| Total | 1 | 12 | - | 17 | 7 | 3 | - | - | 40 |
| All India | 24 | 74 | 23 | 95 | 34 | 11 | 6 | 2 | 269 |
| Total | | | | | | | | | |

Source : Deptt. of Scientific & Industrial Research (1989)

Thus to produce 50 tonnes of liquid steel with two five tonne furnaces the energy consumption would amount to 40,000 KWH whereas for the same quantity of liquid steel when produced in two 25 tonne furnaces power consumption may not exceed 25000 KWH. This means MSPs as constituted at present are a misfit in India's industrial setting particularly in the context of perennial power shortage. EAFs have a useful role as scrap recycling units but in India, it seems, there is a mismatch here too as the scrap needs of MSPs exceed the internal accruals necessitating regular imports of scrap from abroad. MSP's margins are always under pressure owing to the localized/limited market and the customers' preference for price rather than quality. As mere producers of MS ingots, therefore the MSPs may no longer be economical auxiliaries under the country's new

policy of permitting steel plants of one million tonne capacity within the secondary sector.

MSPs as constituted at present are a misfit in India's industrial setting particularly in the context of perennial power shortage.

Principal inputs & their availability

EAF units use a number of input materials, the most important of which are : MS scrap/sponge iron, refractory materials, power, electrodes, and ferro alloys. Some of these inputs are scarce and very often in short supply, others command high prices and usually are of an indifferent quality.

MS scrap is classified into different categories, namely (a) Heavy melting type I (b) Heavy melting type II (c) Bundle No. 1 (d) Bundle No.12 (e) Steel turnings and borings (f) Cast iron borings. Different types of scrap carry different prices, the costlier varieties being the first three. In the early stages, scrap availability in the country was quite comfortable and enabled the MSPs to meet their full needs without resorting to large scale imports. With the melting capacity increasing progressively in subsequent years the indigenous scrap arisings have gradually begun to fall short of MSPs' scrap needs. Table 7 shows the growth of scrap consumption by the EAF units. During the past few years good quality scrap has become a scarce commodity. The position has been further worsened due to the current import restrictions. Electric furnace units are therefore unable to make full use of their installed capacity despite the recent duty concessions announced by the government in respect of MS scrap, sponge iron etc. Imported scrap prices have also shot up; from US \$ 125 in Jan. 1988 to US \$ 175 per tonne in June 1988 and was recently reported to have risen to Rs. 6,345 or (US \$ 217) per tonne. This price rise has also led to local scrap prices going up. The indigenous availability of steel scrap is around 2.5 to 2.8 million tonnes per year. For 4-5 million tonnes annual output by MSPs the requirement of steel scrap works out to about 5-6 million tonnes (including DRI). It would thus appear that the import of scrap will have to continue for a long time to come. Table 8 shows the demand and availability of MS scrap indicating a net deficit of 7.4 million tonnes in the year 2000. The quality of indigenous scrap is also quite poor as compared to the imported variety largely because of the unscientific nature of the collection process used by the unorganized sector engaged in this activity. The steel scrap imported through official canalising agencies is also of somewhat low quality as it

is found to have high non-metallic content of over 4 percent which causes a yield loss of about 3 percent from scrap charge to liquid metal, thereby adding to the ultimate cost of the finished product. Limited use of sponge iron or DRI (Direct Reduced Iron) as a partial substitute of steel scrap which is, in any case, in short supply is being encouraged but due to the cost factor most MSPs seem reluctant to use it. The managements of most MSPs do not appear to be keen to use high priced raw materials or go in for high value products.

Table 7 : Scrap Consumption and availability

(million tonnes)

| Year | EF prodn. | Scrap requirement | Local availability | Imports* |
|-----------|-----------|-------------------|--------------------|----------|
| 1969-70 | 0.63 | 0.69 | 1.02 | NA |
| 1970-71 | 0.79 | 0.78 | 1.07 | NA |
| 1971-72 | 0.83 | 0.91 | NA | NA |
| 1972-73 | 0.99 | 1.09 | NA | NA |
| 1973-74 | 1.01 | 1.11 | NA | NA |
| 1974-75 | 0.81 | 0.89 | NA | NA |
| 1975-76 | 1.04 | 1.14 | NA | NA |
| 1976-77 | 1.60 | 1.76 | 1.55 | NA |
| 1977-78 | 1.59 | 1.74 | 1.71 | NA |
| 1978-79 | 2.10 | 2.31 | 1.80 | NA |
| 1980-81 | NA | NA | NA | NA |
| 1981-82** | 2.16 | 2.38 | 1.79 | 0.59* |
| 1982-83 | 2.23 | 2.45 | 1.78 | 0.67 |
| 1983-84 | 2.42 | 2.66 | 1.92 | 0.74 |
| 1984-85 | 2.33 | 2.56 | 1.76 | 0.80 |
| 1985-86 | 2.94 | 3.23 | 1.69 | 1.54 |
| 1986-87** | 3.12 | 3.43 | 1.95 | 2.48 |
| 1987-88 | 3.11 | 3.42 | 2.11 | 1.96 |
| 1988-89 | 3.18 | 3.50 | 2.28 | 2.24 |
| 1989-90 | 3.12 | 3.43 | 2.46 | 2.76* |
| 1990-91 | 3.51 | 3.86 | 3.2 | 2.83 |

Source : Sidhu (1983); Steel Scenario July 1991

* Imports include DRI (Sponge Iron/HBI) upto 1989-90

** Scrap availability data from 1981-82 to 1986-87, estimates only.

Table 8 : Projected Demand & Availability of Steel Scrap (million tonnes)

| Year | Total estimated Demand | Indigenous Availability | Net Deficiency |
|---------|------------------------|-------------------------|----------------|
| 1989-90 | 7.7 | 2.5 | 5.2 |
| 1994-95 | 11.1 | 3.1 | 8.0 |
| 2000-01 | 11.5 | 4.1 | 7.4 |

Source : Steel Scenario, July 1991

Currently sponge iron is being produced by a number of units either with coal based or gas based technology (table 9). The installed capacity of sponge iron units till 1988-89 was only 3.3 lakh tonnes which later went up to 14 lakh tonnes in 1990-91. A few other units are also under way and it is expected that the annual sponge iron capacity will increase further to 50 lakh tonnes per year by the turn of the century. Since good quality steel scrap from abroad is both expensive and difficult to obtain and indigenous

MSPs will do well to get over their resistance to change and consider using DRI in the most cost effective manner realizing that imported steel scrap may no longer be an easy commodity to come by.

arising of useable MS scrap are also inadequate because of the very low steel consumption, the use of DRI can no longer be avoided. MSPs will do well to get over their resistance to change and consider using DRI in the most cost effective manner realizing that imported steel scrap may no longer be an easy commodity to come by.

Table 9 : Production and Capacity of Sponge Iron (DRI)

(lakh tonnes)

| Unit | Installed Capacity | Output 1989-90 | Output 1990-91 | Output upto 1991-92 Nov. 92 |
|--------------------------|--------------------|----------------|----------------|-----------------------------|
| Sponge Iron India Ltd | 0.6 | 0.54 | 0.47 | 0.30 |
| Orissa Sponge Iron Ltd | 1.5 | 0.91 | 0.80 | 0.64 |
| Bihar Sponge Iron Ltd. | 1.2 | 0.78 | 1.12 | 0.85 |
| Ipatata Sponge | 1.2 | 0.55 | 0.62 | 0.54 |
| Sunflag Iron & Steel Ltd | 1.5 | 0.40 | 0.79 | 0.56 |
| Essar Gujarat* | 8.0 | - | 4.50 | 4.97 |
| Total | 14.0 | 3.18 | 8.30 | 7.86 |

Source : Deptt. of Steel, Annual Report 1991-92

* Gas based unit

Next to steel scrap/metallic inputs, the most important input is electricity which accounts for about 15 to 18 per cent of the total input cost. In fact power availability is a crucial factor especially for MSPs which have installed UHP furnaces. The energy requirements for a tonne of steel, if the furnace is fed with steel scrap alone and has concast facilities, will be around 3700 KWH. It is a major grouse of the MSPs that the supply of power is generally erratic with frequent dips and spikes which make the process control extremely difficult. Although to start with most MSPs were promised steady and regular supplies of electricity at reasonable rates, this has not happened in most cases, resulting in adverse impact on the economics of steel manufacture.

Electrodes for EAFs are another important consumable which are neither available in the right quality nor in the right size. The cost of electrodes amounts to 4 to 5% of every tonne of ingot steel (of high quality alloy steel). It seems there is little or no interaction between the steel industry and electrode manufacturers to develop and produce the right kind of electrodes which will ensure optimal process efficiency of a mini steel plant. Until recently electrodes too were in short supply and imports were allowed

from time to time. The indigenous manufacturers however express their inability to design, develop and produce better quality electrodes because of the inferior grade materials they are forced to use so as to keep the selling cost within reasonable limits. Compared to imported electrodes, the Indian electrodes have much lower current carrying capacity which affects both the cost of steel production and also the overall productivity of the furnace.

Refractories are another essential input item for the MSPs. While there is no problem about their availability, the refractories require a careful and appropriate selection to match the type of technology in use. Recent improvements in the nature of uphill casting, slide gate system of teeming, ladle metallurgy and continuous casting call for high quality refractories. The refractories have a significant role in the internal lining of industrial furnaces. About 70-80% refractories are being consumed by the steel producers. There are about 71 refractory units with an installed capacity of 1.72 million tonnes. The industry is able to meet the overall needs of the consumer but for some high technology items imports are being allowed. The refractory industry which has now surplus capacity has already gone in for upgradation of technology. The new materials, sintered magnesia etc., required for specialized refractories are also currently being imported but efforts to develop indigenous capability for their production are on.

Ferro alloys are also an essential input of the steel industry particularly for the producers of alloy and special steels. India is self sufficient in most ferro alloys except a few which are imported on an actual requirement basis. The production of various ferro alloys during the last 3 years is shown in table 10.

Table 10: Production of Ferro-alloys

| Type of Ferro-alloy | 1988-89 | 1989-90 | 1990-91 |
|---------------------|---------|---------|---------|
| Ferro Manganese | 182.0 | 188.33 | 204.0 |
| Ferro Silicon | 51.0 | 55.26 | 44.0 |
| " Molybdenum | 0.231 | 0.194 | 0.043 |
| " Chrome | 39.09 | 36.0 | 38.00 |
| " Tungston | - | - | - |
| " Vanadium | 0.055 | 0.066 | 0.030 |
| " Titanium | 0.094 | 0.072 | 0.09 |
| Mag. Ferro Silicon | 0.014 | - | - |
| Silicon Chrome | 0.652 | 7.12 | 1.7 |
| Silicon Manganese | 27.34 | 34.00 | 29.0 |
| Charge Chrome | 82.00 | 76.85 | 70.00 |
| Ferro Niobium | 0.025 | 0.039 | 0.050 |

Source: Department of Steel, Annual Report 1991-92

Technology for MSPs

Electric furnaces can be broadly classified into two categories :

- (a) Resistance furnaces (RF)
- (b) ARC furnaces (AF)

Generally, resistance furnace are used for heat treatment purposes and not for melting. Arc furnaces are of several types, e.g. indirect or direct arc furnaces which may be suitable for single, two or three phase electric supply. Indirect arc furnaces are of several designs and may be a DC arc furnace AC arc furnace and AC single arc furnace. Some arc furnaces are a combination of direct arc and resistance types.

The furnaces are either basic lined or acid lined. Initially acid lining was in vogue but later developments led most furnace users to change over to basic lining. Each type of lining has its own use. Generally acid lined furnaces cannot be used with common MS scrap and therefore careful selection or sorting of input scrap becomes necessary. The option of using a wide variety of steel scraps has therefore led to the extensive use of basic electric arc furnaces for steel melting in the secondary steel sector.

The use of induction melting technology is comparatively of recent origin and has come into use only during the past two or three decades mostly in the mini steel sector. According to AIIFA there are around 550 units in the country having 820 induction furnaces with an annual installed capacity of 3.8 million tonnes. Even EAF units have now installed induction furnaces and use them for producing steel ingots which go into the manufacture of cement concrete reinforcement bars. Induction melting consumes less power per tonne of liquid metal but suffers from the main drawback that refinement of the metal is not possible. Several developments in induction melting technology have taken place in the last decade and many new users have been attracted to this technology more particularly in the foundry sector. To meet the increasing demand for better quality iron & steel castings several new developments such as batch melting with medium/high frequency induction furnaces, inert gas shielding of melts, sponge iron melting etc. have taken place in recent years.

Within the mini sector, it is the economic factor which ultimately determines the melting technology to be used. Some people believe that compared to arc furnaces, induction furnaces are net material, labour and energy savers. Comparative advantages of IF over EAF in terms of certain techno economic parameters can be seen from table 11 :

Table 11 : Comparative economics of EAFs & IFs

| Parameter | Unit | EAF | IF |
|---|------|-------|------|
| Electrical efficiency | % | 89 | 90 |
| Overall thermal efficiency | % | 52.2 | 75 |
| Energy Consumption per tonne of M. Steel G.Cal. | | 0.627 | 0.44 |
| Cost of Energy per TLS | Rs. | 1190 | 910 |

Source : Economic Research Unit JPC, Oct.1991

EAF being a much older steel melting practice has several advantages over IF technology. EAF is more versatile and competes with BOF technology globally. The most important factor which makes EAF a preferred steel melting technology, is slag control. This permits an EAF to refine metal to produce a wide variety of steels of different composition and quality. Although in India EAF technology is dominant, its performance so far has been far from impressive. Yet EAF remains the key element of the mini steel concept. It is unlikely to be replaced in the near future.

Table 13: Capacity Utilization, in individual EAF Units:

| Company | Product | Unit | Cap. | Prod. | Cu% | Company | Product | Unit | Cap. | Prod. | Cu% |
|----------------------------------|----------------------------------|--------------|-------|-------|-----|--------------------------------|----------------------------------|---------------------|------|-------|------|
| B.D. Industries (1988) | Billets/Ingots | 000 tonnes | 36 | 29 | 80 | RaipurAlloys & Steels (1991) | Billets | 000 tonnes | 125 | 54 | 55 |
| | Rerolled products | -do | 16 | 15.2 | 95 | | Ingots | | | 1 | |
| Bhoruka Steel (1990) | Refractories | -do | 7 | 2 | 29 | Saurashtra (1991) | M.S. Ingots | -do | 78 | 67.0 | 86 |
| | Billets/Ingots | -do | 100 | 55 | 55 | | R.B. Jodhamal (1991) | M.S. Ingots/billets | -do | 30 | 26.5 |
| Bihar Foundry (1989) | Steel Ingots | -do | 18 | 9 | 50 | Sanghvi Steels (1989) | | Steel Ingots | -do | 43 | 36 |
| Century Iron & Steel | M.S Ingots | -do | 50 | 30 | 60 | | Ravindra Steel (1990) | Rounds/Flats etc. | -do | 16 | 30 |
| | Rolled products | -do | 12 | 9 | 75 | Steel Ingots & billets | | -do | 45 | 34 | 76 |
| India Steel Rolling Mills (1990) | Bars/Rods | -do | 93 | 50 | 54 | Somani Iron & Steel (1991) | M.S. Ingots | -do | 50 | 44 | 88 |
| | Billets/Ingots | -do | 18 | 3 | 72 | | Ingots moulds | -do | | 0.14 | |
| Kalyani Steel (1991) | Wire/Wire Products | tonnes | 9,600 | 2,424 | 25 | Special Steels (1991) | Rolled products | -do | | 0.21 | |
| | M.S./C.S.or Alloy Ingots | '000' tonnes | 72 | 58 | 80 | | M.S. Ingots/billets | -do | 72 | 74 | 102 |
| Mohan Steel (1989) | M.S. Ingots | -do | 18 | 24 | 133 | Titagarh Steels (1990) | Steel Wires | -do | 75 | 84 | 112 |
| | Steel Ingots | -do | 18 | 15 | 83 | | Steel Wire Rods | -do | 96 | 77 | 80 |
| Nipha Steels (1989) | Rolled products | -do | - | 6 | - | Western Ministil (1990) | Steel castings | -do | 14 | 4 | 29 |
| | Bars/Rods etc. | -do | 225 | 49 | 22 | | M.S. Ingots | -do | | 0.04 | |
| Pratap Rolling Mills (1990) | Steel Ingots/billets | -do | 165 | 69 | 42 | Arihant Steels (1990) | Billets | -do | 64 | 70 | 109 |
| | Ingots | -do | 12 | 4.3 | 34 | | Billet castings | -do | | 0.11 | |
| U.P Steels (1991) | Castings | -do | 5 | 1.2 | 24 | Electro Steel (1991) | Castings | -do | 3 | 0.31 | 10 |
| | Sponge Iron | -do | 55 | 54 | 98 | | Ingots | -do | 20 | 12.2 | 61 |
| Sponge Iron (1990) | M.S. Ingots | -do | 18 | 12 | 67 | Firth (India) (1990) | Spun Iron pipes | -do | 125 | 73 | 58 |
| | Steel rolled products | -do | 24 | 2 | 78 | | Ingots/billets | -do | 54 | 0.5 | 1 |
| Ram Krishna Ispat (1989) | M.S. Ingots/billets | -do | 23 | 18 | 78 | Modern Steels (1991) | Alloy/H.S. Steel | -do | 6 | 2.46 | 41 |
| | M.S. rolled products | -do | 24 | 2 | 8 | | Ingots/billets | -do | 6 | 2.54 | 42 |
| Shri Mahavir Ispat (1990) | M.S. Ingots/billets | -do | 23 | 18 | 78 | Tata Yodogawa (1990) | Billets/Ingots | -do | 36 | 45.5 | 126 |
| | M.S. rolled products | -do | 24 | 2 | 8 | | Rolled products | -do | 30 | 13.0 | 43 |
| Anil Steel & Industries (1991) | Steel/C.I. Rolls | -do | 7 | 7 | 100 | Anil Steel & Industries (1991) | Ingots/billets | -do | 30 | 17 | 57 |
| | Ingots/billets | -do | 30 | 17 | 57 | | C.R. Steel Strips | -do | 6 | 4 | 67 |
| Anil Steel & Industries (1991) | Hardened & tempered steel strips | -do | 3 | 3 | 100 | Anil Steel & Industries (1991) | Hardened & tempered steel strips | -do | 3 | 3 | 100 |
| | Hardened & tempered steel strips | -do | 3 | 3 | 100 | | | | | | |

Capacity Utilisation

The overall capacity utilisation (hot metal) in the steel sector is around 82% in SAIL and about 100% in TISCO. Compared to this the secondary sector's (EAF units), capacity utilisation at an average of about 55 per cent (table 12) is obviously very low.

Table 12 : Capacity utilization in MSP sector (Million tonnes)

| Year | Installed capacity | Production | EU % |
|---------|--------------------|------------|------|
| 1988-89 | 4.86 | 3.2 | 66 |
| 1989-90 | 5.63 | 3.1 | 55 |
| 1990-91 | 6.2 | 3.5 | 56 |
| 1991-92 | 6.8 | | |

Source : Dept. of Steel, Annual Report 1991-92, CIER 1991-92.

Earlier years data also show that the capacity in EAF units has never been fully utilized.

Individually some EAF units present a slightly better picture (table 13). The capacity utilization percentage in respect of ingots/billets ranges from a low of 30-40% to a high of 133%. Capacity utilization has been found to be

varying widely from one unit to another. The under utilization of capacity can be attributed to two main factors :

- a. High cost and indifferent quality of MS Scrap and other inputs like electrodes, refractories and ferro-alloys
- b. Erratic and inadequate supply of power.

Besides these, a host of other factors also contribute to poor capacity utilization, low production and indifferent product quality. Some of these are :

- (i) Unbalanced capacity distribution of EAFs. There are too many small capacity furnaces in use which in the long run prove less cost effective.
- (ii) Reluctance to use DRI for melting as a partial substitute of MS scrap. Most of the MSPs seem content to produce low grade steels with low grade inputs.
- (iii) A large number of MSPs are simply functioning as melting shops operated by illequipped semi-literate staff who have little motivation to produce quality steel/products. They have little or no professional or technical expertise available with them.
- (iv) Some MSP units have nothing more than pit casting as the main outlet for their output.
- (v) A low level technology and reluctance of these units to change over to modern day melting technology.
- (vi) Confining their output to low value-added products and catering to low price segment of the local markets.

A MECON study showed the kind of ill-equipped production complexes most of the MSPs are. The number of units with full range of capability from melting to rolling/ forging are said to be just a few. A comparison of the efficiency levels achieved by Indian EAFs with those obtained by similar units abroad, is shown below in table 14. It clearly reveals the state of affairs in our mini steel sector.

Table 14 : Efficiency levels achieved by EAFs in India

| Description | Unit | Japan | India |
|---------------------------------------|--------------------|------------|--------------|
| Furnace Transformer Power | KAA/t | 700-800 | 350-600 |
| Use of Oxygen | Nm ³ /t | 30-35 | 10-12 |
| Tap to tap time | Minutes | 60-80 | 150-180 |
| Energy Consumption in furnace | KWH/t | 325-375 | 500-550 |
| Electrode Consumption | Kg/t | 1.9 to 2.3 | 3.5 to 5.5 |
| Electrode DC Arc furnace Refractories | Kg/t | 1.2-1.3 | - |
| -furnace well bricks | Kg/t | 0.03-0.04 | 0.5 to 0.8 |
| -furnace roof | Kg/t | 0.53 | 1.0 |
| Gunning/ramming Material | Kg/t | 4.0 to 5.0 | 12.0 to 16.0 |
| Sequence Heats | % | 80-90 | - |

Source : Soundarajan, 1991

Productivity

To assess MSP sector's productivity we have em-

A MECON study showed the kind of ill-equipped production complexes most of the MSPs are.

ployed the following parameters :

- (a) Total Earnings to Conversion cost.
- (b) Purchased Services to Total Earnings
- (c) Wages & Salaries as % age of Sales
- (d) Profit to Conversion cost
- (e) Profit as percentage of Sales
- (f) Profit per Employee
- (g) Value added per Employee
- (h) Sales per Employee.

Most of the data used for working out the above ratios have been obtained from secondary sources. A sample of about 32 companies comprising both producers of iron & steel items in primary & semi-finished condition and those that are engaged in the manufacture of sponge iron or rolled/re-rolled products etc. was initially selected. However some companies had to be dropped because their data were either too old or incomplete. Of the 50 mini steel plants approached for information/data only ten responded. The remaining companies in the sample were selected from the list provided by the SFAI, based on considerations of location, size and type of production. Another seven companies whose data were also incomplete or out of date had to be excluded from the final sample. The twenty seven companies comprising the final sample cover a wide variety of end-products and are considered fairly representative of the MSP sector. The sample companies classified according to their end products are as follows :

| | | |
|------------------------------------|---|----|
| MS Ingots/billets/castings | - | 12 |
| Sponge Iron | - | 1 |
| Rolled & Re-rolled products | - | 8 |
| Steel Wire/Rods | - | 3 |
| Others with Diversified production | - | 3 |

The results obtained under different parameters for individual companies are shown in Appendices 1 to 8. However the averages of 5-6 years under different heads are presented in table 15. The trend analysis of the above parameters shows the following :

Table 15 : 4/5 years average of of Productivity Ratios

| Company | Total earning to conversion cost | Purchased services to total Earnings | Wages to Sales % | Profit to Conversion cost | Profit to Sales % | Profit per Employee (Rs. Lakh) | Value added per employee (Rs. Lakh) | Sales per employee (Rs. Lakh) | |
|-------------------------------|----------------------------------|--------------------------------------|------------------|---------------------------|-------------------|--------------------------------|-------------------------------------|-------------------------------|---------------------------|
| Bhoruka (1986-90) | 1.0 | 0.8 | 3.6 | 0.03 | 1.0 | - | - | - | |
| Bihar Foundry (1984-89) | 0.97 | 0.9 | 2.4 | - | - | - | NA | NA | No profit or loss |
| Century (1985-89) | 0.99 | 0.8 | 3.0 | (0.06) | (1.8) | - | - | - | |
| India Steel Rolling (1987-90) | 1.1 | 0.6 | 4.9 | 0.1 | 2.1 | - | - | - | |
| Kalyani Steel (1987-91) | 1.4 | 0.53 | 4.9 | 0.21 | 6.6 | 0.71 | 2.09 | 10.80 | |
| Nipha Steel (1984-89) | 0.99 | 0.9 | 5.9 | (0.1) | (4.8) | - | - | - | |
| Pratap Rolling (1985-90) | 1.0 | 0.7 | 4.7 | (0.002) | (0.06) | - | - | - | |
| Raipur Alloy (1986-91) | 1.2 | 0.7 | 1.9 | 0.1 | 2.5 | 0.21 | 0.47 | 8.54 | |
| Saurashtra Steel (1985-90) | 0.7 | 1.1 | 2.3 | (0.4) | (11.8) | (0.64) | (0.55)* | 5.39 | * Average of 3 years only |
| R.B.Jodhamal (1985-91) | 1.2 | 0.3 | 2.8 | 0.03 | 0.3 | 0.02 | 0.17 | 5.87 | |
| Ravindra Steel (1985-90) | 1.0 | 0.7 | 4.7 | (0.13) | (4.1) | - | - | - | |
| Sanghvi Steel (1985-89) | 1.1 | 0.8 | 5.1 | 0.02 | 0.8 | - | - | - | |
| Special Steels (1986-90) | 1.4 | 0.4 | 10.5 | 0.24 | 6.9 | - | - | - | |
| Titagarh Steels (1985-90) | 1.3 | 0.5 | 8.7 | 0.2 | 8.0 | - | - | - | |
| Western Ministil (1985-90) | 1.1 | 0.9 | 1.7 | 0.05 | 1.4 | - | - | - | |
| Arihant (1986-91) | 0.97 | 0.9 | 1.9 | (0.001) | (0.03) | (0.0025) | 0.17 | 8.74 | |
| UP Steels (1986-91) | 1.5 | 0.4 | 6.7 | 0.32 | 8.0 | 0.180 | 0.69 | 2.25 | |
| Sponge Iron (1986-90) | 1.2 | 0.3 | 13.6 | 0.04 | 1.8 | 0.044 | 0.653 | 2.47 | |
| Ramakrishna Ispat (1985-89) | 1.0 | 0.7 | 6.9 | - | - | - | - | - | No profit or loss |
| Mahavir Ispat (1985-90) | 0.9 | 0.9 | 4.6 | (0.17) | (4.9) | - | - | - | |
| Anil Steels (1987-91) | 1.2 | 0.5 | 7.2 | 0.08 | 2.6 | - | - | - | |
| Tata Yodogawa (1986-90) | 1.0 | 0.6 | 11.1 | 0.01 | 0.25 | - | - | - | |
| Electro Steel (1987-91) | 1.2 | 0.5 | 6.3 | 0.08 | 2.3 | - | - | - | |
| Firth (India) (1986-90) | 1.0 | 0.5 | 18.4 | 0.03 | 1.3 | 0.02 | 1.07 | 1.65 | |
| G.M. Mittal (1988-91) | 1.5 | 0.4 | 2.5 | 0.2 | 2.4 | - | - | - | |
| Haryana Steel (1986-91) | 1.0 | 0.7 | 5.4 | 0.03 | 0.8 | - | - | - | |
| Modern Steel | 1.3 | 0.6 | 2.0 | 0.2 | 3.2 | 0.28 | 0.704 | 8.84 | |

Total Earning to Conversion Cost

Most of the sample MSPs have been able to generate satisfactory level of total funds to enable them to meet the demands made on the organisations. Only one company—Saurashtra Steel—shows a very low ratio (0.7) indicating insufficient and continuously falling earnings year after year which can be attributed largely to inefficient management of resources. Another five companies namely Bihar Foundry, Century, NIPHA, Arihant & Mahavir whose ratios range between 0.9 and 0.99 are marginally below the break even level. This should ring a warning bell for the respective managements for keeping a close watch on the effectiveness of their resources utilization. It is also observed that in all five cases this ratio has either fluctuated widely in some years or there has been a steady decline from year to year. Sudden spurts of the ratio in a particular year (Bihar-1987) & a big drop in another (Saurashtra-1990) may be due to several reasons but these are certainly indicative of slackness in managerial control. Of the remaining twenty companies which show a higher ratio of above unity, the highest ratio of 1.5 has been achieved by UP Steels & GM Mittal. Both the companies also show a steady performance throughout the past five years. Seven other companies (Bhoruka, Partap, Ravindra, Ramakrishna, Tata Yodogawa, Firth & Haryana) have achieved an average ratio of one for the five year periods, the ratios of remaining eleven companies have hovered between 1.1 and 1.4. An analysis of the yearly ratios over the past five year shows that some of the MSP units e.g Kalyani, Raipur, R.B. Jodhamal, Special Steels, Western Ministeel, U.P. Steels, Anil, and Haryana have regularly turned in a good performance throughout and maintained an above unity ratio all through. While the trend under this parameter provides a good indication of the state of productivity in the MSP sector as a whole, it would be prudent to consider the entire mix of outputs and inputs to obtain a clearer picture of productivity in the sample companies. An overall inter firm comparison of ratios should help managements of these units whose performance seems to be below par to look into all major factors of material, labour, energy, prices and capital which have a profound impact on a company's performance.

Purchased Services to Total Earning

Purchased services from all sources are of two kinds. One, the running costs which include electric energy, water, telephone, postage, indirect production materials, and two, the capital costs which include local taxes, insurance etc. Computations show that Saurashtra has incurred the highest cost of Rs. 1.1 for every rupee of total earnings followed by Bihar, NIPHA, Western Ministil, Arihant and Mahavir with a ratio of 0.9. There are at least twelve other companies whose purchased services are costing them 50-80 paise for every rupee of their earnings.

The most economical companies in this aspect are RB Jodhamal & Sponge Iron (0.3 each), Special Steels, U.P. Steels & G.M. Mittal (all 0.4). Another observation is that some companies (Kalyani, Special Steels, Electro Steel, G.M. Mittal on the lower side and NIPHA, Raipur, Sanghvi, Western Ministil, Yodogawa, & Modern on the high side) have maintained a near uniformity of their ratios during the five year period indicating strict managerial control of such costs in some cases and/or failure of managerial efforts to prevent their escalation in others. It is gratifying to find in some cases (Sponge Iron & Haryana) positive efforts to bring down this ratio whereas in a few other cases there seems to be little or no effort to prevent this ratios going up (Bihar Foundry, India Steel Rolling, Saurashtra etc). In the case of Saurashtra Steel it is seen that the ratio has risen to an abnormal level of Rs. 2.6 being spent on purchased services for every rupee of earnings. No wonder the company incurred a loss of Rs 4.01 crores on net sales of Rs. 16.06 crores in the year 1989-90. Being a grass root ratio its control, particularly in small companies, has to be firmly exercised at all times to achieve high performance levels.

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Wages/Salaries to Sales

Both overmanning and understaffing can cause serious erosion of productivity and bring down performance efficiency. The average ratios in table 15 show a few high wage companies with ratios ranging from 10.5 to 18.4; Firth (18.4), Sponge Iron (13.6), Tata Yodogawa (11.1) and Special Steels (10.5). On the other end of the scale some of the low ratio scorers are Western Ministil (1.7), Arihant & Raipur (1.9 each), Modern (2.0) followed by Saurashtra (2.3), Bihar Foundry (2.4), GM Mittal (5.7), RB Jodhamal (2.8). Of the remaining 14 companies the ratios of seven companies range between 3 and 5 and the balance between 5 and 10. Companies paying over Rs. ten in wages to obtain a sale of Rs. 100 need to be extremely careful of not allowing any further increase in this cost for the same level of sales. Similarly those spending very low amounts have to carefully examine whether or not overcautiousness on the part of management is leading to restricted sales and circumscribing company's overall performance. From the figures given in table 16, it would be clear that no one parameter can provide a clear indication of the overall productivity trend. The entire gamut of ratios must be looked at to pinpoint areas needing management's attention for improving the company's performance.

Table 16: Comparison between some productivity ratios

| High Ratio Companies | | | Low Ratio Companies | | |
|----------------------|---|---------------------|---------------------|---|---------------------|
| Company | Average Wages & Salaries to Sales ratio | Average Profit/Loss | Company | Average Wages & Salaries to Sales ratio | Average Profit/Loss |
| Firth | 18.4 | 1.3 | Western | 1.7 | 1.4 |
| Sponge | 13.6 | 1.8 | Arihant | 1.9 | 0.08 |
| Yodogawa | 11.1 | 0.25 | Raipur | 1.9 | 2.5 |
| Special Steel | 10.5 | 6.9 | Saurashtra | 2.3 | 11.8 |

Profit to conversion cost

This ratio can provide a fairly good indication of the profit earning capacity of a company. If this ratio shows improvement, profits too will improve. The averages shown in table 15 indicate that MSPs in general have a low profit to conversion cost ratio. Out of the 27 companies as many as seven show a negative score with Saurashtra showing the lowest, (0.4) followed by Mahavir and Ravindra Steel at (0.17) and (0.13) respectively. Of the remaining, four have ratios ranging from 0.1 (NIPHA) to 0.001 (ARIHANT). Amongst the seven loss making companies Saurashtra seems to have gone deeper into the dumps by generating higher negative ratios from 1988 onwards. Similarly Ravindra has been in the red since 1986 and Mahavir from 1987, the later having since come up with a promising ratio of 0.37 in 1990. In the case of other four with negative ratios most have incurred losses for two or three years in a row. Of the 27 sample MSPs, there are only eight which have consistently shown positive ratios throughout the five/six years periods *albeit* with fluctuating fortune in some years. Of the remaining ten companies showing a positive average ratio, all have slipped from the profit line for one or more years during the five year period as the figures below indicate

| | |
|---------------------------------------|---------|
| Yodogawa, Boruka | 3 years |
| Sanghvi, Haryana, India Steel Rolling | 2 years |
| Sponge Iron, U.P. Steel, RB | 1 year |
| Jodhamal, Anil and Electro steel | |

Profit to Sales

This ratio is an indicator of the profit a company is able to earn for every hundred rupees of its sales. Here too, the ratios show a trend similar to the one signified by the earlier ratio of profit to conversion cost,. While the no. of loss making companies stands at seven with two more showing neither loss nor profit, the profit makers' ratios present slightly different picture due to the size of their operations as table 17 shows.

Table 17. Comparison between various profit ratios

| | Profit to conversion cost | Profit to Sales % | Profit per employee (Rs. lakh) |
|------------------|---------------------------|-------------------|--------------------------------|
| U.P. Steels | 0.32 | 8.0 | 0.180 |
| Special Steels | 0.24 | 6.9 | NA |
| Kalyani | 0.2 | 6.6 | 0.71 |
| Titagarh | 0.2 | 8.0 | NA |
| Modern | 0.2 | 3.2 | 0.28 |
| India Rolling | 0.1 | 2.1 | NA |
| Raipur | 0.1 | 2.5 | 0.21 |
| Anil | 0.08 | 2.6 | NA |
| Electrosteel | 0.08 | 2.3 | NA |
| Western Ministil | 0.05 | 1.4 | NA |
| Sponge Iron | 0.04 | 1.8 | 0.044 |
| Bhoruka | 0.03 | 1.0 | NA |
| Jodhamal | 0.03 | 0.3 | 0.02 |
| Sanghvi | 0.02 | 0.8 | NA |
| Yodogawa | 0.01 | 0.25 | NA |

This ratio however provides a good basis for the management to monitor all upward movement of costs in relation to sales as an output.

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Profit per employee

This along with the other two ratios of value added per employee and sales per employee provide enough indication of employee productivity. However, the three ratios cannot be regarded as the primary evidence of employee productivity. These three ratios should therefore be treated essentially as the by product of the other five, and carefully analysed to assess the areas needing managerial attention. Unfortunately the data on employment could be obtained only from nine MSPs thereby affecting the validity of the results obtained to some extent.

The highest profit earnings of Rs. 0.71 lakhs per employee is recorded by Kalyani, followed by Modern, Raipur & UP Steels with profit per employee at Rs. 0.28, Rs. 0.21 and 0.18 lakhs respectively. The other three profit makers have earned only a nominal amount e.g. Jodhamal & Firth (0.02 lakhs each) and Sponge Iron Rs. 0.044 lakh per employee. The highest loss maker once again is Saurashtra with Rs 0.64 lakhs per employee followed by Arihant with just about Rs. 0.0025 lakh per employee.

The three employee productivity ratios (profit per employee, value added per employee and sales per employee) though confined to only nine companies clearly convey the fact that the managements of some companies need to look closely into the related factors so as to arrest any further drop in the labour productivity. Normally, the first thing a study of these ratios should reveal would be the

extent of over employment the elimination of which may help improve the situation. Further analysis may show up other specific groups of employees whose contribution to productivity needs toning up.

As an overall assessment, it can be stated that the productivity in general requires a great deal of improvement in the MSP sector, Barring a few companies, the majority of the mini steel units are not contributing their full mite to the steel sector. Apparently, many MSPs are facing problems of power and scrap supplies but these alone may not be the cause of low production. A careful and detailed productivity audit by each unit is necessary along with a well designed interfirm comparison and a specific set of productivity measures, so that the managements can take appropriate steps well in time. A study by the Deptt. of Scientific and Industrial Research reached the conclusion that the productivity in the mini steel plants in India is poor.

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d. total energy consumption

e. tap to tap time and

g. furnace availability

As already pointed out, the performance of Indian mini steel plants, under a number of technological parameters, as compared to those obtaining in similar units in Japan, shows a dismal picture. The DST (1989) study also shows that the domestic plants are way behind their counterparts abroad as table 19 shows :

Table 18 Technological Performance data of selected EAF Units in India

| Company | Furnace size | Tap to tap time Hrs | Furnace Pdy. t/hr. | Energy Inputs | | | | |
|------------------|--------------|---------------------|--------------------|---------------|---------------|-----------------|-----------|-----------------------------|
| | | | | Power kwh/t | Fuel Oil kg/t | Electrodes kg/t | Coke kg/t | Energy 10 ³ kg/t |
| Amrit | 2X10/12t | 2.62 | 4.58 | 814 | 6.25 | 5.22 | 13.0 | 879.17 |
| Haryana | 2X8/10t | 2.0 | 5.0 | 627 | 5.31 | 4.22 | 19.0 | 737.4 |
| Rathi Alloys | 1X25t, | | | | | | | |
| | 2X10t | 4.0 | 2.5 | 861 | 12.5 | 4.57 | 7.10 | 938.4 |
| RB Jodhamal | 1X4/5t | 2.91 | 1.72 | NA | 31.0 | 5.0 | 20.0 | 454.5 |
| | 1X8-10t | | 3.43 | | | | | |
| Usha Alloys | 1X30t | 2.41 | 12.4 | NA | NA | NA | NA | NA |
| | 2X5t | 3.0 | 1.66 | NA | NA | NA | NA | NA |
| Firth (India) | 1X5t/2.5 | 4.08 | 1.22 | NA | NA | NA | NA | NA |
| Mukand | 3X30t | 2.41 | 12.4 | 645 | 17.0 | 4.4 | 35.0 | 961.4 |
| | 1X40t | | | | | | | |
| Ravindra | 1X10/12t | 3.75 | 3.2 | NA | NA | NA | NA | NA |
| | 1X15t | - | 4 | - | - | - | - | - |
| Western Ministil | 1X8-10t | 3.5 | 3.42 | | | | | |
| | 1X10-12t | | | 620.0 | 7.0 | 5.0 | 6.0 | 675.7 |
| Bhoruka | 1X25t | 3.33 | 7.5 | 840.0 | 12.25 | 5.25 | 5.72 | 915.0 |
| Brindavan | 2X10t | 2.66 | 3.75 | 590 | 4.6 | 5.8 | 2.0 | 609.5 |
| Steel Complex | 3X10-12t | 4.00 | 3.00 | NA | NA | NA | NA | NA |
| KAP Steel | 2X15t-17t | 3.5 | 4.85 | 85.8 | 12.5 | 5.0 | 7.0 | 931.75 |
| Punjab Concast | 1X15t | | | | | | | |
| | 2X12t | 3.16 | NA | 787 | 16.0 | 6.12 | 10.0 | 937.7 |
| | 1X5t | | | | | | | |

Source : DSIR.1989

This assessment (table 18) has been arrived at after examining the performance data under a number of important technological parameters such as

- average no. of heats per day
- % yield of metallic charge to liquid steel and liquid steel to concast billet/ingot
- consumption of various inputs such as power, electrodes, fuel oil and refractories

Table 19 Performance of Indian MSPs in comparison to foreign MSPs

| | Foreign | Indian |
|---|-------------------|---|
| i) Transformer rating-high power/ ultra high power operation. | 0.7-1.0 MVA/tonne | 0.3 to 0.5 MVA/tonne-low/medium power operation |
| ii) Tap to tap time | 60 mins | 200 mins |
| iii) Elec-power consumption | 400 KW/t | 800-900/KW/t |
| iv) High density graphite electrodes consumption | 2.5 KG/t | 4.7 KG/t regular quality graphite |
| v) Oxygen Consumption | Over 25 NMP/t | less than 10 NMP/t |
| vi) Productivity | above 30 t/h | 1-13 t/h |

It is clear from the study that a lot more needs to be done by mini steel units to bring up their productivity levels closer to international standards. It appears that the specific consumption of raw materials and services vary widely from plant to plant which too calls for early rationalization.

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Modernisation

Experts in the field of iron & steel manufacture believe that upgradation of processes & technology in the steel sector is so fast that no plant or technology can remain in efficient operation after ten years or so. For its survival therefore the steel industry will have to go for a thorough revamp. Years of neglect and indifference to efficient utilization of inputs low capacity utilization and high power consumption with little or no attention to pollution control have brought the steel industry to such a pass that the country has to continue to import huge quantities of steel even after 45 years of independence. The consumption of steel in India in 1988-89 was 13.66 million tonnes. The demand is expected to rise further @ 6.2 percent per year (table 20). Against a total demand of 31 million tonnes by the year 2000, the output, however, is likely to be around 28.20 mt leaving a gap of about 2.80 million tonnes. To bridge this gap the steel sector will need to go in for both expansion and modernisation of the existing plants. Since the govt. has already decided not to set up any new public sector steel mills the onus will obviously fall on the private sector steel units. The private sector (MSP sector) has been now permitted to set up steel plants upto one million tonnes capacity subject to certain conditions such as :

- (i) New units must be based on energy optimization technologies
- (ii) They should provide for captive power generation and should have coal linkage for Blast Furnace plants
- (iii) New EAFs must use at least 70% sponge iron as raw material and minimum capacity of the furnace should be 25/30 tonnes per heat. To ensure compliance, all new projects will be cleared by a high level inter ministerial committee after examining their viability and technological suitability.

Table 20 : Projected demand & Production of finished Steel (million tonnes)

| Year | Projected demand | Estimated Output | Gap |
|-----------|------------------|------------------|------|
| 1992-1993 | 17.76 | 16.48 | 1.28 |
| 1993-1994 | 19.37 | 18.38 | 0.98 |
| 1994-1995 | 21.05 | 20.54 | 0.52 |
| 1995-1996 | 22.95 | 22.21 | 0.69 |
| 1996-1997 | 25.00 | 24.09 | 0.99 |
| 1999-2000 | 31.00 | 28.20 | 2.80 |

Source : PTI Econ. Service, June 1992
Steel Scenario 1991

Already a number of projects have been planned either in the private sector or as joint ventures. The following mini steel plant projects are likely to come up in the next few years.

| Project | Capacity |
|--------------------|--------------------------|
| Mukand Steel/WBIDC | - 1 Million tonne/annum |
| Marmogoa Steel | - 1.1 lakhs tonnes/annum |
| Tripura | - 1 lakh tonnes/annum |

Besides these, the govts. of Madhya Pradesh, Karnataka and Orissa are also planning to set up high capacity mini steel plants. There are reports of some high capacity integrated steel plants coming up in the private sector. Hopefully, the planners of these new projects will ensure that the latest available technology is adopted and the new steel plants, like their predecessors elsewhere, would not turn into mere melting shops to produce steel of pedestrian quality. A large number of new processes and technologies have come up in the world and it will be worth while to ensure that we adopt the latest ones suited to the country's needs.

Against a total demand of 31 million tonnes by the year 2000, the output, however, is likely to be around 28.20 mt leaving a gap of about 2.80 million tonnes.

India had been the most economical producer of steel in the sixties but due to its failure to modernize and keep up with technology developments, its present status has turned to that of the costliest steel producer in the world. In a country like India where per capita consumption of steel is still extremely low (table 21) further economic development is bound to bring about a much higher demand for steel and the MSP sector will have a major role to play in

meeting it. It is estimated that the secondary sector will have to cater for at least 40% of the estimated demand of 31 million tonnes by the turn of the century.

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Table 21: Per Capita consumption in some select countries (1985)

| Country | GNP per capita (\$) | Steel Consumption per capita (Kg) | |
|---------|---------------------|-----------------------------------|-------|
| | | 1985 | 1988 |
| India | 270 | 19.2 | 20.0 |
| China | 310 | 68.3 | NA |
| Brazil | 1640 | 88.5 | 81.1 |
| Mexico | 2080 | 96.2 | 84.5 |
| Italy | 6520 | 387.3 | 460.0 |
| UK | 8460 | 253.5 | 306.6 |
| France | 9540 | 242.7 | 277.5 |
| FDR | 10940 | 558.7 | 612.7 |
| Japan | 11300 | 607.7 | 706.1 |
| US | 16690 | 439.2 | 451.2 |

Source : Steel Scenario 1991
SAIL - 1992

However, modernization efforts will have to be adequately supported by an appropriate policy framework relating to input costs and supplies or else the modernization expenditure may turn infructuous. Since capital is already scarce in the country we can illafford the luxury of letting it remain underutilized.

Despite the ominous doubts cast on the viability and survival of mini steel mills, they have proved to be the most efficient producers of steel of commercial quality EAFs are certainly the most versatile and adaptable equipment which lends them a high survival potential in times of economic recession. However this very virtue of mini mills can turn into a serious drawback, if their design, operation and technology are not updated from time to time.

According to a DSIR (1989) study production cost of mini steel plants can be brought down reasonably through a stringent control of operations and by adopting such modernization measures as.

- High power transformers
- Water cooled side wall panels

- Oxygen lancing facilities
- Providing suitable equipment for metal analysis and temperature measurements and other controls
- Mechanisation of scrap handling and fettling operations and
- Installation of
 - UHP furnaces
 - Scrap preheaters
 - ladle furnace etc.

Research and Development

The Iron & Steel Mission operating under Ministry of Steel guides the Research and Development activities in the steel sector. In the last three years funds made available to the Mission for research projects were as under.

| | | |
|---------|---|-----------------|
| 1988-89 | - | Rs. 3.07 crores |
| 1989-90 | - | Rs. 1.8 crores |
| 1990-91 | - | Rs. 1.8 crores |

Total R & D expenditure during 1986-87 and 1988-89 incurred by 80 units of steel industry was Rs. 4581.59 lakhs and Rs. 7493.09 lakhs respectively. This is about 9% and 10.7% of total R&D expenditure incurred by the entire industrial sector during the same period. This represents an annual compound growth rate of 27.9% in 1988-89 over 1986-87 for the metallurgical industries and was next highest to that of the defence industries sector.

Unfortunately R&D attracts little attention in the private sector. Even the nominal amount expended on R&D in the private sector is largely spent by some of the bigger units. Most of the MSP/EAF units seem to ignore the need for R&D. This state of affairs must no longer be allowed to continue if the MSPs are to play an effective role in the steel future of the country. Dependence on foreign sources for the new technologies is not a cost effective means of modernization particularly for a fast growing industry. MSPs must therefore give up their indifference to the need for improving their technologies, processes and techniques and build up their own R & D on co-operative basis. In this connection the suggestion made by the Minister of State for Science and Technology recently for a 2% cess on turnover of companies to be utilized for R & D would appear to be a step in the right direction.

Dependence on foreign sources for the new technologies is not a cost effective means of modernization particularly for a fast growing industry.

Much of the expenditure currently classified as R & D expenses in the private sector on closer scrutiny is found to be related to such operations as general testing and sample analysis. There is hardly any attempt to develop and evolve better steel making techniques or improving upon the existing process and equipment. Such self delusion may not be in the long term interests of MSPs and the secondary sector. It is time the mini steel sector took up R&D more seriously. The situation is changing fast and MSPs relying solely on 'melting shop' strategies will soon find the going hard when competition in the market place overtakes them. In the public sector individual units do undertake some R&D work but this too is not of the standard that the planned future of the industry calls for. The situation therefore demands a clear strategy and a broad plan of action for the steel industry as a whole.

MSPs relying solely on 'melting shop' strategies will soon find the going hard when competition in the market place overtakes them.

products is not very significant but in the case of flat categories, HR & CR products, plates, tinplates & TMBPs, still continue to account for a major portion of the country's imports. TMBP is in any case not an item of production of Indian mills.

It seems from the current projections that the country may never be able to totally shed its dependence on imports in the case of HR & CR products. There is, however, every possibility of indigenous production capability increasing further. This could help to reduce imports in the coming years. Several units in the secondary sector are also now producing some varieties of CR steel products.

However, due to recent policy changes and restrictions on imports, the production of certain essential steels also put considerable demand strain on the indigenous steel producers. Imports are likely to remain restricted for quite sometime and confined to essential semi-processed/intermediate products. It is not, therefore, unlikely that such imports may go down further in the coming years. Of course, no country can dispense with imports altogether. Even some of the largest steel producers like USA, Japan & UK etc. are resorting to imports of crude steel items

Table 22 : Productwise Imports of Iron & Steel

| Year | Pig Iron | Saleable steel semis | Finished Steel | | Total | | Alloy & Stainless Steel |
|---------|----------|----------------------|----------------|--------|----------------|----------------|-------------------------|
| | | | Non-flats | Flats | Saleable Steel | Finished Steel | |
| 1980-81 | - | 7.0 | NA | NA | 7.0 | 998.0 | NA |
| 1981-82 | 117.1 | 138.8 | NA | NA | 138.8 | 792.3 | NA |
| 1982-83 | 426.9 | 45.7 | NA | NA | 45.7 | 1271.5 | NA |
| 1983-84 | 203.5 | 14.0 | NA | NA | 14.0 | 554.3 | NA |
| 1984-85 | 0.4 | 87.3 | NA | NA | 87.3 | 701.6 | NA |
| 1985-86 | - | 302.7 | NA | NA | 302.7 | 760.8 | NA |
| 1986-87 | 44.1 | 337.2 | 170 | 1373.1 | 1880 | 1543.1 | 72.2 |
| 1987-88 | 34.1 | 168.3 | 322 | 1165.0 | 1654 | 1487 | 90.3 |
| 1988-89 | 164.4 | 29.1 | 225 | 1376.0 | 1630 | 1601 | 97.0 |
| 1989-90 | 356.2 | 10.0 | 213 | 1258.0 | 1481 | 1471 | 97.6 |
| 1990-91 | 189.0 | 27.0 | 106 | 1148.0 | 1281 | 1254 | 107.0 |

Source : SAIL - (1988, 1990, 1992)

Import & Export

India has been a net importer of steel for a long time due to the perennial shortages it has been going through (table 22). No doubt, there has been quite a bit of reduction in imports in recent years largely because of the higher output from the integrated plants, and the general squeezing of imports during the past two years. Imports of non-flat

(table 23.). Similarly countries like India who are themselves producers of steel have to depend for their requirements of special steels on other countries like Sweden, Japan, USA etc. What is, however, needed is that the gap between availability and demand for iron & steel should be gradually closed by increasing capacity, improving capacity utilization and enhancing productivity through more effective utilization of available resources.

Table 23 Major Steel Exporting & Importing Countries - 1988

| EXPORTS | | | IMPORTS | | |
|----------------|------|------|-------------|------|------|
| Country | Qty. | Rank | Country | Qty. | Rank |
| Japan | 23.3 | 1 | USA | 19.3 | 1 |
| FR Germany | 20.1 | 2 | FR Germany | 14.1 | 2 |
| Belgium | 14.2 | 3 | USSR | 10.5 | 3 |
| France | 11.4 | 4 | France | 9.5 | 4 |
| Brazil | 10.9 | 5 | China | 9.0 | 5 |
| USSR | 9.4 | 6 | Italy | 9.0 | 6 |
| Korea | 7.0 | 7 | Japan | 6.9 | 7 |
| Italy | 6.8 | 8 | GDR | 5.7 | 8 |
| UK | 6.7 | 9 | Taiwan | 5.3 | 9 |
| Netherlands | 5.6 | 10 | UK | 5.2 | 10 |
| GDR | 5.0 | 11 | Belgium | 5.1 | 11 |
| Czechoslovakia | 4.1 | 12 | Netherlands | 4.6 | 12 |
| Spain | 3.9 | 13 | Canada | 4.0 | 13 |
| Canada | 3.6 | 14 | Korea | 3.4 | 14 |
| Austria | 3.1 | 15 | Hongkong | 2.7 | 15 |
| Romania | 3.1 | 16 | Spain | 2.7 | 16 |
| Sweden | 3.0 | 17 | Thailand | 2.5 | 17 |
| Turkey | 2.8 | 18 | Switzerland | 2.2 | 18 |
| S. Africa | 2.6 | 19 | Egypt | 2.2 | 19 |
| Poland | 2.3 | 20 | Singapore | 2.1 | 20 |

Source : Steel Scenario, 1991

Exports of steel from India are very insignificant and are just about 0.1% of the total world exports of steel worth US \$ 91173 million (table 24). India's steel exports amounted to 0.83 million tonnes valued at Rs. 1105 millions in 1990-91 which is just about 1% of 13.8 million tonnes of finished steel produced in India. This situation has continued over the last two decades and it seems, exports are unlikely to show any dramatic improvement in the coming years (table 25) due to the continuously rising domestic demand for steel. With exports being so meagre and imports remaining high, it is no wonder that the country has remained a net foreign exchange spender over the years as far as steel is concerned (table 26).

Table 24 India's share in World Steel Exports (US \$ million)

| Year | World | India | % share |
|------|-------|-------|---------|
| 1970 | 14540 | 132 | 0.91 |
| 1980 | 68231 | 87 | 0.13 |
| 1981 | 66101 | 74 | 0.11 |
| 1982 | 60942 | 79 | 0.13 |
| 1983 | 54460 | 66 | 0.12 |
| 1984 | 59418 | 79 | 0.13 |
| 1985 | 59820 | 67 | 0.11 |
| 1986 | 64158 | 49 | 0.08 |
| 1987 | 91173 | 92 | 0.1 |

Source : CII Handbook, 1990.

Table 25 Productwise Exports of Steel

| Product | (.000 tonnes) | | | | | | |
|-----------------------|---------------|---------|---------|---------|---------|---------|---------|
| | 1984-85 | 1985-86 | 1986-87 | 1987-88 | 1988-89 | 1989-90 | 1990-91 |
| Steel Billets | 15.1 | - | - | - | - | - | - |
| Bars/Rods | 87.0 | 14.1 | - | - | 22.0* | 80.8 | - |
| Structurals | 48.8 | - | - | - | - | - | - |
| Plates | 2.5 | - | 27.3 | 42.6 | 96.7 | 164.6 | 183.4 |
| Total | 153.4 | 15.1 | 27.3 | 42.6 | 118.7 | 245.6 | 183.4 |
| Value Rs. crore (FOB) | 34.83 | 3.26 | 8.96 | 16.8 | 61.83 | 105.0 | 110.5 |

* Wires

Source : SAIL (1990, 1992)

Table 26 India's export & import of Iron & Steel

| Year | (Rs. crore) | |
|---------|-------------|--------|
| | Import | Export |
| 1985-86 | 961.3* | 3.26 |
| 1986-87 | 1408.29 | 8.96 |
| 1987-88 | 1326.50 | 16.8 |
| 1988-89 | 2050.35 | 61.83 |
| 1989-90 | 2449.22 | 105.00 |
| 1990-91 | 2591.09 | 110.50 |

*approximate value

Source : SAIL 1991, 1992

The import scenario suffers from certain uncertainties at present. The current restrictions being only a temporary phase may soon pass off. Since MS scrap and other steel items used for the manufacture of steel engineering items lead to a considerable amount of value addition, imports of such items can help to increase our export earnings from engineering goods. Currently our steels exports are directed to only a few countries in Europe, Japan & USA.

India also meets part needs of the countries nearer home, e.g Bangladesh, Nepal. Singapore & Thailand with occasional supplies going to countries in Africa and South East Asia. We have a huge market open to us but before we can tap these fully to our advantage we need a lot more improvement in both quantity and quality of our steel products. The export potential for bars/rods structurals and flat products is substantial but as the things stand at present, there is little possibility for flat products to be exported in the near future. The current situation therefore demands a careful build up of exports, slowly and steadily, of such items as will not hurt the development of domestic engineering industry and the export of engineering goods.

We have a huge market open to us but before we can tap these fully to our advantage we need a lot more improvement in both quantity and quality of our steel products.

Alloy & Special Steels

Until recently, almost the entire requirements of alloy and special steels, particularly those of the defence, railways, automobile and engineering industries, were being met by import. During the last few years, however, alloy & special steels have begun to be produced in good quantities (table 27), although even now some special varieties, because of their size and specification, continue to be imported. From a small beginning with 40, 000 tpa in 1960, the output of special alloy steels has already crossed one million tonne mark, which is about 7% of our total steel consumption.

Table 27: Production of Alloy & Special Steels (Estimate)

(million tonnes)

| Type of Steel | 1985-86 | 1986-87 | 1987-88 | 1988-89 | 1989-90 | 1990-91 |
|---|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Alloy Construction Steel | 0.211 (34.3) | 0.234 (31.9) | 0.227 (29.5) | 0.299 (34.3) | 0.306 (27.3) | 0.368 (29.7) |
| Carbon Construction Steel | 0.190 (30.9) | 0.245 (33.4) | 0.256 (33.2) | 0.237 (27.2) | 0.296 (26.5) | 0.301 (24.2) |
| Spring Steel | 0.096 (15.6) | 0.109 (14.9) | 0.112 (14.5) | 0.095 (10.9) | 0.184 (16.4) | 0.197 (15.9) |
| Stainless Steel | 0.074 (12.0) | 0.100 (13.6) | 0.130 (16.9) | 0.092 (10.6) | 0.132 (11.8) | 0.169 (13.6) |
| Free Cutting, Ball Bearing and other Steels | 0.044 (7.2) | 0.046 (6.2) | 0.045 (5.9) | 0.148 (17.0) | 0.201 (18.0) | 0.206 (16.6) |
| Total | 0.615 | 0.734 | 0.770 | 0.871 | 1.119 | 1.241 |

Source : Dey (1991)

Note : Figures in brackets denote % of total

The growth of alloy & special steels can be attributed to a few pioneering companies who due to their foresight visualized the growing importance of alloy steels resulting from the widespread industrial development taking place in the country. The average annual growth in the early years continued at an impressive rate of 12%. Although the producers of these steels later witnessed some recession,

they were farsighted enough to recognize the bright prospects of special/alloy steels in the future of this country. Some of these producers now are counted amongst the most dependable manufacturers and suppliers of alloy steels in the country.

In the case of alloy steels both the manufacturing techniques and product quality count a lot. Innovations such as the use of ultra high frequency furnaces, water cooled panels and roof, ladle injection systems, oxygen lancing, and eccentric bottom pouring etc. have kept them on the path of modernization and progress.

According to the 8th Plan working group, the production of crude alloy steels from the secondary sector is likely to be

| | |
|-----------|----------------------|
| 1989-90 | 3.00 million tonnes |
| 1994-95 | 6.00 million tonnes |
| 1999-2000 | 10.00 million tonnes |

At present 17% of total capacity goes to the manufacture of alloy & special steels. Since special steels have a wide range of size and specifications all of them cannot be produced by the same manufacturer. It may be therefore worthwhile for the manufacturers to allocate amongst themselves the entire range of the country's requirements so that each could concentrate on a few items (according to their capability) rather than frittering away their skill and knowledge on too many. The expertise thus built will in the long run prove to be of considerable advantage to the MSPs. However, MSPs desiring to change over from MS to Alloy Steel production will have to ensure that they possess the right equipment, manpower, skills and technical expertise.

Alloy and special steel subsector suffers from the same frailties as the MSPs are afflicted with namely, shortage of steel scrap and erratic and insufficient power supply. Alloy and special steel sector, if encouraged to progress on the right lines can certainly become a major source of foreign exchange earnings in the near future. One hopes, the MSPs will choose this special line of production only after an indepth study of the prospects of their making good in this field.

Energy Conservation

The MSPs mostly equipped with EAFs and IFs are counted amongst the high energy intensive units—bulk consumers of electric power. Unless regular and uninterrupted power supply is available to them, they cannot function to their full potential even when all other resources are available to them in full measure. In addition to the severe cuts in power supply and high voltage fluctuations, there are also problems connected with frequent upward

revision in tariffs. MSPs, besides being inherently energy intensive are also known to be inefficient energy users. In an EAF steel making unit, 15-18% cost of ingots is contributed by energy and according to NPC studies the energy saving potential in this sector is quite high, about 20 % or so. There are over 200 EAF and IF units in India. Energy conservation is therefore of vital significance to the industry's performance. While the usual simple conservation measures can save energy upto 5%, much higher savings are possible through better energy management and regular energy audits. For instance, in an EAF unit, metallurgists can help reduce power consumption by

- a) adopting modern steel melting practices such as scrap pre-heating etc.
- b) improving furnace linings and using foamy slag practices, eccentric bottom tapping etc.
- c) replacing pencil ingot casting with continuous casting facility
- d) providing ultra high power electric arc furnaces and introducing ladle (secondary) steel making technology.
- e) establishing economies of scale. The smaller capacity electric arc furnaces are both power inefficient and low in output

The above are only some of the measures EAFs can adopt for reducing energy consumption. But to draw full benefits from the energy saving measures, it is necessary that economic use of other inputs like scrap/DRI electrodes etc. is also given adequate attention.

According to current projections MSPs will have to almost double their contribution to steel production in the next few years. To do this, MSPs will need large scale investments on plant & equipment. It would be in their interest to consider raw material supplies and economies of scale, because a minimum size of plant is necessary to make such investments worthwhile. Simultaneously they will be well advised to install properly integrated systems for both energy conservation and pollution control.

Energy audits are an integral part of energy conservation and involve

- i) getting acquainted with energy systems in use
- ii) obtaining specific information on current energy utilization to serve as a basis for creating energy balance.
- iii) planning and execution of energy measurements
- iv) gathering information on energy systems development to help devise energy saving measures.

Table 29 : Typical distribution of EAF dust (Weight %)

| Dust size | +250 | ~125 | ~74 | ~44 | ~30 | ~15 | 8 | ~4 | ~2 | ~1 | ~1 |
|-----------|------|------|-----|-----|-----|-----|-----|-----|------|------|------|
| EAF | - | - | - | - | 2.5 | 2.7 | 1.9 | 4.6 | 10.5 | 22.6 | 45.4 |

Source : Iron & Steel Engineer, Feb. 1991

Energy audits in the case of MSPs may be somewhat different but to obtain lasting benefits from the exercise the personnel at all levels should acquire the 'Energy Saving' mentality and attitude through intensive training and dissemination of relevant information and data.

Pollution Control

Steel industry is considered to be one of the 'red category' industries. Along with other ferrous and non ferrous metallic extractions, casting forging and alloy making industries, metallurgical manufacturing industries are regarded as of a highly polluting nature.

Although government enactments on prevention & control of pollution are fairly stringent, the enforcement of these provisions so far has not been very strict, but with growing consciousness of the deleterious effects of environmental pollution the enforcement agencies may find it difficult to close their eyes to the breaches of pollution laws. MSPs, like many other small scale industries have always viewed environmental control as a capital expense which diverts the scarce capital from production facilities. It is time that his attitude changes and the MSPs on their own develop cost-effective plans to reduce the emissions.

Electric arc furnaces generate dust and fumes during melting which, if left untreated, pass on to the atmosphere and pollute the environment. Currently the main equipments used for reducing the pollutants are scrubbers and bag filters. Both the ESPs and the equipment for subsequent treatment are no doubt expensive but the treatment being mandatory most companies have to provide for the recovery/conversion process. The typical composition of EAF dust is shown in table 28. along with typical particle size distribution in table 29. Sumitomo has developed a

Table 28 : Typical composition of EAF dust (%wt)

| | | | |
|--------------------------------|------|-------------------------------|-----|
| Total FE | 30.2 | MnO | 2.8 |
| Feo | 2.8 | P ₂ O ₅ | 0.5 |
| Fe ₂ O ₃ | 40.0 | Na+K | 0.4 |
| ZnO | 24.2 | Cu+Ni | 0.9 |
| PbO | 4.1 | C | 1.7 |
| CaO | 5.1 | S | 0.6 |
| SiO ₂ | 4.8 | Ct | 3.3 |
| MgO | 1.3 | LOi | 5.3 |
| Al ₂ O ₃ | 2.4 | | |

Source Iron & Steel Engineer, Feb. 1991

technology whereby the dust treatment cost is considerably reduced by recovering all the metal constituents in their metallic form. Although the process is still in an experimental stage and further research is going on, the EAF industry can take note of these developments and prepare themselves for providing the most efficient and cost effective pollution control equipment available.

Simultaneously with pollution control equipment the most valuable tool for prevention of pollutants is the right type of technology and processes which minimize waste production. Reduction of waste generation can generally be achieved by

- a) substitution of raw materials wherever possible
- b) modifying the existing process & production techniques
- c) eliminating harmful by-products.

Measures designed to control waste generation and recovery of by-products could economically affect the cost of pollution control equipment to some extent. Investment pay-back periods in such cases may also prove to be attractively short which may help overcome the initial resistance of the industry to invest in pollution control equipment.

Future of Mini Steel sector

In the early fifties 32 countries were producing steel with US accounting for about 50% of the total production. Mini mills were unknown then. Open hearth was the main steel making process in use. Today, the number of steel making nations has tripled to around 85 and US has dropped to a lower ranking-producing around 10-11% of the total world output of steel (table 30). India which was

Table 30 : Some of the major Steel producing countries and their ranking (Crude Steel)

(million tonnes)

| Country | 1990 | | 1989 | | 1988 | | 1987 | |
|----------------|------|--------|------|--------|------|--------|------|--------|
| | Rank | Output | Rank | Output | Rank | Output | Rank | Output |
| USSR | 1 | 154.4 | 1 | 160.1 | 1 | 163.0 | 1 | 161.9 |
| Japan | 2 | 110 | 2 | 107.9 | 2 | 105.7 | 2 | 98.5 |
| USA | 3 | 88.9 | 3 | 88.8 | 3 | 90.1 | 9 | 80.9 |
| China | 4 | 67.2 | 4 | 61.6 | 4 | 59.2 | 4 | 56.0 |
| Germany | 5 | 38.4 | 5 | 41.1 | 5 | 41.0 | 5 | 36.2 |
| Italy | 6 | 25.5 | 6 | 25.2 | 7 | 23.7 | 6 | 22.8 |
| S. Korea | 7 | 23.1 | 8 | 21.9 | 8 | 19.1 | 11 | 16.8 |
| Brazil | 8 | 20.6 | 7 | 25.1 | 6 | 24.7 | 7 | 22.2 |
| France | 9 | 19.0 | 10 | 18.7 | 9 | 19.1 | 8 | 17.7 |
| UK | 10 | 17.8 | 9 | 18.7 | 10 | 19.0 | 10 | 17.1 |
| India | 11 | 15.0 | 14 | 14.6 | 15 | 14.3 | 15 | 13.1 |
| Czechoslovakia | 12 | 14.9 | 11 | 15.5 | 12 | 15.3 | 12 | 15.4 |
| Poland | 13 | 13.6 | 13 | 15.1 | 11 | 16.7 | 9 | 17.1 |
| Spain | 14 | 12.9 | 16 | 12.8 | 16 | 11.8 | 16 | 11.7 |
| Canada | 15 | 12.3 | 12 | 15.5 | 13 | 15.2 | 14 | 14.7 |
| Belgium | 16 | 11.4 | 17 | 10.9 | 17 | 11.2 | 17 | 9.8 |
| Taiwan | 17 | 9.7 | 19 | 9.0 | 19 | 18.5 | 24 | 5.9 |
| Romania | 18 | 9.7 | 15 | 14.4 | 14 | 14.5 | 13 | 15.0 |
| Turkey | 19 | 9.3 | 22 | .8 | 21 | 8.1 | 21 | 7.0 |
| Mexico | 20 | 8.7 | 20 | 7.9 | 22 | 7.8 | 20 | 7.6 |
| S. Africa | 21 | 8.6 | 18 | 9.3 | 18 | 8.7 | 18 | 8.9 |
| N. Korea | 22 | 7.0 | 23 | 6.9 | 23 | 6.8 | 22 | 6.7 |
| Australia | 23 | 6.7 | 24 | 6.7 | 24 | 6.4 | 23 | 6.1 |
| GDR | 24 | 5.6 | 21 | 7.8 | 20 | 8.1 | 19 | 8.2 |
| Netherlands | 25 | 5.4 | 25 | 5.7 | 25 | 5.5 | 25 | 5.1 |
| Sweden | 26 | 4.5 | 27 | 4.7 | 26 | 4.8 | 26 | 4.6 |
| Austria | 27 | 4.3 | 26 | 4.7 | 27 | 4.6 | 28 | 4.3 |
| Argentina | 28 | 3.6 | 29 | 3.9 | 31 | 3.6 | 31 | 3.6 |
| Yugoslavia | 29 | 3.6 | 28 | 4.4 | 28 | 4.5 | 27 | 4.4 |
| Luxemburg | 30 | 3.6 | 30 | 3.7 | 29 | 3.7 | 32 | 3.3 |
| Venezuela | 31 | 3.2 | 32 | 3.2 | 30 | 3.7 | 29 | 3.7 |
| Hungry | 32 | 2.9 | 31 | 3.6 | 32 | 3.6 | 30 | 3.6 |
| Finland | 33 | 2.9 | 33 | 2.9 | 33 | 2.8 | 34 | 2.7 |
| Indonesia | 34 | 2.6 | 35 | 2.4 | 36 | 1.9 | 35 | 2.1 |
| Bulgaria | 35 | 2.4 | 34 | 2.9 | 34 | 2.5 | 33 | 3.0 |
| Egypt | 36 | 2.1 | 36 | 2.1 | 35 | 2.0 | 36 | 1.7 |
| Others | - | 18.4 | - | 17.9 | - | 17.6 | - | 16.2 |
| World Total | - | 770.1 | - | 785.5 | - | 778.4 | - | 736.1 |

Source : SAIL (1990, 1992)

ranked 15th in 1987-88, improved its position slightly to 14th in 1989 and later moved up to the 11th position in 1990. Compared to China which started at par with India about 40 years back and now stands 4th in steel production, India's performance pales into insignificance. In the years to come India must therefore endeavor to attain much higher output and level up with other major steel producers. However, the steel industry elsewhere has changed gears and is looking forward to develop new and better methods of making steels of high quality at lower costs. India must keep itself tuned into these changes and try to get the benefit of improved technologies available elsewhere.

With price decontrol of steel, private sector allowed to set up steel plants upto one million tonnes capacity, a projected gap of 2.12 million tonnes between demand and supply in the current year and the additional concessions in respect of excise & import duties on sponge iron & MS scrap, the secondary sector may feel encouraged to invest on expansions, process integration, modernisation and also on setting up additional capacity. However, all that may not be enough to make the MSPs the right kind of adjunct of the steel sector. It will have to do a lot more to increase its contribution to the steel output of the country.

All that may not be enough to make the MSPs the right kind of adjunct of the steel sector. It will have to do a lot more to increase its contribution to the steel output of the country.

Although no new plants are likely to come up in the public sector, (except VSP where trial production has already commenced), large scale expansion and modernization of the existing plants is already in hand. This should help bridge the gap between demand and supply to some extent in the coming years. Since steel is a vital raw material for the engineering industry, the current policy of encouraging the secondary sector to put up additional capacities to meet the current steel shortages and also to help create an exportable surplus of quality steels would seem to be an appropriate strategy for the present. However, the past performance record of the steel sector, public or private, leaves a lurking suspicion about its ability to rise to the occasion and realize the hope of increasing production and improving productivity to make India a front line steel producer and exporter in the world. Despite its

poor showing in the recent past, one may still hope that the trust placed on the steel sector as a whole and the secondary sector as its junior constituent, may prove to be justified.

Capacity utilization by the integrated plants and the performance of the secondary sector are two important areas which need immediate attention. Capacity utilization in the steel industry at 66% in 1979-80 showed a fall of 9% from 75% in 1978-79 and a bigger drop of 19% from 85% in 1977-78. Since then, average capacity utilization has rarely crossed 80% in the public sector although the private sector (TISCO) has consistently shown a remarkably high achievement of 95 to 100% or over, with MSPs rarely going beyond 55-60%. With privatization and other measures now on the way to improve their performance, one hopes the PSUs will soon turn the corner-SAIL has already declared a maiden dividend in the current year. As pointed out earlier there are several reasons for the poor performance of the MSP sector. To enable MSPs to reach international standards of performance it will be necessary to

- a) introduce modern steel making practices so as to improve their productivity such as
 - (i) Oxygen lancing facilities-manual or mechanized
 - (ii) Water Cooled panels and roof for the furnaces
 - (iii) High power & ultra high power furnace operations
 - (iv) Scrap pre-heating for utilization of waste heat
 - (v) Ladle furnace for maximizing output
 - (vi) Foamy slag practices
 - (vii) Eccentric bottom tapping
 - (viii) Automatic monitoring and control equipment for melting and other operations.
- b) use right quality of scrap mix, and substitute MS scrap with sponge iron (DRI) to the maximum extent possible.
- c) use high quality lime as flux and appropriate quality of ferro alloys.
- d) improve tap to tap timing to reach international standards. Some of the practices mentioned under (a) are designed to reduce the melting time
- e) reduce non-productive time for such operations as furnace relining, furnace maintenance, fettling, charging, slag off and tapping etc.

- f) rationalize energy inputs such as electric power, electrodes, coke and fuel oil etc. by adopting suitable energy saving measures
- g) improve yield by adopting suitable methods particularly for (i) yield from metallic charge to liquid steel and (ii) yield from liquid steel to cast ingot/billet.

It will be observed that most of the above suggestions/recommendations relate to the introduction of technological and operational improvements. Unless these are implemented, the possibility of the mini steel industry taking off and reaching performance standards achieved by EAF units abroad can never materialize. Experts feel technology upgradation may not be feasible in smaller size arc furnaces. New MSPs must therefore only think in terms of higher (above 10 tonnes) size furnaces.

Along with these technological changes, product quality also needs adequate attention. In most of the mini steel plants, quality consciousness seems to be totally lacking. Of course, considerable improvement in quality can be brought about simply by giving greater attention to the quality of raw materials and operational standards. All this, however, can be possible only when quality temperament permeates throughout the industry as a part of a deliberate and conscious policy.

Apart from the plant modernization/technological upgradation measures referred to above, the steel world has already moved up on the technology road. Several new energy efficient and cost effective processes are now available and more are on the way. Projects such as the use of coal injection and direct steel making processes are reported to be in the final stages and may get operationalized in the nineties. Direct reduction technology may provide the much needed relief to the EAF units who are starved of good scrap as raw material.

Similarly secondary ladle metallurgy, VAD/VOD for refining, process control equipment and instrumentation for process automation, are some other items which could be put to increasing use for improving quality and costs. The world steel industry is already showing great concern for environmental pollution. The mini-steel mills must also give this matter greater attention when selecting new technologies/plants and equipment.

The world crude steel production is showing signs of depression, with USSR the largest producer of crude steel dropping its output by about 3.5% in 1990. Other countries, notably W. Germany, Brazil, Poland, GDR, Romania also show a similar downtrend for various reasons. The per capita consumption of major steel consuming countries

has however increased substantially although the world per capita consumption shows only a marginal rise. These are some of the factors in world steel output which need to be borne in mind when planning our own steel expansion/modernization. Although our per capita consumption presently is very low, there is bound to be a substantial rise in the near future when the ongoing economic changes take full effect. There is, therefore, little fear of an over capacity situation arising for quite some time to come.

Steel industry in general and mini mills in particular offer good scope for employment particularly of unskilled manpower. Within the current policy framework relating to the improvement of employment opportunities any expansion of the steel sector would be welcome. Manpower of individual units vary widely on account of (i) technological level of operations, (ii) managerial attitudes, (iii) use of contract/casual labour, (iv) indirect employees such as those engaged on sales, purchase, administration / accounts and finance operation etc. It may therefore be difficult to lay down any specific manpower norm for MSPs but an average of 150-165 tonnes per man year may be just about reasonable, according to one study. Table 31 shows the manpower of selected MSPs along with their installed capacity. No definite co-relation is possible to be derived from these figures but if one were to go by the norm of 150-65 tonnes/man/year, a single one million tonne plant would create employment opportunities for a minimum of about six to seven thousand people.

Table 31 : Employment in Selected Mini Steel Plants

| Company | Installed Capacity (tonnes) | Employment | | | Total |
|-------------|-----------------------------|-------------|---------|--------|-------|
| | | Supervisory | Skilled | Others | |
| Amrit | 40,000 | 114 | 46 | 145 | 305 |
| Haryana | 50,000 | 235 | 134 | - | 369 |
| Rathi Ispat | 40,000 | 24 | 34 | 68 | 126 |
| Jodhamal | 30,000 | 27 | 24 | 58 | 109 |
| Shriniwas | 9,000 | 17 | 16 | 19 | 52 |
| Bhoruka | 60,000 | 172 | 212 | - | 384 |
| Brindavan | 50,000 | 37 | 93 | 142 | 272 |
| KAP Steel | 62,000 | 56 | 30 | 109 | 195 |
| GujaratMini | 26,400 | 31 | 30 | 24 | 85 |
| Western | 40,000 | 38 | 37 | 65 | 140 |
| Dhatu | 15,000 | 14 | 24 | 32 | 70 |
| Paliwal | 14,000 | 24 | 34 | 68 | 126 |
| Star Steel | 65,000 | 139 | 102 | 183 | 424 |
| Saraswati | 12,000 | 21 | 65 | 31 | 117 |

Source : DSIR (1989)

With regulatory controls already removed the government's role also needs to undergo some change. It should direct its efforts towards the creation of conditions which

will ensure easy availability of inputs at costs which fit in with the economics of steel making. Similarly the current policy framework on imports and exports, excise duties, etc., will also need to be kept under constant review so that changes necessary to supplement industry's efforts to improve steel output can be effected when needed.

Abbreviations used

| | |
|---------|--|
| AF | - Arc furnace |
| AllFA | - All India Induction Furnaces Association |
| AMBIO | - K. Svenska, Vetenskapsakade-MEIN STOCKHOLM |
| BOF | - Blast Furnace /Open hearth furnace |
| CIER | - Centre for Industrial and Economic Research |
| CII | - Confederation of Indian Industries |
| CMIE | - Centre for Monitoring Indian Economy |
| CU | - Capacity Utilization. |
| DRI | - Direct Reduced Iron (Sponge Iron) |
| DST | - Deptt. of Science & Technology |
| EF | - Electric Furnaces |
| EAF | - Electric Arc Furnace |
| HBI | - Hot Briquet Iron |
| HO/CR | - Hot rolled/Cold rolled |
| IF | - Induction furnace |
| IGIDR | - Indira Gandhi Institute for Development Research |
| JPC | - Joint Plant Committee |
| MECON | - Metallurgical & Engineering Consultants |
| MS | - Mild Steel |
| MSP | - Mini Steel Plant |
| MSTC | - Metal Scrap Trading Corporation |
| MTPA | - Million Tonnes Per Annum. |
| PTI | - Press Trust of India |
| RF | - Resistance Furnace |
| SAIL | - Steel Authority of India Ltd. |
| SFAI | - Steel Furnace Association of India |
| TISCO | - Tata Iron & Steel Company |
| TLS | - Tonnes Liquid Steel |
| TMBP | - Tin Mill Black Plate |
| UHP | - Ultra High Power |
| VAD/VOD | - Vacuum Argon Decarburisation/Vacuum Oxygen Decarburisation |

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QUALITY, PHILOSOPHY & POLICY IN MODI ALKALIES & CHEMICALS LIMITED

Quality Philosophy

Quality in MACL means to have satisfied customers, both external and internal

It is the concern of each employee to build and sustain this organisation by creating a reputation for achieving leadership in quality in India and abroad.

Our philosophy is to reflect our integrity and meticulousness in all our activities in order to establish our credibility with customers & vendors and to build a culture imbued with trust, values and dedication to work.

Quality Policy

- Quality is job No.1
- To do everything right the first time, every time
- To maintain a pollution-free and safe environment
- To involve all employees, vendors & customers to continuously develop, adopt & improve technology for enhancing productivity, effectiveness and quality
- Commitment to manufacture products of highest quality and to provide service for complete customer care

Yogendra K. Modi
Vice Chairman & Managing Director

Appendix I : Total Earnings to Conversion Cost

| UNIT | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | |
|--|-----------------|-----------------|-----------------------------|----------------------|-----------------------------|-----------------|----------|------------------------------------|
| BHORUKA | | 0.9 | 0.88 | 1.1 | 0.9 (9 m) | 1.2 | - | Data pertain to 1984-89 period |
| BIHAR FDRY CENTURY | - 1.1 | 1.0 - | 2.0 1.0 (18 m) | 0.95 0.99 | 0.8 0.97 | 0.7 - | - - | |
| INDIA STEEL ROLLING KALYANI | - - | - - | 0.8 1.4 | 0.99 1.4 | 1.07 1.4 | 1.3 1.5 | - 1.3 | |
| NIPHA PRATAP ROLLING | - 1.2 | 0.9 0.9 | 1.1 - | 0.97 1.1 | 0.99 0.9 | 0.97 1.0 | - | Data pertains to 1984-89 period |
| RAIPUR ALLOY SAURASHTRA | - 1.2 | 0.9 0.8 | 1.1 - | 1.2 0.7 (15 m) | 1.2 0.8 | 1.2 0.3 | 1.1 - | |
| R.B. JODHAMAL RAVINDRA | 0.1 1.3 | - 1.1 | 1.0 0.8 | 2.0 - | 1.2 0.9 (18 m) | 1.3 0.9 | 1.0 - | |
| SANGHVI | 1.2 | 1.1 | 1.0 | 1.1 | 1.0 (13 m) | - | - | |
| SPECIAL STEELS | - | 1.5 | 1.2 | - | 1.4 (15 m) | 1.5 | 1.4 | |
| TITAGARH STEELS | 2.2 | 1.1 | 1.2 | - | 1.3 (18 m) | 0.96 | - | |
| WESTERN MINISTIL | 1.1 | 1.0 | 1.1 | - | 1.1 (15 m) | 1.0 | - | |
| ARIHANT | - | - | 0.93 | - | 0.9 (18 m) | 1.1 | 0.96 | |
| UP STEELS | - | 0.8 | 1.5 | 1.3 (9 m) | - | 1.6 | 1.9 | |
| SPONGE IRON RAMKRISHNA ISPAT MAHAVIR ISPAT | - 1.2 1.2 | 0.8 1.2 - | 0.7 1.0 0.8 (18 m) | 0.8 1.0 1.3 | 1.3 0.8 0.8 (10 m) | 1.8 - 0.7 | - | |
| ANIL STEEL | - | - | 1.2 | 1.3 | 1.1 (9 m) | 1.3 | 1.2 | |
| TATA YODOGAWA ELECTROSTEEL | - - | 1.1 - | 1.1 0.9 | 0.98 1.2 | 0.99 1.3 | 1.0 1.3 | - 1.2 | |
| FIRTH (INDIA) G.M. MITTAL | - - | 1.1 - | 1.2 - | 0.9 - | 1.1 0.94 | 0.9 1.0 | - 1.1 | |
| HARYANA STEEL | - | 0.99 (18 m) | - | 1.5 | 1.3 | 1.3 | 1.6 | |
| MODERN STEEL | - | 1.0 | 1.4 | 1.3 | 1.6 | 1.3 | 1.3 | |

m = months

Appendix 2 : Purchased Services to Total Earnings

| UNIT | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | |
|-----------------------|------|--------------|----------------------|---------------|---------------|------------|--------|--------------------------------------|
| BHORUKA | | 0.9 | 1.0 | 0.8 | 0.8 (9 m) | 0.7 | - | Data pertain to 1984-89 period |
| BIHAR FDRY CENTURY | 0.6 | 0.8 - | 0.7 0.7 (15 m) | 0.9 0.9 | 1.1 1.7 | 1.2 1.2 | - - | |
| INDIA STEEL ROLLING | - | - | 0.8 | 0.99 | 1.07 | 1.3 | - | Data pertain to 1984-89 period |
| KALYANI | - | - | 0.5 | 0.5 | 0.5 | 0.5 | 0.6 | |
| NIPHA | - | 0.9 | 0.8 | 0.9 | 0.9 | 0.9 | - | Data pertain to 1984-89 period |
| PRATAP ROLLING | 0.6 | 0.9 | - | 0.7 | 0.8 | 0.7 | - | |
| RAIPUR ALLOY | - | 0.7 | 0.8 | 0.7 | 0.7 | 0.7 | 0.8 | Data pertain to 1984-89 period |
| SAURASHTRA | 0.7 | 1.1 | - | 1.2 (15 m) | 1.0 | 2.6 | - | |
| R.B. JODHAMAL | 2.3 | - | 0.3 | 0.1 | 0.4 | 0.4 | 0.4 | Data pertain to 1984-89 period |
| RAVINDRA | 0.5 | 0.7 | 0.9 | - | 0.8 (18 m) | 0.8 | - | |
| SANGHVI | 0.7 | 0.8 | 0.8 | 0.8 | 0.8 (13 m) | - | - | Data pertain to 1984-89 period |
| SPECIAL STEELS | - | 0.4 | 0.5 | - | 0.4 (15 m) | 0.4 | 0.4 | |
| TITAGARH STEELS | 0.3 | 0.6 | 0.5 | - | 0.4 (18 m) | 0.7 | - | Data pertain to 1984-89 period |
| WESTERN MINISTIL | 0.8 | 0.9 | 0.9 | - | 0.9 (15 m) | 0.9 | - | |
| ARIHANT | | - | 0.8 | - | 0.9 (18 m) | 0.8 | 0.95 | Data pertain to 1984-89 period |
| UP STEELS | | 0.7 | 0.4 | 0.5 | - | 0.6 | 0.3 | |
| SPONGE IRON | | 0.5 | 0.6 | 0.4 | 0.3 | 0.2 | - | Data pertain to 1984-89 period |
| RAMKRISHNA ISPAT | 0.6 | 0.6 | 0.7 | 1.0 | 0.9 | - | - | |
| MAHAVIR ISPAT | 0.6 | - | 0.9 (18 m) | 0.7 | 1.0 (10 m) | 1.2 | - | Data pertain to 1984-89 period |
| ANIL STEEL | | - | 0.5 | 0.5 | 0.6 (9 m) | 0.5 | 0.6 | |
| TATA YODOGAWA | | 0.6 | 0.6 | 0.7 | 0.6 | 0.6 | - | Data pertain to 1984-89 period |
| ELECTROSTEEL | | - | 0.6 | 0.5 | 0.5 (9m) | 0.5 | 0.5 | |
| FIRTH (INDIA) | | 0.5 | 0.5 | 0.6 | 0.5 | 0.6 | - | Data pertain to 1984-89 period |
| G.M. MITTAL | | - | - | 0.4 | 0.5 | 0.4 | 0.4 | |
| HARYANA STEEL | | 0.8 (18m) | - | - | 0.7 | 0.7 | 0.6 | Data pertain to 1984-89 period |
| MODERN STEEL | | 0.3 | 0.6 | 0.5 | 0.6 | 0.6 | 0.6 | |

m = months

Appendix 3 : Wages & Salries to Sales

| UNIT | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | | |
|---------------------|------|--------------|---------------|---------------|----------------|------|------|-------------------------------|-----------------------------------|
| BHORUKA | - | 4.6 | 4.7 | 5.0 | 3.4 | 2.2 | - | Data is for 1984-89 period | |
| BIHAR FDRY | - | 2.4 | 2.4 | 2.1 | 3.0 | 2.5 | - | | |
| CENTURY | 3.7 | - | 4.0 (15 m) | 3.8 | 1.2 | - | - | | |
| INDIA STEEL ROLLING | - | - | 7.4 | 6.8 | 5.3 | 3.7 | - | | |
| KALYANI | - | - | 5.5 | 5.7 | 4.7 | 4.1 | 4.9 | | |
| NIPHA | - | 6.4 | 5.2 | 5.3 | 5.7 | 7.1 | - | | Data pertain to 1984-89 period |
| PRATAP ROLLING | 5.0 | 4.7 | - | 5.4 | 4.5 | 4.2 | - | | |
| RAIPUR ALLOY | - | 2.2 | 2.4 | 2.3 | 2.0 | 2.1 | 1.3 | | |
| SAURASHTRA | 2.2 | 3.0 | - | 2.5 (15 m) | 1.9 | 2.3 | - | | |
| R.B. JODHAMAL | 5.1 | - | 3.0 (18 m) | 2.1 | 2.4 | 2.9 | 3.0 | | |
| RAVINDRA | 4.3 | 4.8 | 6.3 | - | 4.5 (18 m) | 4.5 | - | | |
| SANGHVI | 5.2 | 5.1 | 5.9 | 5.0 | 4.5 (13 m) | - | - | | |
| SPECIAL STEELS | - | 9.3 | 12.0 | - | 10.8 (15 m) | 9.7 | 10.5 | | |
| TITAGARH STEELS | 6.0 | 9.1 | 9.4 | - | 8.6 | 9.7 | - | | |
| WESTERN MINISTIL | 2.1 | 2.1 | 1.8 | - | 1.7 | 1.3 | - | | |
| ARIHANT | - | - | 2.6 | - | 2.1 (18 m) | 1.9 | 1.4 | | |
| UP STEELS | - | 8.7 | 7.6 | 7.0 (9 m) | - | 6.6 | 5.9 | | |
| SPONGE IRON | - | 14.0 | 15.2 | 18.2 | 12.4 | 11.8 | - | | |
| RAMKRISHNA ISPAT | 5.7 | 6.8 | 7.2 | 6.7 | 8.7 | - | - | | |
| MAHAVIR ISPAT | 7.5 | - | 6.8 (18 m) | 4.2 | 4.3 (10 m) | 3.4 | - | | |
| ANIL STEEL | - | - | 8.0 | 7.2 | 7.2 (9 m) | 6.8 | 7.2 | | |
| TATA YODOGAWA | - | 10.4 | 11.5 | 11.0 | - | 11.1 | - | | |
| ELECTROSTEEL | - | - | 10.4 | 7.8 | 5.9 (9 m) | 5.2 | 4.8 | | |
| FIRTH (INDIA) | - | 17.8 | 17.1 | 19.6 | 18.8 | 18.3 | - | | |
| G.M. MITTAL | - | - | - | 2.0 | 2.3 | 2.6 | 2.9 | | |
| HARYANA STEEL | - | 3.4 (18m) | - | - | 8.6 | 6.5 | 3.9 | | |
| MODERN STEEL | - | 1.7 | 1.7 | 2.2 | 2.1 | 2.1 | 2.2 | | |

m = months

Appendix 4 : Profit to Conversion Cost

| UNIT | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | |
|---------------------|-------|--------|------------------|---------------|------------------|--------|------|----------------------------|
| BHORUKA | - | (0.2) | (0.09) | (0.09) | 0.07 | 0.08 | - | Data pertain to 1984-89 |
| BIHAR FDRY | - | 0.03 | 0.16 | 0.02 | (0.12) | (0.11) | | |
| CENTURY | 0.1 | - | (0.07) | (0.04) | (0.1) | - | | |
| INDIA STEEL ROLLING | - | - | (0.08) | (0.05) | 0.002 | 0.3 | - | |
| KALYANI | - | - | 0.25 | 0.22 | 0.2 | 0.26 | 0.14 | |
| NIPHA | - | (0.23) | 0.02 | (0.09) | (0.09) | 0.12 | | Data pertain to 1984-89 |
| PRATAP ROLLING | 0.3 | 0.05 | - | 0.03 | (0.1) | (0.13) | | |
| RAIPUR ALLOY | - | 0.05 | 0.04 | 0.2 | 0.2 | 0.1 | 0.07 | |
| SAURASHTRA | 0.04 | 0.02 | - | (0.3) | (0.5) | (0.8) | - | |
| R.B. JODHAMAL | (0.4) | - | 0.09 (18 m) | 0.26 | (0.02) | 0.01 | 0.07 | |
| RAVINDRA | 0.14 | (0.04) | (0.35) | - | (0.06) (18 m) | (0.26) | - | |
| SANGHVI | 0.16 | 0.07 | 0.008 | (0.003) | (0.01) (13 m) | - | - | |
| SPECIAL STEELS | - | 0.3 | 0.2 | - | 0.25 (15 m) | 0.3 | 0.2 | |
| TITAGARH STEELS | 0.7 | 0.2 | 0.2 | - | 0.1 (18m) | 0.2 | - | |
| WESTERN MINISTIL | 0.05 | 0.04 | 0.04 | - | 0.06 (15 m) | 0.05 | - | |
| ARIHANT | - | - | (0.08) | - | 0.03 (18 m) | 0.007 | 0.02 | |
| UP STEELS | - | (0.27) | 0.26 | 0.25 (9 m) | - | 0.41 | 0.7 | |
| SPONGE IRON | - | 0.04 | 0.06 | (0.28) | 0.02 | 0.29 | - | |
| RAMKRISHNA ISPAT | 0.3 | 0.2 | 0.04 | (0.1) | (0.4) (9 m) | - | - | |
| MAHAVIR ISPAT | 0.08 | - | (0.14) (18 m) | (0.07) | (0.13) (10 m) | 0.37 | - | |
| ANIL STEEL | - | - | (0.1) | 0.1 | 0.1 | 0.1 | 0.1 | |
| TATA YODOGAWA | - | (0.08) | 0.08 | (0.03) | (0.02) | 0.06 | - | |
| ELECTRO STEEL | - | - | (0.2) | 0.2 | 0.2 | 0.09 | 0.1 | |
| FIRTH (INDAI) | - | 0.07 | 0.06 | 0.01 | 0.009 | 0.006 | - | |
| G.M. MITTAL | - | - | - | 0.04 | 0.3 (15 m) | 0.2 | 0.1 | |
| HARYANA STEEL | | (0.08) | - | - | (0.2) | 0.04 | 0.2 | |
| MODERN STEEL | | 0.16 | 0.14 | 0.14 | 0.30 | 0.20 | 0.15 | |

m = months

Appendix 5 : Profit to Sales percentage

| UNIT | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | |
|---------------------|-------|--------|--------|--------|--------|--------|------|------------------------------------|
| BHORUKA | - | (6.4) | (4.0) | (3.4) | 2.2 | 7.6 | - | Data is for 1984-89 period |
| BIHAR FDRY | - | 0.96 | 4.5 | 0.8 | (4.6) | 3.5 | - | |
| CENTURY | 0.23 | - | (1.2) | (2.0) | (4.1) | - | - | |
| INDIA STEEL ROLLING | - | - | (2.8) | (1.6) | 0.04 | 5.0 | - | |
| KALYANI | - | - | 8.5 | 7.6 | 6.2 | 7.2 | 4.8 | Data pertaing to 1984-89 period |
| NIPHA | - | (11.4) | 1.1 | (4.3) | (5.0) | (6.5) | - | |
| PRATAP ROLLING | 8.0 | 1.6 | - | 1.0 | (2.9) | (3.5) | - | |
| RAIPUR ALLOY | - | 1.3 | 1.1 | 4.4 | 3.7 | 2.9 | 1.5 | |
| SAURASHTRA | 1.2 | 0.6 | - | (10.9) | (15.1) | (25.0) | - | |
| | | | | (15 m) | | | | |
| R.B. JODHAMAL | (8.7) | - | (1.2) | 2.7 | (0.2) | 0.1 | 0.5 | |
| | | | (18 m) | | | | | |
| RAVINDRA | 4.4 | (1.4) | (14.6) | - | (2.2) | (7.8) | - | |
| | | | | | (18 m) | | | |
| SANGHVI | 4.8 | 2.9 | 0.4 | (1.3) | (0.4) | - | - | |
| | | | | | (13 m) | | | |
| SPECIAL STEELS | - | 8.6 | 6.1 | - | 7.2 | 7.5 | 5.6 | |
| | | | | | (15 m) | | | |
| TITAGARH STEEL | 19.7 | 7.6 | 8.2 | - | 4.4 | 6.9 | - | |
| | | | | | (18 m) | | | |
| WESTERN MINISTIL | 1.9 | 1.7 | 2.0 | - | 1.3 | 0.9 | - | |
| | | | | | (15 m) | | | |
| ARIHANT | - | - | (3.6) | - | 0.9 | 0.2 | 4.4 | |
| | | | | | (18 m) | | | |
| UP STEELS | - | (9.6) | 6.9 | 6.5 | - | 9.5 | 14.1 | |
| | | | | (9 m) | | | | |
| SPONGE IRON | - | 3.1 | 2.6 | (14.1) | 0.7 | 9.1 | - | |
| RAMKRISHNA ISPAT | 5.9 | 5.6 | 1.4 | (3.3) | (15.9) | - | - | |
| | | | | | (9 m) | | | |
| MAHAVIR ISPAT | 2.2 | - | (4.7) | (2.0) | 3.7 | 10.0 | - | |
| | | | (18 m) | | (10 m) | | | |
| ANIL STEEL | - | - | (3.8) | 4.3 | 4.4 | 3.2 | 3.2 | |
| TATA YODOGAWA | - | (2.9) | 3.2 | (1.4) | (0.9) | 2.3 | - | |
| ELECTROSTEEL | - | - | (6.7) | 5.2 | 4.6 | 2.3 | 3.3 | |
| FIRTH (INDIA) | - | 3.2 | 2.9 | 0.7 | 0.4 | 0.3 | - | |
| G.M. MITTAL | - | - | - | 0.5 | 3.7 | 1.9 | 2.1 | |
| | | | | | (15 m) | (9 m) | | |
| HARYANA STEEL | - | (3.8) | - | - | (6.6) | 1.0 | 4.0 | |
| MODERN STEEL | - | 2.8 | 2.4 | 2.8 | 4.8 | 3.5 | 2.5 | |

m = months

Appendix 6 : Profit per Employee (Rs. lakh)

| UNIT | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---------------|-------|--------|----------------|------------------|----------------|--------|-------|
| KALYANI | - | - | 0.67 | 0.67 | 0.44 | 0.98 | 0.76 |
| RAIPUR ALLOY | - | 0.65 | 0.066 | 0.33 | 0.26 | 0.35 | 0.22 |
| SAURASHTRA | 0.056 | 0.027 | - | (0.54) (15 m) | (0.94) | (1.60) | - |
| R.B. JODHAMAL | (0.1) | (0.05) | 0.13 (18 m) | - | (0.01) | 0.009 | 0.05 |
| ARIHANT | - | - | (0.18) | 0.09 | 0.02 (18 m) | 0.06 | - |
| UP STEELS | - | 0.141 | 0.122 | 0.106 (9 m) | - | 0.245 | 0.486 |
| SPONGE IRON | - | 0.033 | 0.048 | (0.242) | 0.020 | 0.352 | - |
| FIRTH (INDIA) | - | 0.042 | 0.043 | 0.001 | 0.008 | 0.006 | - |
| MODERN SEEL | - | 0.161 | 0.182 | 0.178 | 0.485 | 0.374 | 0.284 |

Appendix 7 : Value Added per Employee (Rs. lakh)

| UNIT | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---------------|--------|-------|----------------|----------------|----------------|-------|-------|
| KALYANI | - | - | 7.89 | 8.86 | 7.15 | 13.65 | 15.82 |
| RAIPUR ALLOY | - | 5.12 | 6.15 | 7.46 | 7.01 | 12.24 | 14.73 |
| SAURASHTRA | 0.35 | - | - | - | 0.581 | 1.232 | - |
| R.B. JODHAMAL | (0.04) | 0.07 | 0.23 (18 m) | - | 0.11 | 0.24 | 0.31 |
| ARIHANT | - | - | (0.04) | 0.31 | 0.18 (18 m) | 0.21 | - |
| UP STEELS | - | 0.295 | 0.613 | 0.439 (9 m) | - | 0.785 | 1.21 |
| SPONGE IRON | - | 0.45 | 0.61 | 0.37 | 0.69 | 1.09 | - |
| FIRTH (INDIA) | - | 0.845 | 1.03 | 0.91 | 1.22 | 1.132 | - |
| MODERN STEEL | - | 0.390 | 0.471 | 0.548 | 0.947 | 0.908 | 0.864 |

Appendix-8 : Sales per Employee (Rs. lakh)

| UNIT | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 |
|---------------|------|-------|----------------|----------------|-------|-------|-------|
| KALYANI | - | - | 1.73 | 1.88 | 1.37 | 2.60 | 2.75 |
| RAIPUR ALLOY | - | 0.33 | 0.34 | 0.57 | 0.60 | 0.52 | 0.47 |
| SAURASHTRA | 4.81 | 4.35 | - | 4.95 (15 m) | 6.20 | 6.42 | - |
| R.B. JODHAMAL | 1.15 | 3.94 | 4.77 (18 m) | 5.53 | 7.86 | 8.88 | - |
| ARIHANT | - | - | 5.04 | 10.32 | 8.23 | 11.37 | - |
| UP STEELS | - | 1.464 | 1.85 | 1.63 (9 m) | - | 2.59 | 3.45 |
| SPONGE IRON | - | 1.76 | 1.87 | 1.72 | 2.9 | 3.86 | - |
| FIRTH (INDIA) | - | 1.33 | 1.50 | 1.45 | 1.88 | 2.11 | - |
| MODERN STEEL | - | 5.79 | 7.72 | 6.35 | 10.19 | 10.83 | 11.30 |

m = months

Total Quality Management : A Case Analysis

L. Richard Oliker

Total quality management constitutes the success formula the world over in the current decade of competitive industrial scenario. This article analyses TQM from the viewpoint of a small supplier of parts to a multinational firm. The introduction and implementation of the strategy are presented in detail with a concluding note on the lessons to be learnt from this exercise.

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Major, multi-national corporations around the world have adopted *Total Quality Management* as a driving force in the global marketplace. While price competition will continue to be employed as both a tactical and strategic device, competition on the basis of proven, continuing quality will assume an increasingly significant role for both marketing and manufacturing operations in the international scene.

This article addresses TQM from a specific business relationship: that of a relatively small supplier of parts to a large, multi-national firm. The former is a manufacturer of plastic components, located in England. The latter is the Ford Motor Company (more specifically, its European Division).

While price competition will continue to be employed as both a tactical and strategic device, competition on the basis of proven, continuing quality will assume an increasingly significant role for both marketing and manufacturing operations on the international scene.

This analysis of the TQM partnership forged between these two firms is based upon the author's personal experience with the former firm as it developed and implemented plans to qualify as a supplier of parts to Ford. Spectrum Products, Ltd., (the "cover" name used to identify the firm) had to meet a series of quality-capability tests in order to receive a Q-1 rating from Ford, the rating conferring the status of being a regular supplier of certain parts to Ford—some on a no-bid contract basis.

Basic Principles

Spectrum Product's management based the design and execution of TQM activities on the following principles:

1. The firm had to achieve functional integration and the effective coordination of the key TQM components—quality, utilization and risk management.

2. TQM activities had to reflect reasonable technical sophistication and be consistent with the internal capacity/capability of Spectrum to meet Ford's quality standards.
3. In order to achieve the greatest degree of effective implementation, monitoring, evaluation, and incremental improvement had to become the primary goal (and responsibility) of top management.
4. The effectiveness of quality management had to be subject to continuous reappraisal, and would be judged on measurable service, prompt delivery, increased cost-effectiveness, and risk reduction.

Defining The Process

When a small firm desires to qualify as a supplier of parts to a much larger corporation which emphasizes TQM as a way of life, its management must be able to clearly define that goal in operational terms and communicate it properly to its employees. Ultimately, it is the latter group which will determine the success or failure of this effort.

TQM is doing the job right the first time, with waste (in terms of material, time and energy) minimized.

The following statements were articulated by Spectrum's Chief Executive Office as a *Quality Creed* which stated that TQM:

- * Is *doing the job right the first time*, with waste (in terms of material, time and energy) minimized.
- * Is *constantly* improving the quality of output provided to the customer.
- * Creates a participative environment which emphasizes teamwork and employee involvement at all levels of the firm.
- * Is *not* a catchy new phrase or programme which will disappear tomorrow. It will become a way of life, necessary to survive in today's global business climate.
- * Will require *all* employees to have a much greater understanding and appreciation for what key customers expect from the firm.
- * Will require a much greater level of employee education and training than has previously been the case.

- * Is taking a number of small steps toward improving quality performance, rather than trying to achieve a quantum leap in a short period of time.
- * It will involve creating a series of strategic alliances with key customers and vendors (and, possibly, creditors).

One of the key outgrowths of TQM principles is the involvement of employees in the decision-making process. This is defined today as *employee empowerment*. It requires a commitment on the part of management to open up the process to employees. In turn it also requires the employees to commit to the process. No TQM programme can be fully effective without both sides of this human equation being met. It is an evolutionary process which has no conclusion; but, rather, it is a continuous extension of the firm's ability to meet customer requirements. This fulfillment will achieve the repeat business which is so necessary for growth and survival. It cannot change what happened yesterday, but it can most certainly make the difference for tomorrow. Only team-oriented, quality-focused firms can succeed in the markets of the future.

A Situational Perspective

Spectrum Products is, as noted, a manufacturer of plastic components which had to change its corporate culture in order to adopt the TQM approach. Management style, as well as leadership, also changed.

Imagine two assembly lines, each monitored by a foreman. Foreman 1 walks the line, watching carefully, "I can see you all," he warns. "I have the means to measure your work, and I will do so. I will find those among you who are unprepared or unwilling to do your job, and when I do, there will be dire consequences. There are many workers available for those jobs, and you can be replaced."

One of the key outgrowths of TQM principles is the involvement of employees in the decision-making process.

Foreman 2 walks a different line, and he too watches, "I am here to help you if I can," he says. "We are all in this together for the long haul. You and I have a common interest in doing a good job. I know that most of you are trying hard, but sometimes things go wrong. My job is to notice opportunities for improvement—skills that can be shared, lessons from the past, or experiments for us to try

together—and to give you the means to do your work even better than you do now. I want to help you all, not just the exceptional few at either end of the competence spectrum.”

Which line works better? Which is more likely to do the job well over the long run? Where would the better employee rather work?

The first approach relies upon inspection to improve quality. Unfortunately, it was an approach adopted by many companies throughout the world. It “worked” to a certain degree in the era prior to the globalization of the marketplace. However, today it is at best inefficient, and at worst, a formula for failure.

Defects in quality could only rarely be attributed to a lack of will, skill, or intention among people involved in manufacturing process; the problem was more generally not one of motivation or effort, but rather of poor job design, failure of leadership, or unclear goals.

The Japanese learned first that there were other ways—far better ways—to improve quality and extend those improvements continuously and strategically into marketplaces. They learned a new, more cogent way to focus the organization on quality improvement. Defects in quality could only rarely be attributed to a lack of will, skill, or intention among people involved in manufacturing process. Even when these people were the cause of defects, the problem was more generally not one of motivation or effort, but rather of poor job design, failure of leadership, or unclear goals.

TQM Overview at Spectrum Products

The management of Spectrum Products realized that their goal to become a supplier of parts to certain major clients could only be achieved through *exceeding* the quality specifications of those clients. Their structural system for firm-wide participation in the TQM process involved three major components:

1. **Advantage Planning (AP)** was initiated by a careful statement of the firm's vision of where it wanted to be in the next five years. In order to give direction to the vision planning effort, the management:

- a. identified specific operational/production goals to be met.
- b. Identified the critical manufacturing/assembly processes that had to deliver the components meeting/excelling the client's quality standards.
- c. Selected a few (three, in this case) innovative product designs.
- d. Communicated the vision and the methods by which it would be achieved to all Spectrum employees. (Value statements were added to remind employees of the rewards inherent in meeting the Advantage Planning goal.)

2. **Collegial Management (CM)** was provided on a systems basis to demonstrate to employees what each must personally commit to do, and what they must measure and control to keep the firm operating in an efficient manner. This systems approach helped employees understand fully what was involved in meeting customer quality requirements. Once this was clearly understood, employees were encouraged to continuously improve quality; then standardize these improvements to ensure that gains would be repeated and maintained.

This was the *empowerment* stage of the TQM process at Spectrum, involving *all* employees and focussing management improvement efforts on process problems.

3. **Trans-Functional Management (TFM)** integrated team activities across various manufacturing and service operations to achieve quality goals. The integrative approach dissolved barriers which existed between different functional departments at Spectrum. Through this coordinating mechanism, management ensured that all teams within the firm were working to achieve the stated goals.

Defining Customer Requirements

In employing TQM, *how* a process is implemented is as important as *what* the process includes. The firm utilized “Quality Sequence Deployment” (QSD) as an

In employing TQM, *how* a process is implemented is as important as *what* the process includes.

organizing system to identify and prioritize major client quality requirements, and translate them into operational guidelines. QSD was strategic a methodology in which customer needs and the operating characteristics of Spectrum's manufacturing system were arrayed in a matrix and definitively compared.

Both external customers (current customers and the targeted major clients like Ford) and internal customers (employees, supervisors, and management) were identified. Tools such as customer surveys, focus groups, customer complaints and feedback, etc. were employed to focus on the specific needs of the target market segment. The results from these data sources were combined to form a complete set of customer perspectives. This data assisted Spectrum's management to better understand their own internal operating capabilities, and how to strategically position the firm to more effectively respond to the inherent quality changes (upgrades). In addition, Spectrum learned how to deal with large customers whose perceptions of their quality needs exceeded their actual requirements (part of the Advantage Planning activity).

Collegial Management teams developed systems which translated this planning effort into operational realities. Alliances with the engineering departments of potential major clients (like Ford) were initiated. These "partnership-style" arrangements allowed Spectrum to propose quality standards which exceeded the needs of their potential customers. Joint venture agreements articulated in the final stages of contract negotiations ensured that capital acquisition/retooling costs would be shared by the partners to the contract.

Trans-Functional Management was the binding agent to successfully integrate the manufacturing operations at Spectrum with the logistical specifications at Ford (whose "just-in-time" inventory system demanded delivery expertise not yet fully demonstrated on Spectrum's part.) The results of this synergistic effort convinced Ford that Spectrum could indeed meet its (Ford's) shipment requirements.

The evaluation (feedback) process for this unique, three-step TQM approach was not done on a period basis. Rather, it became a continuous, on-going activity on the part of two of the Collegial Management teams. These teams included engineering and quality-control personnel from both Spectrum and Ford. Their joint activities resulted in a feeling of ownership in the successful outcomes. Each firm developed a group of advocates for the efforts of the other firm. The "plank-owner" feeling cemented this cooperative endeavour to the satisfaction (and profit) of both participants.

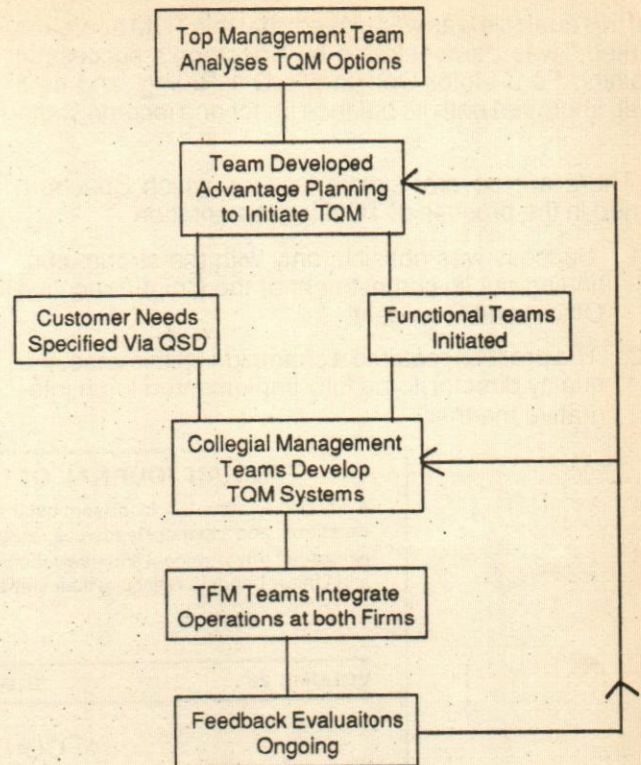


FIG. 1: TOTAL QUALITY MANAGEMENT IMPLEMENTATION SPECTRUM PRODUCTS LTD.

The TQM approach which was developed at Spectrum may be depicted as in fig. 1

Conclusions

Organizational change may be the direct by-product of any successful TQM implementation. No company which expects to grow and survive in the rapidly changing operational environment of the current decade can maintain the status quo. TQM can be broadly defined as conformance to requirements. Since these requirements are subject to constant change (improvement), any firm will have to decide whether it wants to initiate change or adapt to a change which has been externally imposed upon it. In other words, change or be changed.

At Spectrum Products (as has been the case at many other firms) the appointment of a quality director and the creation of a quality department heralded the fact that business would not be conducted as had been the case in the past. The new director had two primary responsibilities:

1. Administer the TQM process as depicted; and
2. Assist top management to develop a strategic approach to quality management.

That this dual role was well played; that this TQM approach "worked;" was demonstrated by Spectrum's success in obtaining Ford Motor Company's Q-1 Rating, and as a result, improved both its balance sheet and income statement.

There are several simple lessons which Spectrum learned in the process of TQM implementation:

1. Success was possible only with the strong, continuing public commitment of the Chief Executive Officer and President.
2. The process required a champion (in this case, the quality director) to be fully implemented in an integrative manner.

3. The composition and operation of the quality teams was the key to the focus on process/capability improvement.
4. Initiative is vital. Don't try to analyze TQM into an early grave. Get started with the implementation phase and learn, in the process, what TQM is all about and whether it has a strategic fit with the firm's corporate culture.
5. Reward and recognize those who contribute to the development and implementation of TQM to ensure its acceptance.

INDIAN JOURNAL OF INDUSTRIAL RELATIONS

A Quarterly devoted to dissemination of knowledge in the fields of Industrial Relations and Human Resources, including relevant aspects of labour relations, personnel management and rural labour. Besides, communications from Managers and Union Leaders reflecting their views and Book Reviews are also incorporated.

EDITOR : RAMA J. JOSHI

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Infrastructure Development In Indian States

NPC Research Division

In an earlier issue [Productivity, 33(2) July-Sept 1992], we evolved a Human Development Index in Indian States based on the methodology adopted by the Human Development Report (1990) of the UNDP. In this issue we have made use of the same methodology for arriving at an Infrastructure Development Index for the 15 major states in India. It is difficult to give a concise definition for the term infrastructure. We can define it broadly in terms of the nature of the variables into physical and social.

Due to the indivisibility prevailing upon most of the infrastructural investments, states play a crucial role in their development and maintenance. Lack of infrastructure has been found to affect the developmental process of most of the underdeveloped countries unfavourably as in the case with India. In this report, we concentrate mainly on the development of physical infrastructure which are considered as crucial determinants directly influencing the industrial development in the states. Such an exercise would be useful for decision makers on industrial investments.

Infrastructure is now increasingly becoming one of the major indicators to measure the standard of living of the people in the region. There is no single indicator which gives an overview of the level of development of the physical infrastructure in each state of India. Here we have made an attempt to develop an aggregate index of physical infrastructure development across the states. The physical infrastructure items identified for estimating the aggregated index are :

- (i) *Length of roads* which indicates the access to the hinterlands of economic activity and the accessibility of the region with respect to other regions.
- (ii) *Navigable waterways* are mainly controlled by topographical characteristics of the region. They also positively contribute to the bulk movement of commodities for activating the lifeline of major economic operations. Sometimes they can function as a substitute to roads and rails.

- (iii) *Railways* have been widely studied and identified as having a positive correlation with industrial development. They enable mass transit of goods and people across long destinations, thus making the national economy vibrant.
- (iv) *Telephones* facilitate the communication network essential for modern business ventures.
- (v) *Electricity* has become a basic component for industrial development as most of the modern industrial equipments are electric-motive. Without electricity other developmental benefits cannot be reaped effectively.
- (vi) *Commercial banks* provide the vital financial infrastructure in the case of a market economy. They are the lubricant supplier of the financial flow mechanism in the economy.

In the present study we have ranked the 15 major Indian states according to the level of infrastructure development achieved by them in regard to the above indicators. We have combined the above indicators, viz. road length, navigable waterways, railway route length, telephones, electricity supply and spread of commercial banks into a single index. In order to neutralise the impact of the differing size of each state, we have considered each variable as a proportion to the population of the state. The indexes indicate that infrastructure development is a harbinger of greater developmental process through industrialisation in the state economy.

Methodology

The first step is to define the measure of deprivation that a state suffers in the case of each of the six basic variables—Roads (X1), Waterways (X2), Railways (X3), Telecommunications (X4), Electricity (X5) and Commercial banks (X6). Maximum and minimum values are determined for each of the six variables, given the actual values. The deprivation measure then places a state in the range

of zero to one as defined by the difference between the maximum and the minimum. Thus l_{ij} is the deprivation indicator for the j th state with respect to the i th variable and it is defined as :

$$l_{ij} = \frac{\left(\max_j X_{ij} - X_{ij} \right)}{\left(\max_j X_{ij} - \min_j X_{ij} \right)}$$

The second step is to define an average deprivation indicator (l_j). This is done by taking a simple average of the six indicators :

$$l_j = \sum_{i=1}^6 l_{ij}$$

The third step is to measure the Infrastructure Development Index (IDI) as one minus the average deprivation index :

$$IDI = (1 - l_j)$$

To make the results more comprehensible the state ranking the highest in IDI has been calculated as 100 and the IDI for all other states have been taken as a proportion to it. Results of our computations are given in table 1.

Table 1. Infrastructure Development Index in fifteen Indian states (1990-91)

| Sl.No. | State | Length of road per lakh population* (kms) | Navigable waterways per lakh population** (kms) | Railway route per lakh population (kms) | Telephone per 100 Population @ (Nos) | Electricity per 100 population (units) | Commercial Banks per lakh population (Nos) | IDI |
|--------|----------------|---|---|---|--------------------------------------|--|--|-----|
| 1. | Punjab | 284.8 | — | 10.70 | 3.12 | 80120 | 10.59 | 100 |
| 2. | Gujarat | 194.6 | 0.69 | 12.84 | 3.03 | 59300 | 8.17 | 69 |
| 3. | Haryana | 193.6 | — | 9.19 | 2.69 | 62030 | 7.73 | 66 |
| 4. | Rajasthan | 243.6 | — | 13.28 | 1.69 | 29690 | 6.94 | 57 |
| 5. | Assam | 302.2 | 8.89 | 11.07 | 2.05 | 5458 | 5.42 | 56 |
| 6. | Karnataka | 310.1 | 0.99 | 6.84 | 1.72 | 34700 | 9.52 | 48 |
| 7. | Kerala | 383.8 | 5.33 | 3.39 | 1.19 | 24780 | 9.75 | 47 |
| 8. | Orissa | 463.6 | 3.13 | 6.35 | 1.79 | 23790 | 6.59 | 46 |
| 9. | Tamil Nadu | 297.0 | 0.38 | 7.11 | 1.77 | 39120 | 7.58 | 40 |
| 10. | Maharashtra | 293.3 | 0.63 | 6.80 | 1.54 | 51110 | 6.97 | 39 |
| 11. | Andhra Pradesh | 246.6 | 3.01 | 7.62 | 1.40 | 33780 | 6.91 | 38 |
| 12. | Madhya Pradesh | 222.7 | — | 8.87 | 1.25 | 30150 | 6.54 | 36 |
| 13. | Uttar Pradesh | 147.8 | 1.76 | 6.42 | 1.30 | 20304 | 6.07 | 18 |
| 14. | West Bengal | 105.4 | 3.44 | 5.61 | 0.81 | 14910 | 6.16 | 13 |
| 15. | Bihar | 119.6 | 1.46 | 6.15 | 0.97 | 6040 | 5.61 | 7 |

* Road length figures relate to 1984 and Population figures to 1981 Census.

** Population figures relate to 1991 Census.

@ Relates only to cities of 1 lakh population and above.

- Sources : (1) Length of roads :Pocket Book on Transport in India, Transport Research Division, Ministry of Surface Transport. GOI, New Delhi 1989.
 (2) Navigable waterways :Source same as in (1). Table 10.1.
 (3) Railway route :Year Book, Indian Railways, Railways Ministry 1990-91.
 (4) Telephones :Indian Telecommunication, Telephones, Table 11—Number of Telephones (DELs), Population and Telephone Density, Indian cities (state wise) - 1991.
 (5) Electricity :Current Energy Scene in India, Centre for Monitoring Indian Economy, May 1992.
 (6) Commercial Banks :Report on Trend and Progress of Banking in India, 1990-91 (July-June), Supplement to RBI Bulletin, April 1992.
 (7) Population figures :Provisional Population Totals (Paper 2, Series - 1), Census of India 1991, Registrar General & Census Commissioner, India, August 1991.

Complied by :
N.K. Nair & K.P. Sunny



Air Pollution from Industrial Boilers

NPC Pollution Control Division

In India, there are over 50,000 registered industrial boilers (water tube and fire tube type) of capacities ranging from 0.25 T/Hr to 30 T/Hr generating steam for meeting various process requirements. These boilers differ widely in terms of furnace construction, fuel usage and combustion mechanism and range from most primitive Lancashire boilers to advanced semi-automatic fluidized bed boilers. Coal is the most dominant fuel used followed by oil and natural gas. Non-conventional fuels like rice husks, cotton stalk, bagasse etc. are also used wherever available as residues or byproducts.

Pollution Scenario

Industrial Pollution Control Cell of NPC since its inception in 1984 has carried out over 100 air pollution monitoring studies covering a wide range of boilers. The emission data obtained during these studies relating to dust, sulphur dioxide and other gases are summarized and presented in table 1.

Air Pollution

1. Combustion emissions

The main source of air pollution from industrial boilers is the release of dust and gas emission during fuel combustion. The dust emissions during coal combustion in boilers consist primarily of unburnt carbon and ash containing silica, alumina, iron oxide and alkali oxides. Gas emissions are mainly sulphur oxide (SO_x), nitrogen oxides (NO_x), carbon monoxide and hydrocarbons. The dust emissions from oil and gas combustion are comparatively lower and mainly in the form of unburnt carbon and sulphates. In the case of non-conventional fuels, the dust emission is higher on account of higher ash content.

2. Fugitive emissions

In larger capacity boilers using coal as fuel, fugitive dust may be emitted from several sources of coal sizing/handling systems. This can be prevented to a certain extent by maintaining the coal in wet condition. Fugitive emissions also arise from coal storage yard on account of

wind erosion. Lorry movement during transport of coal in and out of storage yard and loading/unloading of coal also lead to fugitive emissions.

Solid and Liquid Wastes

These wastes mostly arise as a result of action to control air pollution in form of pollution control devices. Solid wastes occur in the form of residual ash left after combustion of coal. Fly ash is arrested in the outlet of air pollution control system. These solid wastes are disposed for land filling and making products like bricks and cement. Liquid effluents are generated during regeneration of demineralized water plant/water softener and in wet pollution control systems like scrubber. In the case of oil as fuel, solid waste can occur in the form of unburnt carbon (soot) in burners and sludge in oil storage tank.

Factors Influencing Emissions

The factors influencing emissions are:

- Type of combustion equipment
- Type and quality of fuel
- Combustion conditions
- Boiler load.

Pollution Control

Combustion practices like proper sizing of fuel, uniform firing, excess air control and draft optimization go a long way in reducing source emissions and promoting combustion efficiency. Most large coal-fired boilers require some form of control system like multiclone/scrubber/bagfilter to limit the dust concentrations in the flue gases. Sulphur dioxide concentration (proportional to sulphur content in the fuel) governs the stack height which should be sufficiently tall for safe dispersion of sulphur dioxide into the atmosphere. Particle size distribution (PSD) is the most important parameter for the design and selection of suitable control system. A typical PSD analysis from coal-fired Industrial boiler for manual firing and spreader stoker firing is presented in table 2.

Table 1: Typical Stack Emissions from Industrial Boilers

| Type of Boiler | Rated Capacity T/Hr | Actual Capacity T/Hr | Gas Composition (%) | | | Temp °C | Flow Rate of gases Nm ³ /Hr ^A | Dust Emissions | | SO ₂ Emissions | | Control System | Emission Standard mg/Nm ³ |
|---------------------------|---------------------|----------------------|---------------------|----------------|-----|---------|---|--------------------------|------------|---------------------------|------------|----------------|--------------------------------------|
| | | | CO ₂ | O ₂ | CO | | | Conc. mg/Nm ³ | Load Kg/Hr | Cont. mg/Nm ³ | Load Kg/Hr | | |
| Coal Fired Boilers | | | | | | | | | | | | | |
| FT(C) | 0.175 | NA | 6 | 11 | - | 227 | 2150 | 966 | 2.08 | 235 | 0.51 | - | 1600 |
| FT(C) | 1.5 | 1 | 5 | 15 | - | 317 | 3200 | 470 | 1.5 | 148 | 0.47 | - | 1600 |
| WT | 2 | 1 | 5.3 | 16.0 | - | 260 | 3545 | 771 | 2.73 | 287 | 1.02 | - | 1200 |
| FT | 4 | 2 | 4.5 | 15.5 | - | 100 | 4340 | 1091 | 4.73 | 747 | 3.2 | - | 1200 |
| WT | 4 | 1.5 | 2.6 | 18.0 | - | 155 | 10300 ^C | 719 | 7.4 | 82 | 0.84 | - | 1200 |
| FT(L) | 6 | NA | 5.3 | 15.2 | 0.1 | 378 | 19400 | 415 | 8.0 | 2822 ^D | 54.75 | - | 1200 |
| FT(L) | 7 | 5.5 | 3.0 | 1.7 | - | 355 | 11835 | 286 | 3.40 | 296 | 3.50 | - | 1200 |
| FB | 12 | 7.5 | 9.5 | 11.7 | - | 105 | 10500 | 225 | 2.36 | 500 | 5.25 | M/B | 1200 |
| WT | 30 | NA | 11.5 | 9.5 | - | 169 | 40780 | 461 | 18.8 | - | - | M | 150 |
| Oil Fired Boilers | | | | | | | | | | | | | |
| PB (FD) | 1 | NA | 12.9 | 3.5 | - | 304 | 685 | 189 | 0.13 | 343 | 0.23 | - | 1600 |
| PB (FD) | 1.2 | NA | 8 | 11.8 | - | 117 | 1611 | - | - | 1432 | 2.30 | - | 1600 |
| PB (FD) | 2 | NA | 9 | 11.7 | - | 210 | 8627 | - | - | 1746 | 15.06 | - | 1200 |
| PB (FD) | 5 | 5 | 11 | 9.4 | - | 195 | 9090 | 65 | 0.6 | 45 | 0.41 | - | 1200 |
| PB (FD) | 6 | NA | 9 | 9.10 | - | 180 | 3410 | 339 | 1.16 | 1052 | 3.58 | - | 1200 |
| PB (LDO) | 8 | NA | 9 | 11 | - | 144 | 3260 | 55 | 0.18 | 530 | 1.73 | - | 1200 |

WT — Water Tube
 FT(L) — Lancashire fire tube boiler
 FT — Fire tube
 NA — Not available
 FB — Fluidized bed boiler
 PB — Packed boilers
 FT (C) — Cochran fire tube boiler
 B — Bag filter
 M — Multiclne

Table 2. Typical Particle size distribution analysis

| Particle Size (in microns) | Percentage of particles | | |
|----------------------------|-------------------------------|----------------|--------------------------|
| | Manual (1.5 TPH) ^E | Manual (4 TPH) | Spreader stoker (30 TPH) |
| > 1 | 55.6 | 86.8 | 88.8 |
| > 2 | 48.1 | 78.2 | 81.1 |
| > 5 | 37.3 | 59.9 | 64.2 |
| > 10 | 29.0 | 41 | 45.7 |
| > 15 | 24.4 | 29.1 | 33.6 |
| > 20 | 21.2 | 21.2 | 25.2 |
| > 30 | 17.1 | 11.7 | 14.6 |

A Nm³ corresponds to normal temperature of 25°C and normal pressure of 760 mm Hg
 B Variation in SO₂ emissions particularly in oil fired boilers is on account of variation of S% in fuel
 C High air infiltration
 D High SO₂ on account of Assam coal fired in the boiler
 E Case of heavy fines in the coal

Complied by:
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Energy Audit In Re-Rolling Mills

NPC Energy Management Division

Steel re-rolling is the most popular method of producing finished steel all over the world. Almost all steel products made from steel are finished in the re-rolling process. With the increasing requirement of steel in the country and limitation of the main steel producers to meet this growing demand, the secondary steel sector has been identified as an alternate and viable source to meet the country's future steel requirements.

It is estimated that there are about 1100 re-rolling units in the country producing 5.5 million tonnes of rolled products per year of various size and shapes. These include rounds, squares, wire/rods, structural, loops slabs/plates and special sections like I beams, angles, wide flange beams, Zees, tees and H-piles. Unfortunately this industry has developed haphazardly adopting old conventional technologies. Even then the growth of this sector as a whole has been stupendous and is expected to reach 6 million tonnes by 2000 AD.

Process Description :

Most of the steel re-rolling mills receive their raw materials from integrated-steel plants or from mini steel plants. The raw materials are generally received in the form of ingots, blooms, slabs or billets. Higher sized ingots, blooms and slabs are gas cut to proper sizes of billets and then sent to the grinding house for trimming.

Billets are first heated in oil/coal fired reheating furnaces which can be of continuous type and heated to rolling temperature of around 1100°C to 1200°C. It is then processed in a rolling mill into finished products such as bar and rod stock.

As the billets are carried through the rolls, the hot plastic steel is squeezed to a smaller thickness. The rolls are brought closer together on each pass causing the billet to get longer and thinner as it passes between rolls. The rolled shapes become quite long and must be cut to

standard customer length. Finishing mills are of continuous type having number of mill stands, each adding to the final shape.

Energy Use

The primary energy sources in the re-rolling mills are electricity, coal or fuel oil in the form of furnace oil, R.F.O., LSHS and L.D.O. Thermal energy is required for heating the steel before the rolling operation and electrical energy is required to run the mill and other auxiliaries of furnace, mill and lighting.

The energy cost as a percentage of total sales works out to about 3.2 per cent. Fuel oil/coal accounts for about two third of the energy cost. Furnace oil is the most commonly used fuel in the reheating furnaces. Out of the total units surveyed by NPC, about 65 per cent are using oil and the rest are using coal as the main thermal energy input. Electrical energy is used by all the units to run their motive loads. About 70 to 80 per cent of the total electrical load is connected to the main mill motor and the remaining 20 to 30 % is in the auxiliaries.

The specific thermal energy consumption in oil fired furnace is in the range of 57 to 80 litres per tonne of finished product whereas in coal fired furnace it is in the range of 120 to 213 Kgs. The specific electrical energy consumption is in the range of 60 to 165 Kwh per tonne of finished product.

Energy Conservation

Thermal energy is the major source of energy in re-rolling industries. The results of preliminary energy audit conducted in 12 re-rolling units shows that an average 20 % of thermal energy and only 2% of electrical energy can be conserved by implementing energy conservation measures.

The energy conservation potential and investment required for both thermal and electrical energy have been assessed for all the 12 units studied and are shown in table 1.

By reduction of excess air in reheating furnace 50 % of the total energy can be conserved. Other major areas identified for energy conservation are recovery of waste heat from flue gas (20.6 per cent and use of ceramic fibre veneering module as hot face insulation in furnace (19.6%).

Certain long term measures for conservation of energy have also been identified such as going in for three zone over fired/under fired furnaces and adoption of high efficiency furnaces like walking beam furnaces for billets of higher sizes.

Table 1 : Details Of Annual Saving Potential

| Plant | Annual Savings | | Percentage of existing energy saving | | Investment (Lakh Rs.) | Annual saving (Lakh Rs.) | Payback period (months) |
|-------|--------------------------|----------------|--------------------------------------|------------|-----------------------|--------------------------|-------------------------|
| | Thermal Coal (T)/oil(KL) | Electrical Kwh | Thermal | Electrical | | | |
| A | 254.87KL | - | 7 | - | 1.37 | 8.66 | 2 |
| B | 337.00 KL | 33,600 | 33 | 3 | 1.72 | 11.168 | 2 |
| C | 339.29 KL | - | 19.24 | - | 0.97 | 11.538 | 1 |
| D | 254.00T | 26,500 | 16.39 | 3.63 | 0.885 | 2.305 | 6 |
| E | 181.36 KL | - | 19.1 | - | 1.89 | 6.16 | 4 |
| F | 321.00 KL | 13500 | 21 | 1 | 1.42 | 11.11 | 2 |
| G | 181.62 KL | - | 28 | - | 2.35 | 6.175 | 6 |
| H | 70.5 KL | - | 9.82 | - | 0.58 | 2.396 | 3 |
| I | 191.5 T | 6000 | 17.41 | 1.43 | 0.3 | 1.64 | 3 |
| J | 210.00 T | 5000 | 30.0 | 3.33 | 1.41 | 2.069 | 12 |
| K | 489.78 KL | - | 18.83 | - | 1.56 | 16.65 | 2 |
| L | 254.00 KL | - | 25.65 | - | 1.62 | 8.62 | 3 |

Compiled by :
S. Gopinath
H.R. Prabhu



QUALITY AUDITORS

Even under ideal conditions, someone is needed to verify that the system is working. Independent quality control auditors often perform this function. Auditors verify that the operators are following the right procedures when making and checking the product. Auditors may inspect parts, assemblies, and materials part of the audit, but their main responsibilities involve the system.

The number of auditors needed in a plant with good self inspection is less than the number of inspectors needed in a plant with no self-inspection.

Source: Edward M. Sehrock & Henry L. Lefevre
The Good & Bad About Quality, Marcel Dekker
New York, 1988.

News & Notes

TAPPING AN UNFAMILIAR LODGE

To the typical chemical engineer, the title "industrial engineer" is likely to conjure up a person with a clipboard and a stopwatch analyzing how items come off an assembly line—useful may be if you're making ballpoint pens, but certainly not for chemical-process production. That's more or less the way we felt last September when we unenthusiastically accepted an invitation to a three-hour presentation on industrial engineering's relevance to the chemical process industries.

What we heard quickly changed our minds. The get-together, which was sponsored by the Institute of Industrial Engineers (IIE, Atlanta), made it quite obvious that IEs involve themselves with a host of matters of real importance to a chemical-process plant: inventory assurance, maintenance, material tracking and control, inventory management and process integration, to name just a few of them.

The meeting did more than open our eyes. It also led to a technical session cosponsored by Chemical Engineering and IIE, entitled "Raising Productivity and Quality in Chemical Process Plants," for presentation at the Institute's 1992 annual conference at Rosemont, Ill., in late May. Most of the speakers were not only confirmed believers in industrial engineering's relevance—they were also chemical engineers by education, and held key positions at chemical process facilities.

For instance, Ray Floyd, the site manager of Exxon Chemical's vast Baytown, Tex., operation, explained how just-in-time manufacturing (in essence, producing material only as needed) can reduce not only the inventories but also the waste at CPI plants. Operations manager Michael McCandless from Union Carbide's South Charleston, W.Va., chemical facility narrated the careful planning and prudent execution of a program that has significantly been raising workers' efficiency at that long-standing plant.

A practical multistep program for attaining better maintenance was outlined by Kevin Bodine, manufacturing manager for compounded plastics at B.F. Goodrich's

Avon Lake, Ohio, plant. And general manager R.K. Singhanian and maintenance manager Michael Smith of BASF's Freeport, Tex., complex showed how chemical-process plants can benefit from total productive maintenance (TPM), a systematized, people-oriented approach that is drawing much attention in industrial-engineering circles. Fred Florian, TPM resource person for Dupont's Camden, S.C., synthetic fibers operation also described his firm's success with applying TPM.

Capping the meeting were case histories of applications of industrial engineering at Air Products & Chemicals. They were described by Hermann Ortega, vice president and general manager of the Mfg. Div. in that firm's Chemicals Group.

Unless we've already heard about such success, we chemical engineers tend to have a problem when first looking over the industrial engineer's shoulder. We're used to dealing in precise and concrete concepts, such as heat-exchanger calculations and liquid-homogenization principles, and the seeming fuzziness of industrial engineering's activities is likely to put us off.

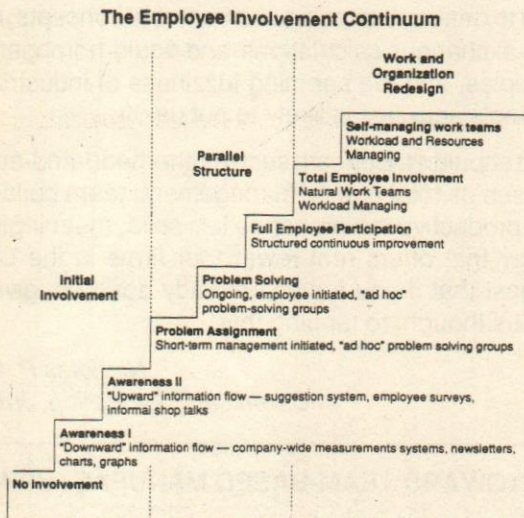
It shouldn't. Beneath such motherhood-and-apple-pie phrases as total quality management, team building and total productive maintenance lies solid, meaningful technology that offers real reward for firms in the CPI. We suggest that if you haven't already done so, give some serious thought to tapping this.

*Nicholas P. Chopey
in Chemical Engineering, July 1992.*

TOWARD TEAM-BASED MANUFACTURING

There are many perceptions of what a high-performance organization is. However, there are common threads most managers agree to. The high-performance organization is characterized by high levels of effectiveness, efficiency, quality, productivity and profitability, and involves people at all levels of the organization. Understanding these characteristics is important to understanding the high-performance organization.

1. Effectiveness—the organization accomplishes the “right” things on time and in the right manner. Simply, the organization does what it says it will do and what it is supposed to do. Promises are sacred, and the organization accents nothing short of meeting its promises to its customers.
2. Efficiency—the ratio of resource expected to be consumed and the resources actually consumed doing the “right” things.
3. Quality —Quality is focused in two directions: toward the process and toward internal and external customers. The organization attends to the quality of its manufacturing system from its suppliers and the receipt of materials, through production, assembly, inspection, and distribution to its customers. The company strives to manufacture products that exceed its customers’ demands, needs, desires, requests, etc.
4. Productivity—the efficiency by which raw materials are transformed into products or services, using the “right” amount of resources to get the “right” things done.
5. Profitability—the relationship between revenues and costs. Manufacturing companies must be profitable. They cannot continually spend more than they make if they wish to exist in the future.



Robert J. Ferenze,
quoted in

Manufacturing Competitiveness Frontiers, Jan, 92

ELECTRONIC SOCIETY : SINGAPORE

By 2007 all Singaporean homes, offices and places of

work will be connected together by computers and optical fibres making Singapore one of the first, truly electronic societies on the planet. This futuristic vision of the island Republic was painted by Mr Tan Chin Nam, Chairman of the National Computer Board (NCB) when he recently unveiled IT2000, a strategy to turn Singapore into an “intelligent” island in the next 15 years. IT2000 envisages every school, factory, office and home being connected by computers providing rapid access to services and information.

From the home a screen which doubles as a computer, television, video camera and telephone will allow electronic shopping, banking and “paperwork”. Friends will be able to link together and see each other, a distinct advantage for the elderly or immobile. Education will be brought to the living rooms and offices of all Singaporeans who want to participate in conferences and lectures given in any part of the world. For the busy housewife or husband, voice recognition will allow recipes to appear on screen after the utterance of an ingredient or two. Bedtime reading will take on a new meaning because the book itself will not come from a bookshelf but from a vast library of electronic texts selected by the consumer and read from the screen in his or her bedroom.

For industries, intercontinental product development will become an electronic reality as NII will facilitate the transfer of documents, designs and live pictures to and from anywhere in the world. This in turn will help to transform Singapore into a world centre for creative services.

IT2000 is not an eccentric scientist’s pipedream. It was put together by 200 senior executives and academics under the auspices of the NCB. Already, feasibility plans are being drawn up to turn many of these ideas into reality. Several of them will point the way to new research and development which will have to be undertaken if IT2000 is to meet the high goals and objectives it has set itself. In this regard the National Technology Plan (NTP) to promote indigenous R&D has an important role to play.

Its aim is to increase Singapore’s spending on R&D from 1.0 percent of GDP in 1991 to 2.0 percent by 1995. Compared to Taiwan’s 1.3 percent, South Korea’s 1.8 percent and Japan’s whopping 2.9 percent, it’s clear that if the Republic is to join the ranks of innovation driven economics, more must be done to promote indigenous R&D. This is exactly why the SGD2 billion National Technology Plan (NTP) has been conceived.

Funds will be invested in projects which develop skills and technologies for industry but which are presently lacking in the private sector. It will also be used to attract

200 research scientists annually to Singapore. Tax incentives and allowances will also encourage private industry to increase its share of the R&D effort from its present level of 66 percent of all research carried out in Singapore.

The NTP is administered by the National Science and Technology Board (NSTB) who will also be creating a technology corridor of advanced research institutes in southwest Singapore. In addition, NSTB with the National University of Singapore Computer Centre, will be linking scientists together through TechNet which in turn will be linked to InterNet a global scientific network. Technet subscribers will be able to organize computer conferences nationally and internationally, submit journal articles for review and so on. TechNet will facilitate the exchange of ideas and data and provide a higher profile in the international community for Singapore's scientific personnel.

Access
No.1. June 1992

MIDDLE MANAGERS: DYING OUT?

Traditionally middle management has acted as a conduit between top management and shopfloor. Some argue that information technology (IT) is taking over this role. But, although IT can monitor, report, and support the decision-making process, it rarely offers two-way communication. So, for example, a VDU on the senior manager's desk might provide shopfloor statistics, but it won't give feedback about people's feelings and concerns.

Too many middle managers, however, can inhibit communication. Murray Steele, senior lecturer in strategic management at Cranfield School of Management, believes delayering stems from past neglect by senior management. There is, he says, much evidence of gross overmanning at middle management level resulting in vast bureaucracies which stifle innovation and paralyse flexibility.

Steele cites a real, but anonymous, example: "A business took 900 people, mainly middle managers, out of its operations division and reduced the number of layers from the operations director to the frontline employees from 12 down to four. By doing this it took 10 million out of the cost base and sales went up."

And the reason? Prior to the restructuring, the company was tied up in red tape with middle managers only there to say 'no'. "So the company couldn't move. It was the organizational misfits prepared to break the rules who got things done", says Steele.

Malcolm Wheatley, who conducted the BIM survey, agrees that middle management can be an obstacle to the free flow of information: "[In the Eighties] company after company found that 'delayering' exercises could not only strip out managerial costs but actually improve the top-to-bottom communication that the in-between layers were notionally there to provide", he says.

Of the future, the BIM survey reports: "A glance at the work of middle managers shows that many of them are first line troubleshooters: directed rather than directing, they are the first port of call—upwards and downwards—when things go wrong. Late deliveries, quality problems, customer complaints, rescheduling, sudden stockouts: these are the grist of the middle managers's mill.

"The whole ethos behind Just-in-Time and Total Quality in particular is the eradication of all these sorts of problems."

But, despite an apparently inevitable move towards flatter organizations, the survey reveals a remarkable complacency among middle managers; four fifths of those surveyed feel that delayering poses no threat to their current job. They are wrong—by definition, it does.

So, what can middle managers do? The answer is improve key management skills such as team-building, leadership, motivation and appraisal.

But there is insufficient emphasis on training and development, even among the managers themselves. The Industrial Society's Forrest is worried: "People are being pitchforked into new, broader and in many ways more stressful jobs. The problem with redeployment is that most managers have not acquired many transferable skills."

He offers this advice: "Middle managers need to become more self-reliant and think in terms of a sideways spread of skills, not vertical promotion. The higher they get in an organization, the broader their skills must be."

Works Management
April 1992

TAPPING THE POTENTIAL

Agriculture is the backbone of most developing economies. For the majority of populations it is the primary means of sustenance. In China and India, the two countries with the greatest populations, as many as 75-80% depend on agriculture for their main livelihood.

With underdeveloped infrastructure and communications facilities, access to information, technology and the

latest agricultural developments has been limited. But the extensive spread of television coverage in the last seven to ten years has largely overcome this problem.

India's inherent agricultural advantages include a surplus of land for cultivation; almost continuous sunlight all year round; qualified and talented agricultural scientists and technicians who can absorb high technology; fairly good irrigation facilities and cheap labour.

All of these have helped the country to become self-sufficient in food grains. From independence in 1947 when India found it difficult to feed 330 million, we now have no problem in feeding a population of 850 million. India is now the largest producer of millet and groundnut world-wide, and the second largest producer of rice, rape-seed and sugar cane.

A surplus of grains has even been created for difficult times. Food grain production has increased so steadily that exports have become possible, though only in small quantities so far. Yet only around 20% of India's agricultural potential has been exploited to date.

The problem is no longer inadequate production but low productivity in terms of yields per hectare. Worldwide, India is ranked 33rd in terms of yield per hectare of rice produced, 29th for wheat, 43rd for millet, 32nd for groundnut and 31st for rape-seed. The situation highlights the need for modern technology. For, with appropriate and timely technological inputs, India could produce at least four times more food grain per unit of land.

Technology would also lead to better use of the country's fruit crops. India is currently the third largest producer of fruits in the world after Brazil and the U.S. It accounts for more than 60% of the global output of mangoes, 15% of papaya, 11% of banana and 8% of pineapple. Its overall share in world fruit production is about 7.7%.

Unfortunately nearly 30% of the total fruit production worth Rs30 billion (\$1 billion) is lost annually due to poor pre-and post-harvest infrastructure. Where the processed fruit industries in most other countries use about 70% of the fruit produced, in India the figure is barely 0.5%. The large variance between the quantity of fruits produced and those processed underlines the vast expansion potential.

But we need technology. With modern processing equipment and technology India can become a major source of global supply of both fresh and processed fruits and vegetables.

Developing countries may also have a significant role to play in making the environment-conscious programmes of the West more cost effective. One example of efficient collaboration would be on the large-scale re-forestation which is now taking place in North America and Europe, using tissue culture to grow the saplings that are eventually planted.

The tissue culture process has a substantial labour requirement, very expensive in developed countries where wage costs are already high and keep on spiralling. It would therefore be of mutual advantage if tissue culture technology were to be transferred to developing countries. Abundant land available for cultivation coupled with low wage costs means saplings can be grown and sent back for reforestation at far less cost. The entire activity is commercially viable.

Cooperation between developed and developing countries has been limited so far. This was primarily because of the protectionist policies that existed in most developing countries. But things have begun to change in the last few years: economies are rapidly opening up with foreign investment and technologies being actively sought. Developing countries whose sole aim used to be self-sufficiency, irrespective of the costs involved, are now steering a new course. Self-sufficiency has lost its charm.

What both developing and developed countries need now is greater cooperation and the removal of all obstacles and barriers. Competitive advantages that already exist and those that can be generated must be channelled and harnessed to benefit a wider spectrum of people.

The principle can be applied across the board, but it is of primary importance in agriculture where cooperation can benefit larger numbers of people, while tapping developing countries' competitive advantages in that sector.

Agriculture is the most appropriate vehicle for stronger North/South cooperation and the mutual advantages it can help generate are potentially far in excess of the benefits that may arise from cooperation in any other field.

*Neelkanth Kalyani
in WORLDLINK,
May-June 1992*

EXPORT PROCESSING ZONES

Global markets require global manufacturing, and export processing zones (EPZ) are duty-free areas dedi-

cated to manufacturing. They provide the high-quality industrial infrastructure needed to maximize the efficiency of the "global factory" —a plant that uses raw materials, parts components and supplies from anywhere in the world and produces products that may be sold anywhere in the world.

No customs duties are charged for entry of the materials and supplies used to produce manufactured goods, provided these are then exported. The zones supply land, buildings and many helpful services to the manufacturers. There are more than 200 EPZs employing nearly 2 million workers in over 50 countries around the world outside the USA.

The following facts illustrate the current status of export processing zones worldwide:

- * The USSR had proposals from 60 cities to establish EPZs as a means to link into the global market economy. Today, following the breakup of the Soviet Union, only a few of these have been formed.
- * A World Bank study of 86 Third World EPZs in 1991 shows a dozen to be efficient and profitable. The rest, averaging about 4,000 employees each, need to double in size to break even. But they are established in many countries that had no export manufacturing infrastructure at all a few years ago.
- * After seven years in preparation, US law was changed in 1992 to encourage manufacturing in general purpose foreign trade zones, as well as in subzones. Honda motor vehicles are now produced in Ohio for the Japanese market in a US Foreign Trade Subzone.
- * A groundswell of business interest has been noticed in the European Community's zones, especially to continue and expand barter trade with Eastern Europe.
- * The Mexican Maquila industry employing nearly 500,000 workers in about 2,000 factories is second only to the petroleum industry in earning foreign exchange for Mexico.
- * Japan, Taiwan and Korea have established trading centers under zone rules in the Netherlands to serve the interests of their national manufacturers. Taiwan is building 11 EPZs around the world to provide sites and service for its global manufacturing sector.
- * In Lesotho, a "least developed" country surrounded

by South Africa, China is investing in garment manufacturing in the industrial zone to export high-quality apparel to Europe under the Lomé Convention—with a plan to increase output by tenfold in 1992.

*Richard L. Bolin
in WORLDLINK
No.2, 1992*

ENVIRONMENTAL FACTORS & QUALITY CIRCLES

Economic Factors

In a subsistence economy with high employment, the labour force generally is more concerned about satisfying their basic needs and about the security of their jobs. Hence, the question of employing Quality Circles will be more of taking a humanistic view of industrial society rather than securing commitments from workers. A suggestion scheme is likely to work equally well under such circumstances as far as productivity is concerned.

Poor market or bad economic conditions tend to result in redundancies or retrenchment too. If an organisation is truly paternalistic, then the workers and management are likely to seek to overcome the problem via agreed lower take-home pay until the crisis is over. In Japan, even when there are lay offs, it is done in such a fashion that the employees who need incomes are the most protected. The burden of adjustments is taken by those who can afford it. In such situations, Quality Circles will not work well because management cannot talk about welfare and retrenchments at the same time.

Political Factors

Political factors have a lot to do with the growth of quality circles. Where the government takes an active interest in Quality Circles, national bodies and institutions also take interest in which concerted efforts are put in to promote their growth. This is normally followed by intensive public media coverage and with speeches by ministers to support the Quality Circle movement during conferences, seminars etc. Singapore, Hong Kong, Philippines and Malaysia are such examples where Quality Circles have grown very fast due to political and government support.

Technical Factors

Quality Circles are likely to be very important in advanced technology where commitment of workers is very

necessary to ensure productivity. While traditional assembly line or production can be controlled by supervision, this becomes less effective. If we go on to automation it is difficult to monitor all worker's tasks directly due to their high level skills. Hence, workers are likely to be relatively independent in their work and thus requiring more commitment for which Quality Circles would be extremely useful as a concept. Quality Circles are also very useful in areas of rapidly changing technology because the involvement of operators and others can give rise to the development of new methods of working.

Quality Circles have their basis and background in motivational theory. Many of the behavioural theories discussed here have been proved in practice. The outcomes of various Quality Circle surveys are ample evidence. The Quality Circle concepts and philosophy is a more complex subject for implementation successfully, than it seems. Both extrinsic and intrinsic rewards are integrated into the nature of jobs with Quality Circles. However, Quality circles should not be treated as entirely a behavioural science concept. There should be a recognition that their success lies in CWQC or TQM systems which help to inculcate a sense of problem solving, quality and improvement consciousness as a way of life.

Ajit Singh,
Quality Circles
National Productivity Council, 1992.

THE PACIFIC RIM—WORKERS ON THE MOVE

Over 300,000 Asian workers pack their bags each year and head for the wealthier countries of the Pacific Rim. From Bangladesh, the Philippines, Indonesia and elsewhere, they set their sights on better job prospects and higher wages overseas, with Japan, Singapore, and the Republic of Korea among the most likely destination. As the 1992 World Labour Report points out: "Other regions of the world struggle with pacts and federations and economic integration, but the Pacific Rim seems to be achieving much the same result on a more informal basis. Capital and labour are swirling round the region in currents of ever increasing complexity."

At one level the mechanism is simple: the pull of labour shortage from the more advanced countries, and the push of poverty from the sending countries. But government policies and considerations of long-term planning often conflict with such elemental market forces. The governments of the richer countries say they do not want to see

so many unskilled labourers arrive on their shores. And, as a result, around half the region's migrants are working illegally. The issue is most acute in Japan. That is the only developed country which has not used immigrant labour at times of labour shortage—a very different approach to that of the United Kingdom in the 1950s, for example, or of Germany, which in the 1970s employed large numbers of *Gastarbeiter*. Japan's solution has been to export labour-intensive assembly processes to neighbouring countries such as the Republic of Korea and Taiwan and China, and simultaneously to increase the productivity of industries (such as steel) which it kept at home.

But this strategy may no longer work. For one thing the labour shortages are much more acute, with 1.46 vacancies for every job-seeker. There are fewer new Japanese workers overall because the birth rate is dropping. But there are even fewer Japanese candidates for jobs which the new and more choosy generation of workers identifies with what in Japanese are the three "K's" - *Kitani*, *Kiken* and *Kitsuis*; and in English are the three "D's" - "dirty, dangerous and difficult". Construction, for example, is a three-K industry which is now facing a 39 percent labour shortage.

The Japanese Government is reluctant to fill the vacancies with foreign workers, and nervous about social and welfare problems this might create. In fact it has recently tightened up its immigration laws with heavy fines for offenders, both workers and employers. And RENGO, the Japanese Trade Union Federation, also opposes using foreign workers, pointing out the dangers of exploitation of immigrants and arguing instead that more women and older people should join, or re-join, the labour force. In practice, many needs are being filled by illegal immigrants. The Government says there are around 100,000 (though employers suggest there are five times as many). Most enter Japan as tourists. Some just work 12-hour days for three months of their permitted stay: others overstay their visas. In 1990 a record 29,884 were caught and sent home. The business community in Japan is pressing for a change in policy. One suggestion is that one per cent of the total labour requirement be open to foreign workers. But so far the Government is standing firm.

The four newly-industrialising countries of the region are facing similar dilemmas. Hong Kong, the Republic of Korea, Singapore and Taiwan, China are all running into labour shortages. The Republic of Korea, for example, was short of an estimated 190,000 manufacturing workers in 1991. Again the problem is a slowing birth rate combined with the higher aspirations of the new generation—95% of Korean high-school students now want to go to college.

These four countries have in the past followed diverging different policies on migration, ranging from absolute prohibition, as in the Republic of Korea, to the more open approaches of Hong Kong and Taiwan, China, Singapore has taken the most distinctive line: taking in "guest workers" when labour is short and expelling them when no longer needed. And Singapore has also, for industries like construction restricted the percentage of the workforce which can be foreigners, as well as charging employers a flat tax per person on unskilled foreign labour.

But all four are now taking a harder line. They believe that future prosperity will depend on moving to higher levels of technology and productivity and argue that the presence of imported cheap labour would delay that process. So Taiwan, China, for example, announced in 1991 that its ban on foreign workers would now be enforced much more rigorously. At that point there were an estimated 90,000 illegal workers, of whom 22,000 gave themselves up before the deadline; the remainder now face heavy fines if caught.

The Republic of Korea has had fewer illegal workers—unofficial estimates suggest 10,000, of whom about 1,000 were caught and deported in 1990. Employers have been pressing for a relaxation on the current ban, and suggested that permits be issued for specific projects. But the Government has so far refused; instead announced in 1991 that some army conscripts would be allowed to swap military service for a five-year period of work in industry.

Singapore has increased the punishment for the use of illegal labour: both employers and workers can now be caned if caught. But the Government does not want to ban foreign workers altogether, merely restrict their numbers. And in 1991 it suggested that this rationing should be achieved through an auction. Employers wanting to take on foreign workers beyond their current allowances would have to make a bid for the necessary certificates. Certificates would not carry the name of individual workers; they would merely grant the holder permission to employ foreign workers (who would be free to change their jobs). Employers do not find the idea very attractive, however, since the uncertain outcome of the auction would make it difficult for them to plan ahead.

Migration, legal and illegal, in the Pacific Rim, seems set to remain a contentious issue for many years to come.

ILO 1992 World Labour Report

PROTECTION AND POVERTY

Many of the arguments justifying past and present agricultural policies have ceased to be valid in developed

countries. In particular, the objectives of food, security and protection of consumers' living standards can be demonstrated not to be served by protectionist policies. On the contrary, existing agricultural policies have led to severe distortions in resource use. The resulting misallocation of resources has affected the growth potential of all sectors of the economy. Indeed, the spill-over economy-wide effects of agricultural protectionism are more serious than the soaring direct budgetary and other costs. Over time, these negative effects are amplified, so that existing policies need to be examined not simply in terms of their existing costs, but in terms of their dynamic impact on income generation, investment, growth and the environment.

While the aim of the protectionist policies in the industrialised countries has been to support farmers, they have in fact been associated with a decline in the number of farmers and rapid increase in average farm size; it is the large farmers, rather than the poorer small farmers who have benefitted from subsidies. The urban poor, who spend a higher share of their income on food, also have been particularly disadvantaged by policies which have held food prices well above world market levels.

Policies aimed at internal income redistribution and farmer support should be designed to ensure the maximum effectiveness of instruments. Agricultural price support policies and other protectionist measures are inefficient mechanisms for supporting farm incomes, with the eventual benefit to the farmer typically representing a minor part of the budgetary and economic costs. For example, it has been estimated that the total costs to consumers and taxpayers of agricultural protection in 1986 was \$36 billion. The net benefit to producers was \$15 billion. In other words, of the total transfer from consumers and taxpayers of \$36 billion, 60 per cent was lost to inefficiency.

Direct income supports and other more targeted measures are more effective in overcoming rural poverty and achieving distributive and other social objectives, and more efficient in terms of the budgetary cost of achieving these objectives. Equally important, decoupled direct income support is neutral in its impact on international markets and developing countries, and therefore is compatible with the objective of level international playing field and global, as opposed to simply national, redistribution.

Failure to reform developed countries' agricultural policies will significantly reduce the growth potential of developing and formerly centrally planned countries. A reduction of subsidies to producers in developed countries would raise world prices of key commodities and place

developing and other countries on an equal footing with the industrialised countries. Trade liberalisation would benefit food production and those developing countries with export potential, but also have a negative impact on food importers' balance of payments. A reduction in developed countries' agricultural production may result in lower quantities of food aid. Mechanisms should be developed to ensure that developing countries do not suffer from higher cereal prices resulting from trade liberalisation, and that food aid is not conditional on protectionism in the industrialised countries. A number of the poorest countries—and notably those in Africa—stand to gain least from liberalisation. Development assistance packages should be enhanced to compensate for the potential losses in these low-income regions.

The quantitative analysis using the RUNS model clearly demonstrated the effects of protectionism. World prices, trade patterns, trade volumes, and the global distribution of production are all distorted, and lead to an inefficient allocation of resources, both within and across countries. The aggregate measure of these distortions could be \$477 billion or more per annum, or roughly half the income of the less developed economies representing a population of 3 billion. A conclusion of the Uruguay Round, even if it only implies partial reform such as envisaged in the Draft Final Act, would add around \$195 billion per annum to world income, or about 50 percent of the income of China.

The probable increase in the world price for cereals and other main temperate products may stimulate production of developing countries only if a range of policy measures are taken. These include: 1) passing on the rise in world agricultural prices to domestic farmers and ; ii) improving yields through enhancing technologies, storage facilities, distribution, and other related infrastructure. In such a situation, the negative impact of higher world prices on food deficit countries could be dampened and may even lead to a reduction in food imports because of expanded domestic production.

In fact, many developing and formerly centrally planned countries have already adopted trade liberalisation policies; their levels of distortions have fallen dramatically since 1985. Policies which favour equity need to be placed alongside those favouring growth. This will ensure that the critical problem of nutrition and personal food security is

addressed. For the 800 million or more people in the world facing malnutrition, what matters is their entitlement to food—the economic power to grow or buy food—rather than the national level of agricultural production. Most poor and malnourished people live in the countryside, and hence policies which are favourable to agriculture tend to improve their prospects. Liberalisation on a global and national level encourages developing country agriculture and improves rural income in these countries.

Trade Liberalisation : What is at Stake?

Developing countries have learned from bitter experience that they cannot afford the subsidies and distortions which have become endemic in industrialised countries. Their future depends on the establishment of a standardised rule system of international trading, such as that offered by the Uruguay Round of the GATT. The results of our analysis show that the most powerful contribution which industrialised countries can make to their own and to global development to honour their Punta del Este commitments to "halt and reverse protectionism and to remove distortions to trade". The challenge for the industrialised countries is to do as they preach, breaking away from the strait jacket they currently find themselves in. The alternative is to leave in place an economic system that violates the principles of the market system on which the OECD economies are based. This deprives the citizens of OECD and non-OECD countries of potential employment and income, undermining their food security, economic prospects and social harmony. The continuation of the current system feeds the forces of political nationalism and economic protectionism. It would be unfortunate if the industrialised world missed this opportunity to incorporate the economies in transition—the formerly centrally planned economies—on an equal basis, providing these countries, as well as the developing countries, a greater chance to participate in a growing world economy. The failure to reach an agreement poses a threat not only to economic recovery and global equity, but also, by fueling trade conflicts, to peace in the world.

Ian Goldin & Dominique van der Mensbrugge
Trade Liberalisation. What is at Stake?
OECD Development Centre,
Policy Brief no.5



Book Review

Stress & Coping — The Indian Experience: Pestonjee D.M. New Delhi, Sage Publications, 1992, p 240. Rs. 225

"Stress Management" is probably one of the most relevant aspects of individual effectiveness and performance. Programmes that help individuals cope with stress are one of the most exploited areas of management development and training. These programmes, where they do exist, are generally administered by people who have little or no exposure to scientific research. This book by Pestonjee integrates Indian research and experience on stress and coping.

The book consists of eight chapters organised into three sections. The dominant theme of the book is to clarify and define relevant terms and critically review the research studies on stress in Indian organizations.

Section I discusses what is stress, stress and philosophy and life events stress. Pestonjee highlights the confusion that exists in the definitions of stress. He suggests that one has to examine the context of the research study, the discipline of the researcher, and the stimuli and response considered by the researcher in order to overcome the confusion. In a quick review of the various approaches he covers the stimulus-oriented approach, the response-oriented interpretations and the psychodynamic approach. Further, he examines ancient Indian concepts and the positive role of stress. He has also elaborated on stress in relation to creative personality, creative process, creative managers and creative organizations. The author is of the view that certain concepts and ideas demand empirical validation.

He covers the topic from various angles such as stress and diseases, Endocrinology of stress, stress and environment, social factors and body construction in stress, Indian indigenous drugs and stress. Some of the diseases examined are cancer, psycho-sexual disease, gastric ulcer, bronchial asthma and anxiety neurosis. Studies conducted on reactions of the pituitary gland, pineal gland, adrenal gland and thyroid gland in relation to stress and studies on malnutrition, cold, surgical stress and industrial toxicants are included. This chapter clearly demonstrates the variety and lack of integration of studies in the Indian context. Various scales to measure life events stress are men-

tioned with a critical assessment.

In section II on stress and organization, the author observes that "one of the major areas of research in India appears to be organizational stress in general and role stresses in particular". The topics included are measurement of role stress and correlates of role stress. Correlates have been grouped under personal, background, organizational and productivity factors. With focus on executive health in terms of psychological, psychosomatic and physiological ailment, public and private sector executives, bank professionals, computer professionals. The author has successfully categorized the relevant research studies to show again the variety, depth and complexity of the issue involved in stress research. In this chapter, I was also looking for profiles of stress amongst managers belonging to various functional groups such as Production, Personnel, Marketing, Research and Development, Finance, etc. Obviously, there is a scope for comparative studies on role stress within and across various special groups.

Section III on management of stress includes coping styles or strategies, moderators of stress and counteracting stress with topics on personality variables like needs, locus of control, Type-A pattern of behaviour, mental health, coping strategies, effort and outcome orientation and organizational variables such as organizational climate, job satisfaction and occupational stress. Stress audit, an action plan for coping, yoga and the spiritual dimension of health are also covered.

This is a slick and well-written book. The style and summarization of various research studies are highly objective and straight forward. This serious orientation to academic standards may not attract managers looking for a prescription. The book is certainly a rich source of published and unpublished material on stress studies in India. It would be most helpful as an advanced text for courses on Organizational Behaviour and a must for students and teachers in this area.

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Maintenance Planning and Control : Anthony Kelly, New Delhi, Affiliated East-West Press, 1991, p 330, Rs. 95.

The ever growing complexity and size of industries in recent times have brought into sharp focus the need and importance of effective maintenance management systems for keeping industries running round the year safely without breakdowns. It is in this context that Anthony Kelly's book is a welcome addition to the literature on Maintenance Management.

Kelly has dealt with the subject of maintenance management in a methodical and systematic matter, laying particular emphasis on planning, scheduling, documentation and control of maintenance functions.

This is particularly relevant for Indian industries, because 'documentation' is the weakest link in the chain of maintenance management. Kelly has illustrated his exposition with a few examples on organising and installing an effective preventive maintenance system. The chapter on computerised documentation systems is written in a lucid and simple style and should arouse the interest of maintenance engineers in this topic. Admittedly, this chapter is brief because of the limitation of space. However, Anthony Kelly has managed to convey the essentials of computerisation of maintenance activity and the basic requirements thereof. The information given about different softwares should indeed be useful to all maintenance engineers who want to go in for computerisation.

The chapter on planning and scheduling of plant shut-downs is also well written and should be useful in enhancing the effectiveness of existing systems. Even if one day is saved in the annual turnaround, in the work of large industries like Refineries and Fertiliser plants, it means a great deal to the management in terms of increased turnover and therefore profit.

A few of the case studies mentioned in the book and in particular the list of references to some useful literature on topics related to various aspects of maintenance function, given at the end of each chapter enhance the value of this publication.

The chapter on failure analysis involving the use of statistics in estimating the hazard function of each equipment and/or component should be very useful in optimising the expenses on maintenance functions, while reducing avoidable breakdown of plant and machinery.

However, the author could have included a chapter on how maintenance activity contributes to the 'Total Quality Management' programme particularly in view of the emphasis

being placed on this aspect in recent times. Likewise, he ought to have made a reference to the tremendous influence that operation function has on effective maintenance function. Considering the importance of "Functional System Documentation" in enhancing the maintenance effectiveness, it is indeed a pity that this topic has been referred to briefly, only in passing. The role of vendor development and the impact of the science of tribology on maintenance function ought to have been discussed also, in view of their importance in increasing effectiveness and efficiency of maintenance function.

However, in view of the fact that the subject of maintenance management is so complex and vast, the author's inability to deal with all aspects in a small volume like the present one, is well appreciated.

Nonetheless, the book in its present form fulfils a long-felt need of maintenance engineers. Kelly, coming as he does from a university background, has written about maintenance in a pedagogic manner and therefore is well worth serious attention from maintenance professionals all over the world.

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Innovation and Entrepreneurship : Peter F. Drucker. New Delhi, Affiliated East West Press, 1991, p278, Rs. 63.

Reading Drucker is always an educative experience; reviewing him is always a test of one's competence. It is an honour for me to review this thought-provoking masterpiece, and this brief review should be viewed by the readers as an expression of my respect for the living legend of Modern Management.

The book is divided into three parts—the practice of innovation; the practice of entrepreneurship and entrepreneurial strategies. However, the readers must not deprive themselves of the wisdom contained in the preface and introduction. Observe the simplicity and the seriousness of his thoughts there : "Entrepreneurship is neither a science nor an art. It is practice". And, "The new technology is entrepreneurial management".

The practice of innovation for Drucker consists of 'systematic entrepreneurship' and 'purposeful innovation'. The essence of systematic entrepreneurship lies in the ability to search change; preparedness to respond to it; and competence to exploit it as an opportunity. It implies that the task of entrepreneurship is to shift resources from

areas of low productivity and yield to areas of high productivity and yield. Once this is done, "entrepreneurship should be the least risky rather than the most risky course."

Entrepreneurs innovate and what they innovate is the NEW USE. A resource acquires economic value only when one finds a use for it. "Until then every plant is a weed and every mineral just another rock". Innovation, as it is often believed is not a matter of genius, intuition or chance. It is a *trained capacity* to look at its sources which always present themselves in the environment; the unexpected, the incongruity, the process need, changes in the industry or market structure, demographic changes, changes in perception, mood and meaning, new knowledge etc.

Then there are a few do's and don'ts for purposeful and systematic innovation. They are listed under the 'Principle of Innovation' the last sub-section. The chapter ends with a direction for innovation: "Successful innovators are not 'risk focussed'; they are 'opportunity focussed'.

The Practice of Entrepreneurship (part II) defines the nature, scope and tasks of and challenges for entrepreneurial management, entrepreneurial business, entrepreneurship in service institutions and new ventures. The all pervading theme that runs through this chapter can be summarised in two sentences. Success is not a divine gift, instead it requires concerted efforts. Entrepreneurial businesses treat entrepreneurship as a duty—they are disciplined about it, they work at it, they practise it.

The key elements of the entrepreneurial business includes : policies, practices, a system for measuring innovative performance, structures, staffing and the don'ts. Drucker cautions : "Nothing requires more heroic effort than to keep a corpse from stinking and yet nothing is quite so futile. If it is known throughout the organisation that the dead will be left to bury the dead, then the living will be willing—indeed eager—to go to work on innovation. Further a business does not exist to satisfy the management ego; it exists to create a profitable present and future."

The sub-section dealing with entrepreneurship in service institutions should be a compulsory reading for policy and decision makers in the public services, public utilities, public sector and public administration. If they follow even half the wisdom contained in this section the agony of the masses whose life is affected by their inefficiency and ineffectiveness would be greatly reduced.

The author gives a blueprint for new ventures highlighting the need for: a focus on the market; financial fore-

sight; building up of a top management team; and a clearly defined job description of the founding entrepreneur—the role, area of work and inter-team relationships.

Just as entrepreneurship requires the practice of innovation and the practice of entrepreneurship i.e. innovative practices and policies within the enterprise, so it requires practices and policies outside in the market place. It requires entrepreneurial strategies. The last part in entrepreneurial strategies underlines four strategies vitally important for success. They are: being fastest with the most; hitting them where they Ain't; finding and occupying a specialised ecological niche; changing economic characteristics of a product, a market, or an industry.

By way of conclusion, Drucker draws an agenda for the entrepreneurial society. According to him the *Laissez Faire* has already been buried; the welfare state is past rather than the future; it is the entrepreneurial society which is emerging and will be a major turning point in history.

Let it be said in the end that Peter F. Drucker and his works neither need my recommendation nor your admiration. What the readers of this book can do is to translate the wisdom contained in this book into action for their own benefit.

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Biotechnology in Asia—Development Strategies, Applications and Potentials. Tokyo, Asian Productivity organisation, 1990, 412 p.

The technologies based on use of biological systems including micro-organisms, which are collectively termed as biotechnology, have been in practice since time immemorial. In recent years, with developments of scientific understanding in selection and manipulation of genetic materials, biotechnology has opened up new vistas in several spheres like agriculture, plant and animal breeding, chemicals and additives, pharmaceuticals bio-mass, and energy production, bio-electronics and environmental improvement.

The recombinant DNA (rDNA) technique for manipulation of genetic material, preparation of complex molecules known as mono-clonal antibody, cell fusion for joining of cells and such other technological breakthrough have significantly increased the potential for industrial applications. Several products and processes derived

from modern biotechnology are already in the market while others are in the pipeline. These include hybrid seeds, diagnostic vaccines, microbial production of interferon and enzymic production of aspartame (sweetener).

Genetically engineered plants and crops to suit tropical and sub-tropical climate, vaccines requiring no refrigeration and conversion of biomass to ethanol or other energy sources are among the potential applications of biotechnology particularly relevant to developing countries. Many of these countries are endowed with rich reserves of natural bio-resources which could be used as raw materials for production of high value-added products with the aid of biotechnology. Another feature in favour of developing countries is that bio-industry does not necessarily depend on large investment and it could be viable even in small scale operations.

The Asian Productivity Organisation (APO) conducted a one-year study to assess the nature and extent of commercialisation of biotechnology in five selected countries of Asia—the Republic of China, India, Japan, the Republic of Korea and Thailand. Professor Toshiba Yoshida of Osaka University, Japan, a biotechnologist of international repute along with experts from respective countries, the United Nations Industrial Development Organisation (UNIDO) and the Asian Productivity Organisation (APO) participated in the study. Professor T.K. Ghose, who has been instrumental in introducing Biochemical Engineering curricula in Jadavpur University and subsequently in the Indian Institute of Technology, New Delhi was among the experts associated with the study. The present volume is a compilation of survey reports in respect of India, Japan, Republic of Korea and Thailand. Also, it contains country papers contributed by experts from other countries of Asia. In addition, the new trends and strategic needs for development of biotechnology industry with particular reference to Japanese and Australian experience have been highlighted in two resource papers by Professor Fusao Tomita, Hokkaido University, Japan and Dr. Peter L. Rogers, University of South Wales, Australia.

The survey reports and country papers have dealt with, in some detail, the present status and future potential of biotechnology in different countries. The policy initiatives, industrial interest, raw material availability, professional manpower, R & D status and supporting facilities including bio-process engineering systems are among the various aspects that have been covered in the study.

The study has identified five sectors of importance for biotechnology based industry. These are (i) agriculture,

(ii), agro-industry, (iii) food, beverages and speciality chemicals (iv) health and health related products, (v) energy and environmental control. The issues that have been examined include: needs of each sector, status of the industry, available technology, industrial linkages and infrastructural limitations.

The study has concluded that there are promising possibilities for the growth of biotechnology industry in developing countries of Asia. Availability of raw materials and opportunity of launching viable biotech-industry without incurring large investments are the two major conducive factors. The study has advocated strong Government policies for promotion of R & D, creation of professional manpower, strengthening linkage between academic institutes and private sector and incentives for commercialisation. It has been recommended that international collaboration should be intensified in regard to basic research, technology transfer and training of scientists and engineers. The study has also noted that the facilities for training of engineers are not commensurate with the needs which is an important factor for promotion of biotechnology based industry.

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Contemporary Macro-economic Theory and Policy :
Raghbendra Jha, New Delhi, Wiley Eastern, 1991, p 417.

Text-books are not easy to review. For one thing, it is difficult to give an overview of the book to the reader except in terms of indicating its coverage. Then, in so far as a text-book is supposed to give a clear and comprehensive exposition of established positions according to the level of students targetted, one may have more to say about the style than about the contents. There may arise questions regarding the interpretation of a particular theory and its applicability which may invite some discussion. However, in the present case, even that does not seem to be an exercisable option. This is because the author does not specify his intended audience except the Post-graduate level of students for whom it is meant. Apparently the underlying assumption seems to be that there is some kind of a universally valid macro economic theory which can be applied to the macro economic policies everywhere. Were one to go with this assumption, not many questions would arise on which one can join issues with the author regarding his exposition, interpretation and the applications.

However, I presume that the book is meant primarily for Indian students, who may be expected to be helped in understanding the macro economic working of the Indian economy and her macro economic policies. On this test, I find that the present book cannot hope to score too well. The underlying assumption regarding the Indian economy in the study seems to be that it is fulfilled, well-developed and fairly homogeneous or undifferentiated market economy. In the process of providing the micro-economic foundations of the macro-theoretical propositions, the author discusses household supply of labour and savings and attempts to give a model of production decisions of the firm. Any one with even a modicum of understanding of the Indian economy would agree, that the household labour supply and savings behaviour as discussed by the author barely touches the fringe of Indian reality.

Similarly, it is a heroic assumption that the production system in India can be understood in terms of the model given by the author. The large unorganised or informal sector, the rampant black economy and variety of forms of organisation of production units with entrepreneurs of different types, their diverse motivation, access to information, technology and variety of market structures, are so complex that the wholesale importation of Western models can hardly be justified. Similarly, it is naive to postulate that horizontal summation of individual savings and labour supply schedules can give one the respective aggregate schedules. After all, the aggregate system is much more than the sum total of the constituent parts. Macro economic theory has demonstrated how such generalisations based on summation of micro behaviour pattern can easily lead to fallacy of composition.

In so far as one is looking for a short and up-to-date summary of various theories and latest development in macro economic theory in the English-speaking world, one would find that Jha's text book is a reasonably well written one. At times one finds that the presentation is too terse and without any illustrations and examples, the absence of which may easily give a few headaches to the student trying to grapple with it. At certain places precise terms do not seem to have been used like for example, the expression, "the value of the money supply on 30th June, 1988" (p.11)

An overall feeling one gets from this kind of text-book is that, instead of trying to present theories which can help explain at least parts of broad reality, these theories seem to assume a world that is shaped and works according to the dictates of the theory. For example, the author says that perfect competition obtains only in equilibrium. Outside of equilibrium, the individual firm faces a downward

sloping demand curve for its product. Now, either it is assumed that an economy or a firm would never be in equilibrium or that the market structures keep changing from perfect competition to imperfect competition and vice-versa and the firm moves in and away from equilibrium positions. It raises serious questions regarding the concept of time: whether one is thinking of historical time or logical time.

This difficulty is further compounded when one finds that selectively the author refers to historical and empirical evidence like, for example, with reference to the analysis of Phillips curve. (p. 94). The ambivalence of the approach increases when one finds that the Phillips curve is said to be devastated in the light of empirical facts while in the discussion on Okun's law the author does not bring in any empirical evidence concerning the postulated relationship that a 1 per cent reduction in unemployment will increase real GNP by about 3 per cent.

What kind of unemployment is referred to or what kind of composition of GNP is postulated or whether Okun's law has only limited retrospective validity or it also has some meaningful predictive value, etc. are some of the questions which are likely to torment a perceptive student. However, he will look in vain if he were to go through Jha's text-book in order to explore such questions.

The author has tried to cover a number of recent developments in macro economic theory and hence this book can be regarded as a useful guide to recent U.S. and British literature. However, as a text-book for Indian students who are supposed to acquire a certain amount of capability to understand and explain the country's macro economic performance, the book can hardly be of any help.

This raises a basic question regarding the kind of economics taught in our universities. It seems methodology without regard to content and wholesale importation of Western models and paradigms are emphasised so excessively and one-sidedly that any concern with the reality around us gets heavily discounted. It seems we are teaching a certain kind of voodoo in the name of economics. Certainly, it is not my point that all this is happening or is likely to happen owing to Jha's text-book. My point is that this text-book is in the tradition of that kind of ostrich like post-graduate teaching.

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Statistical Methods for the Process Industries (Quality and Reliability Series/28): William H. McNeese and Robert A. Klein. New York, Marcel Dekker, 1991, 536p, \$ 63.25.

To excel in this world of competition, the industry is looking for methods that can improve quality and reduce cost of products and services and thus augment growth potential. This book is a valuable addition to the growing literature on Statistical Methods in Industry. It covers topics of interest in 32 chapters.

The book is an excellent attempt in projecting basic concepts and practices of statistical methods in improving and controlling the quality of product through systematic approaches in improving product and process design and procedure for assuming their conformance. In fact it goes beyond what the title suggests and strongly advocates the culture of 'Total Quality Management'. The communication of concepts is simple, lucid, clear and unambiguous. The illustrative examples and similes described are very appropriate and practical. In fact it clarifies many myths about quality and successfully demonstrates its universal application in a variety of industries, products, and processes.

Apart from the usual simple statistical tools, it lays emphasis on systems for measurement of quality and their appropriateness to a given situation.

There are some factually wrong remarks (eg: pages 164-165) that process is in state of statistical control, when it is not. It gives a wrong message that improvement with appropriate action with present system is not possible; when it is considered well feasible.

The process is not considered in state of statistical control for the following reasons:

1. Eleven consecutive points, on the chart on page 164, from 6th to 16th week provide an indication of declining trend (trend of gradual improvement). Correlation coefficient between 'week number' and 'number of late shipments' is 0.72 against α (.05)

= 0.60. Weeks 17 to 22 and 23 to 28 also show these trends.

2. The p (0.20 and 0.05) for weeks 6 to 12 and 13 to 16 are significantly different using t test.
3. The probability that three consecutive points (weeks 20, 21 and 22) shall be so good (0,1,0) compared to average of 2.8 is very low ($.05 \times 16 \times .25 = .002$)
4. If every succeeding higher point is indicated by (+) and lower point by (-), the number of runs exceeds or equals the critical number for all the 30 weeks or for weeks 6th to 16th.
5. The expected and observed frequency distributions of number of shipments per week are as under:

| No. of Shipments per week | Frequency | |
|------------------------------|-----------|----------|
| | Expected | Observed |
| 0 | 1.5 | 6 |
| 1 | 4.8 | 3 |
| 2 | 7.4 | 7 |
| 3 | 7.2 | 3 |
| 4 | 5.0 | 4 |
| 5 | 2.6 | 1 |
| 6 | 1.1 | 5 |
| 7 & above | 0.4 | 1 |

Though X^2 square test does not provide adequate evidence, the pattern does not provide a happy situation either.

The boxes provided for objectives in the beginning, high lights in the main contents and Application exercises at the end of each chapter enhance the utility of the book.

This book is no doubt an asset for students, teachers and practitioners engaged in industry in manufacture of products and provision of services at all levels.

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