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Employee Compensation and Advanced Manufacturing Technology

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Abstract

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The globalization of product markets has intensified competition in an increasingly wide array of industries, including automobiles, consumer electronics, steel, and computer chips to name just a few. In manufacturing as a whole during the last thirty years, productivity growth in the U.S. has lagged significantly behind that of Japan, Germany, Sweden, and many other industrialized countries. For example, between 1960 and 1985, the annual growth in manufacturing productivity (output per hour) was 2.7 percent in the U.S. compared with 8.0 percent in Japan. Unless this trend can be turned around, U.S. companies will find it increasingly difficult to compete in the world market.[1]

Automation is one important factor in productivity and productivity growth. In particular, organizations are increasingly turning to advanced manufacturing technology (AMT) to enhance their ability to compete. AMT typically refers to flexible manufacturing systems (FMS), computer numerical control (CNC), computer aided design and computer aided manufacturing (CADCAM), and computer integrated manufacturing (CIM). It is sometimes also used to include total quality management (TQM) and just in time (JIT) strategies (Harrison, 1990).

As the papers in this volume indicate, however, the payoff to AMT depends on developing management structures and practices that take full advantage of employee skills and abilities. Hayes and Jaikumar (1988) have

argued that U.S. managers have too often "acquired new equipment much in the way a family buys a new car. Drive out the old, drive in the new, enjoy the faster, smoother, more economical ride--and go on with life as before. With the new technology, however, 'as before' can mean disaster" (p. 77). A company cannot "exploit the full potential of advanced equipment unless it organized to do so" (p. 83).

In the present paper, our focus is on the specific role that compensation and related activities like performance appraisal play in the effective management of human resources in AMT settings. As Gerhart and Milkovich (forthcoming) have argued, compensation decisions are of key strategic importance, with some empirical evidence suggesting that such decisions may have significant consequences for organizations' financial performance (Gerhart & Milkovich, 1990). This is not surprising because compensation has at least two important attributes. First, employee pay and benefits typically account for a substantial portion of total operating costs. Although this share is ordinarily smaller in AMT settings because of the automation of many labor-intensive activities, it is still significant, and thus requires careful management. Second, beyond cost, compensation decisions can have important consequences for key outcomes like job satisfaction, attraction, retention, performance, flexibility, initiative, commitment, cooperation, skill acquisition, individual performance, and, as

indicated above, ultimately organization performance. Putting the cost (investment) and behavioral/performance (return) aspects together makes it clear that compensation can have an important influence on productivity and therefore, the ability of an organization to compete in the global marketplace.

Prior to our discussion of the link between compensation and productivity, it may be useful to provide an example of the magnitude of productivity differences that can be found across organizations within a particular industry. A comprehensive study of the automobile industry (Womack, Jones, & Roos, 1990) is very helpful in this regard, particularly given the important role of automation in this sector of the economy. Womack et al. note that the U.S. and Canadian share of world motor vehicle production has fallen from over 70 percent in 1955 to approximately 25 percent in the late 1980s. The share of the U.S. domestic motor vehicle market held by U.S. manufacturers has fallen from nearly 100 percent in 1955 to just over 60 percent by the late 1980s. What explains this decline in the market share of U.S. companies?

Comparisons with Japanese producers shed some light on the issue. Womack et al. (1990) report that the average Japanese plant requires fewer assembly hours per vehicle (17 versus 25), one-third less physical space, and carries a dramatically lower inventory (0.2 days versus 2.9 days). Moreover, the Japanese plants demonstrate that such efficiency does not have to come at the

expense of quality. In fact, their quality (e.g., defects per 100 vehicles) is 25 percent better than that of U.S. manufacturers (Womack et al., p. 92).[2] Finally, Japanese producers achieve all of this despite having lower labor costs (Capdevielle, 1989).[3]

How is the average Japanese plant able to produce motor vehicles with greater efficiency and quality, as well as lower labor costs? One explanation revolves around automation. The average Japanese motor vehicle plant is more heavily automated than its U.S. counterpart and Womack et al. (1990) show that higher automation significantly reduces the number of assembly hours per vehicle ($r = -.67$). Further, this high investment in automation has not come at the price of reduced flexibility. As Adler (1988, p. 40) has noted, AMT strategies such as flexible automation "undermine a deeply and widely felt intuition...that there is a fundamental tension between innovation and efficiency." (see also Hayes & Wheelwright, 1984).

However, consistent with the Hayes and Jaikumar (1988) argument, Womack et al. (1990) also concluded that the Japanese advantage in automation was only one (albeit an important) part of the story, explaining perhaps one-third of total productivity differences between plants. As they put it, "automation and manufacturability are important, but gaining the full potential of either requires superior plant management" (p. 98). Womack et al.'s (1990) focus here is on

"lean production," which has two key features: "It transfers the maximum number of tasks and responsibilities to those workers actually adding value to the car on the line, and it has in place a system for detecting defects that quickly traces every problem, once discovered, to its ultimate cause" (p. 99).

Compensation and Human Resource Implications of AMT

What do AMT and lean production require of employees and employment relations? According to Womack et al. (1990), it is the following: teamwork, open communication and information-sharing, and skill breadth (e.g., to fill in for each other and be able to quickly solve any problems that arise). Employees also "need encouragement to think actively, indeed proactively, so they can devise solutions before problems become too serious." Further, they argue that "workers respond only when there exists some sense of reciprocal obligation, a sense that management actually values skilled workers, will make sacrifices to retain them, and is willing to delegate responsibility to the team" (p. 99). Again, comparisons between Japanese and U.S. motor vehicle producers suggest significant differences on these dimensions. The Japanese have a greater percentage of the work force in teams (69 percent versus 17 percent), more suggestions per employee (62 versus 0.4), fewer job classes (12 versus 67), more training for new production workers (380 hours versus 46 hours), and significantly greater use of job rotation (3 versus 0.9 on a scale ranging from 0 = none to 4 = frequent). Employment

stability is also significantly greater in both the automotive industry (Womack et al.) and economy-wide (see Gerhart for a partial review).

Consistent with the above, a multi-industry study of practices in 24 AMT settings (Walton & Susman, 1987) concluded that the following factors characterize the AMT workplace: (a) greater interdependence among employees and their activities, with smaller organizational units that make an entire product or part; (b) different (often higher) skill requirements and fewer job classifications; (c) increased cost of errors or malfunctions; (d) skill, knowledge and mental effort are more important than physical effort; (e) more monitoring, maintenance, and other long cycle activities that can make it easy for employees to become inattentive, although it "requires workers to be alert and take initiatives"; (f) continuous change and the need for adaptability and the ability to learn; (g) higher investment per employee and leaner staffing levels; and (h) more decentralized decision-making.

These consequences of AMT have implications for each of the basic areas of compensation (e.g., Gerhart & Milkovich, forthcoming): structure, level, individual differences (e.g., merit pay), and benefits. We examine each in turn below (and also briefly touch on the topic of top management pay). As a general point, we note that the influence of compensation practices on important objectives can be very direct. Skill-based pay, for example, directly pays

employees to acquire skills. Just as important, however, are the "indirect" effects of compensation. For example, the compensation system can either facilitate or constrain the success of other human resource management activities in areas such as recruiting, selection, training, development, participative decision-making, and team approaches. At times, in fact, a compensation program can be particularly successful for what it does not do. Deming (1986), for example, argues that most organizations do more harm than good when they reward managers for achieving narrow (e.g., individual, departmental), numerical, short-term goals. The implication is that removal of rewards for such behaviors would benefit the organization.

We now turn to a discussion of the components of compensation, beginning with pay structures.

Structure

Paying the Job

Pay structures are typically defined in terms of jobs. Tasks and responsibilities for jobs are clearly specified in job descriptions. Job evaluation is used to measure the worth of jobs to the organization and to allow comparisons with jobs in other organizations for the purpose of establishing market-based rates of pay (Schwab, 1980).

However, Lawler (1990) has argued that job-based pay structures can be

characterized by one or more of the following potential disadvantages. First, paying the job instead of the individual may encourage a bureaucratic orientation (see also Kanter, 1989). The job description sets out specific tasks and activities for which the incumbent is responsible, and by implication, those for which the incumbent is not responsible. Although this facilitates performance evaluation and control by the manager, it can also encourage a lack of flexibility and a lack of initiative on the part of employees as in "Why should I do that?--It's not in my job description." Second, the hierarchical nature of this system entails mostly top-down decision-making and information flow, as well as status differentials. This is not consistent with the increasing emphasis on taking advantage of the skills and knowledge of those closest to production or with reciprocal feedback and information-sharing. Third, the bureaucracy required to generate and update job descriptions and job evaluations can become a barrier to change because wholesale changes to job descriptions can involve a tremendous amount of time and cost. Fourth, the job-based pay system may not reward desired behaviors, particularly in a rapidly changing environment where the knowledge, skills, and abilities needed yesterday may not be very helpful today and tomorrow. Lawler suggests that promotion-seeking behavior is typically rewarded, which may not be consistent with goals such as skill acquisition and continuous improvement that are being increasingly embraced by AMT and other organizations.

One response by some organizations has been to reduce the number of job classifications and levels, sometimes dramatically. For example, General Electric replaced its 29 pay grades with 5 grades. Pay grades 8 through 11, for instance, were combined into one "band" ranging from $33,000 to $74,000 (Business Week, December 10, 1990), giving GE considerably more flexibility in job assignments and in assigning merit increases. In the automobile industry, Saturn, the new division of General Motors, has only a few job classifications, in sharp contrast to most other U.S. automobile manufacturers where the average is 67, but very similar to Japanese manufacturers where the average is 12 (Womack et al., 1990). One possible consequence, however, of a reduction in job classifications is a reduced opportunity for promotion. Therefore, organizations need to consider what they will offer employees instead. Continuous training, greater responsibility, and pay tied to seniority or performance are some of the approaches being used (Business Week, 1990). Finally, reducing job classifications as a means of simply getting more work out of employees and without decentralizing decision-making may not be a recipe for success (Keefe & Katz, 1990).

Paying the Person: Pay for Skill and Knowledge

As another response to the drawbacks of job-based systems, some organizations have turned to an alternative type of structure based on individual

characteristics such as skill or knowledge (Lawler, 1990; Ledford, 1991). The idea is very simple. If you want employees to learn more skills and become more flexible in the jobs they perform, pay them to do it. It is, however, "a fundamental departure" because employees are now "paid for the skills they are capable of using, not for the job they are performing at a particular point in time" (Ledford, p. 199).

Conceptually, skill-based systems seem to fit well with the increased breadth and depth of skill that many authors believe is necessary to maximize AMT effectiveness (Adler, 1988; Cummings & Blumberg, 1987; Gupta, 1989; Walton & Susman, 1987; Womack et al., 1990). For example, instead of being limited to loading, monitoring, and unloading parts from a machine, operators might be expected to take responsibility for maintenance and trouble-shooting, reducing variance in the quality of materials, adjusting machines to within needed tolerances, or modifying computer programs (Wall, Corbett, Martin, Clegg & Jackson, 1990). Cummings and Blumberg (1987, p. 48, cited in Wall et al.) recommended that production workers should be "given the necessary skills, information and freedom to respond to unforseen circumstances." In similar fashion, Toyota concluded years ago that "none of the specialists [e.g., quality inspectors, many managers and foremen] beyond the assembly worker was actually adding any value to the car. What's more...assembly workers could probably do

most of the functions of specialists much better because of their direct acquaintance with conditions on the line" (Womack et al., p. 56).

Thus, the key advantage of skill-based pay in an AMT environment is its contribution to increased flexibility and the ability to decentralize decision-making to those who are most knowledgeable. This flexibility can help in covering employee turnover or absenteeism (Lawler, 1990), thus permitting leaner staffing levels. In addition, multi-skilled employees are important in cases where different products are manufactured requiring different processes, or where supply shortages or other problems call for adaptive or flexible responses (Lawler)--characteristics typical of many AMT environments (e.g., flexible manufacturing, just-in-time systems). So, if there is an equipment failure or a need to shift resources on short notice to a particular part of production, multi-skilled employees should be better prepared. Lawler also observes that in addition to the content of the particular skills acquired, skill-based plans may carry a more general benefit in that they foster a climate of learning and adaptability. Finally, employees with a broader view of the production process and organization should be in a better position to participate in decision-making and make constructive suggestions for continuous improvement.

On the other hand, skill-based approaches also have a number of potential drawbacks (Gupta, Jenkins, & Curington, 1986; Lawler, 1990; Gerhart &

Milkovich, 1991). First, such plans can become very costly as employees acquire more skills that are not being utilized but must, nevertheless be compensated. Thus, it is essential that the work process be structured so as to take full advantage of this costly investment. Obviously, creating multi-skilled employees who continue to work on one narrow job will not offer a good return on investment. Second, as with job-based systems, "topping out" can be a problem if employees reach a point where they have acquired all the skills and are therefore not eligible for further pay increases. Third, to effectively administer the system, a large bureaucracy may arise, ironically, very similar to that which occurs with job-based systems. Training programs need to be developed. Skills (e.g., skill blocks) must be described, measured, and assigned monetary values. Certification tests of some sort must be constructed to determine whether an employee has in fact acquired a certain skill. As Ledford (1991) points out, this can be a very contentious process, and has no real counterpart in job-based systems. Finally, it may be difficult to determine market rates under skill-based systems, partly because relatively few companies are available for comparison.

Pay Level and Labor Cost

Initially, it will be helpful to think of pay level as cost per employee. As discussed, skill level and breadth requirements often increase with the introduction of AMT. For several (related) reasons, this may result in

organizations choosing (or being pressured) to raise pay levels. Higher levels and breadth of skill typically bring higher pay in the labor market (e.g., Campion & Berger, 1990). Not surprisingly then, a substantial body of evidence indicates that employees expect higher pay in return for increasing their skill level and breadth, and without what they see as fair (higher) pay, they may strongly resist the introduction of AMT technology (Cummings & Blumberg, 1987; Wall et al., 1990). Some organizations act proactively by using skill-based pay programs, which as discussed above, can also result in higher pay levels.

Second, employee movement can be very costly in an AMT environment. As the organization's investment in its employees grows, so too does the cost of employee movement. Therefore, a higher pay level policy may be chosen to enhance retention and thus, the probability of realizing an adequate return on the investment in training. Employee retention is also important in avoiding possible disruptions in production while replacement employees are found. The large investment in capital equipment in AMT settings can make such disruptions very costly if it results in equipment being left idle.

Third, if as Walton and Susman (1987) suggest, the cost of errors increases under AMT, a high quality workforce becomes more important. Consequently, a high pay level may be chosen to achieve greater selectivity in hiring decisions.

A final factor relevant to pay level in AMT is the ratio of total labor costs

to either total costs or revenues. These ratios are typically much lower under AMT because of a combination of large investments in technology and low staffing levels. The fact that labor costs are a smaller percentage of total costs does not necessarily mean that pay level will be higher, but it may permit greater flexibility on the part of the organization to choose a higher pay level.

Individual Differences in Pay

Pay structures include definitions of pay averages and ranges. Within ranges, especially those that are job-based, individual differences in pay are often determined through one or more "pay for performance" programs such as merit pay, individual incentives, group incentives, gainsharing, profit-sharing, and ownership.[4] In describing specific programs, it may be useful to keep in mind a classification scheme based on two dimensions (Milkovich & Wigdor, 1991): (a) whether pay changes are rolled into the base (yes for merit pay, but not for most others), and (b) the criterion (e.g., organization profits, group output, individual performance appraisal) on which pay is based. The first dimension has implications for the long-term accumulation of labor costs and the second dimension has consequences for the types of behaviors encouraged (and by implication, discouraged) under the compensation system.

Traditionally, individual differences in pay (and to some extent, pay structures) have been viewed as most important in influencing the behaviors and

attitudes of current employees, whereas pay level and benefits have been seen as more critical to achieving attraction and retention objectives. However, as Gerhart and Milkovich (forthcoming) have noted, this view leaves out the potentially important influence of individual pay programs on the composition of the workforce (see also Milkovich & Wigdor, 1991). It may be, for instance, that high performers will be most attracted to organizations that have a strong pay for (individual) performance relationship. For example, evidence indicates that such organizations are more attractive among those that have a high need for achievement (Bretz, Ash, & Dreher, 1989) or strongly value individual achievement (Judge & Bretz, forthcoming). By the same logic, it is also possible that people who prefer to work in teams may be more attracted to organizations that link pay to team performance. If so, this reinforces the need to make sure that compensation design is consistent with other human resource policies and objectives.

As a final general observation, we suggest that the following pay programs should not be viewed as competing alternatives in making design decisions. Instead, because organizations have multiple, sometimes conflicting objectives, multiple compensation programs are likely to be necessary (Majchrzak, 1988; Lawler, 1990; Gerhart & Milkovich, forthcoming). So, profit-sharing might be well-suited to helping control fixed labor costs and promoting a broad view, but at

the same time, there are individual and group level objectives that may be balanced through the simultaneous use of merit pay and team awards.

Merit Pay

Merit pay ties increases in base pay to individual performance. As a recent report (Bretz, Milkovich, & Read, 1989) indicates, merit pay continues to be widely used in U.S. companies. As such, we give it and related activities such as performance appraisal considerable attention here.

The traditional approach to performance assessment is often described as having the following features. First, there is a focus on identifying individual differences in performance. These are assumed to reflect differences in ability or motivation. By implication, system constraints on performance are not seen as significant. Second, the majority of information on individual performance is collected from the immediate supervisor. Peer and subordinate ratings are rare and where they do exist they tend to receive less weight than supervisory ratings (Bretz et al., 1989). Third, there is a policy of linking pay increases to performance appraisal results (Bretz et al.). Fourth, the feedback under such systems tends to occur infrequently, often once per year at the formal performance review session. Fifth, the flow of feedback tends to be largely unidirectional, from supervisor to subordinate.

Despite its widespread use, merit pay as typically practiced is being

increasingly questioned, especially in the context of AMT, where teams, interdependence, flexibility, and decentralization are often key considerations. Best known perhaps are several criticisms raised by Deming (1986). First, he argues that it is unfair to rate individual performance because "apparent differences between people arise almost entirely from the system that they work in, not from the people themselves. A man not promoted is unable to understand why his performance is lower than someone else's. No wonder; his rating was the result of a lottery" (1986, p. 110). As examples of system factors, Deming cites a person's co-workers, the job, materials, equipment, customers, management, supervision, and environmental conditions. He argues that these are, for the most part, outside of the worker's control, instead falling under management's responsibility.

Second, Deming argues that merit pay discourages teamwork. As he puts it, "Everyone propels himself forward, or tries to, for his own good, on his own life preserver. The organization is the loser" (p. 102). As one example, he notes that if people in the purchasing department are evaluated on something like the number of contracts negotiated per man year, they may not take much interest in improving the quality of materials because that might help people in manufacturing, but not necessarily them (i.e., their pay). So, they do not seek such improvement even though the organization suffers as a result. (See also

Hayes & Jaikumar, 1988 on this point.)

Deming's suggested solution is to eliminate the link between individual performance and pay. What is used instead? Schuler and Harris's (1991) case study of a small electronic instrument manufacturer provides some insight. The company has attempted to follow the Deming philosophy. It pays hourly workers on the basis of seniority (not performance) and a profit-sharing plan. (It is not clear whether seniority also determines promotions.) Performance appraisals are used for developmental purposes and where necessary, to identify employees who are "out of the system."[5]

Salaried employees are also on the profit-sharing plan, but in other respects, the determination of their pay is "a little different" (Schuler & Harris, 1991, p. 201). This appears to be something of an understatement. They note that "greater competition for skilled employees forces [the company] to adjust to the market" (p. 201) and that significant adjustments take place "when the employee and management become aware of an imbalance between the employee's skills and the public market valuation of these skills" (p. 202).

This approach sounds very much like pay for performance to us and illustrates the limitations of arguments that call for completely ignoring individual differences in performance, especially in key jobs. As discussed earlier, high performers may be more attracted to organizations that do pay for performance.

Organizations that do not pay for individual performance face the risk of losing higher performers (Gerhart, 1990). At some point, this disadvantage will negate any advantage derived from an egalitarian approach to pay. Therefore, although we agree with Deming that individual differences in performance may be given too much emphasis in many cases, and certain steps can be taken to reduce this emphasis (e.g., Scholtes, 1987), the answer is not to completely eliminate merit pay. This would only replace one set of problems with another. Rather, as discussed earlier, the goal is to design a mix of pay programs that will be effective in accomplishing a mix of objectives.

Another issue concerns the heavy reliance on the supervisor as the source of performance information and feedback. In a team environment, for example, there may not be a supervisor or if there is, s/he may delegate many of the traditional roles to the team. In such cases, peer ratings may be considered as an alternative to supervisory ratings. What is the evidence on peer ratings?

On some dimensions, peer ratings have received high praise. For example, McEvoy and Buller's (1987) analysis of the literature suggested that peer ratings are more stable than supervisory ratings and more likely to focus on task-relevant abilities and competencies. Wexley and Klimoski (1984, cited in McEvoy & Buller, p. 785), in fact, concluded that peer ratings were "potentially the most accurate judgments of employee behavior" (p. 60). This may be due, in large part,

to the ample opportunity that peers have to observe each other's performance.

Nevertheless, peer ratings are very rare in practice, with one study finding that "less than 3% of the rating information used in the final appraisal decision comes from [peer and other non-traditional] sources" (Bretz et al., 1989, p. 9). Why is there this discrepancy between research and practice?

The most common explanation in the academic literature is that employees simply do not like peer ratings (see empirical findings by Cederblom & Lounsbury, 1980; Downey, Medland, & Yates, 1976; Love, 1981) for a variety of reasons (Smith, 1976; Kane & Lawler, 1978; DeNisi & Mitchell, 1978; see McEvoy & Buller, 1987 for a summary), including: (a) managers' reluctance to turn over evaluation power to others, (b) the belief that peer ratings are a popularity contest, (c) reliance of peers on stereotypes, and (d) the possibility of retaliation if one provides a peer with a low rating.

However, there are some potential problems with both the empirical evidence and the logic employed in the peer ratings literature. Without exception, the empirical literature has focused on the following question: How much do employees like peer ratings in an absolute sense? As discussed, there is typically a lack of enthusiasm. But, we would argue, the more relevant question concerns how employees view peer ratings relative to supervisory ratings. This question has not been asked, but evidence from other sources suggests that supervisory ratings

are not terribly popular among either supervisors (Rice, 1985) or the employees they rate.[6] Thus, it may be a mistake to make too much of the lack of user acceptance of peer ratings found in the literature. Moreover, McEvoy and Buller (1987) argue that the low levels of user acceptance found in some previous studies of peer ratings (e.g., Cederblom & Lounsbury, 1980) may be due, in large part, to the fact that there was not confidentiality of raters.

Closer examination of the suggested drawbacks of peer ratings (see a--d above) suggests similar doubts. In particular, problems b, c, and d are not unique to peer ratings--they apply equally well to supervisory ratings. Again, the more relevant (but unstudied) question is whether peer ratings are more susceptible to such problems than are supervisory ratings.

There are, in fact, several reasons to believe that peer ratings can be superior to supervisory ratings under certain conditions. Performance rating accuracy can be thought of as a function of ability and motivation. Key factors on the ability side are the opportunity to observe performance and knowledge of what constitutes good performance. In a team setting, peers are likely to be superior to supervisors on both counts. The motivation side is less straightforward, with key considerations being the reward system and the degree of decentralization of actual decision-making. For example, where pay is linked to individual performance and is relative (e.g., ranking), the motivation to rate

accurately may not be high. On the other hand, in cases where pay is based on team performance and the team has the formal authority to take remedial (or even disciplinary) action, motivation to rate accurately can be quite high.

Whatever the source of performance rating information, acceptance of the process is likely to be greater if employees believe it is procedurally fair. This may be more likely in cases where employees (a) believe feedback is well-grounded in evidence, (b) feel that consistent performance standards are used, and (c) have an opportunity to provide input prior to a recommendation (Folger & Konovsky, 1989).

Individual Incentives

Like merit pay, individual incentives reward individual performance. But, in this case, payments are not rolled into the base and the performance measure is usually some type of physical output rather than a subjective assessment. Individual incentives have the potential to significantly impact performance, but are relatively rare for a variety of reasons (Gerhart & Milkovich, forthcoming). First, they simply are not feasible for many jobs because there is no physical output measure. Second, there are a host of potential administrative problems (e.g., in setting and maintaining acceptable standards) that often prove to be intractable. Third, individual incentives may do too good of a job of motivating employees in the following sense--they do whatever they get paid for and nothing

else.

Individual incentives can be particularly ill-suited to many AMT environments. For instance, individual incentives typically do not fit well with the team approach. The payment system does not encourage cooperation or any sort of organizational citizenship behavior, which has been defined as discretionary behaviors "that are not part of employees' formal role requirements, but nevertheless promote the effective functioning of the organization" (Organ, 1988, p. 4). Individual incentives may also be inconsistent with multi-skilling and proactive problem-solving. Learning new skills can entail a large opportunity cost because of lost income. In addition, income can be maximized by specializing in one task (e.g., a particular machine). Proactive problem-solving is likely to have a very narrow focus, limited to maximizing output (and thus income) on a particular task. Therefore, although individual incentives carry potential advantages, these are not likely to include contributing to a flexible, proactive, problem-solving workforce.

Finally, in cases where individual incentives have been in place for some time, they may be particularly difficult to remove. If, as suggested above, different compensation systems attract different types of employees, it may be the case that individual incentives attract the most individualistic employees. An easy transition to cooperation and teamwork may be especially difficult in this case.

Somewhat related, as suggested in the case of merit pay, high performers earning high pay may be more prone to question what they stand to gain from a more egalitarian approach to pay.

Profit-sharing and Employee Ownership

At the other end of the continuum from individual plans are profit-sharing and stock ownership plans. Under profit-sharing, payments are based on an organization level performance measure (profits) and the payments do not become part of the base salary. Profit-sharing has two potential advantages. First, it may encourage employees to think more like owners, taking a broad view of what needs to be done to make the organization more effective. Thus, the sort of narrow self-interest encouraged by individual incentive plans (and perhaps also by merit pay) would presumably be less of an issue. Rather, greater levels of cooperation and citizenship behaviors would be expected. Second, because payments do not become part of base pay, it automatically reduces labor costs during difficult economic times and shares the wealth during good times. As one consequence, organizations may not need to rely on layoffs as much to reduce costs during tough times (Weitzman, 1984).

Although there is some evidence that employment stability is greater under profit-sharing (Chelius & Smith, 1990; Gerhart, 1990; Kruse, 1991), the evidence on performance effects is less clear. Weitzman and Kruse (1990) conclude that

profit-sharing does increase organization performance, but Gerhart and Milkovich (forthcoming) question the nature of much of this evidence. Conceptually, Deming's point about the relative influence of the individual versus the system comes to mind here. It is not clear that any single employee (except for top executives and other key employees) is likely to see much of a link between his/her performance and profits, because the latter are influenced by so many factors beyond his/her control and outside the scope of the job. Consequently, profit-sharing may not only fail to increase performance motivation, but employees may also view as unfair the fact that they are expected to earn less money during business downturns if they feel that are not to blame.[7] In addition, at lower pay levels, income reductions due to low profits can be very painful. Therefore, although profit-sharing may be useful as one component of a compensation system (e.g., to enhance identification with broad organizational goals), it may need to be complemented with other pay programs that more closely link pay to outcomes that individuals or teams can control (or "own").

Employee ownership vehicles such as stock options are similar to profit-sharing in that employees are encouraged to identify with broad organization goals. As owners, this identification may be stronger. In addition, under employee stock ownership plans (ESOPs), employees must be permitted to vote their securities if they are registered on a national exchange (Conte & Svejnar,

1990). In this sense, participation in decision-making may be given a boost. Finally, ESOPs can carry important tax and financing advantages and are sometimes used as a takeover defense (under the assumption that employee owners will be "friendly" to management). Given the similarity with profit-sharing, stock ownership also has the same potential disadvantages--a questionable impact on individual motivation and significant income risk.

Gainsharing, Group Incentives and Team Awards

These plans are similar in that they (a) do not roll payments into the base, and (b) they attempt to blend the advantages of individual and organizational level pay plans. As Milkovich and Wigdor (1991) have suggested, these plans "may provide a way to accommodate the complexity and interdependence of jobs, the need for work group cooperation, and the existence of work group performance norms and still offer the motivational potential of clear goals, clear pay-to-performance links, and relatively large pay increases" (p. 86).

One way to distinguish the plans is in terms of coverage breadth. Gainsharing plans may encompass an entire business unit (e.g., division, department, plant), whereas group incentives and team awards would typically cover one of the groups or teams within the business unit (Welbourne & Gomez-Mejia, 1991). Perhaps the main distinction between group incentives and team awards is that the former typically refers to plans where performance is measured

as physical output, whereas team awards can be tied to a variety of performance measures (e.g., cost savings, successful completion of product design, meeting deadlines; see Welbourne & Gomez-Mejia). Gainsharing plans can also include a similar variety of performance measures.

The similarity of group incentive plans to individual incentive plans suggests some of the same potential drawbacks such as narrowness of focus, as well as lack of cooperation (in this case, between groups rather than individuals). Team awards also raise the question of how inter-team relationships can be effectively handled (Welbourne & Gomez-Mejia, 1991).

Because of its wider coverage, gainsharing may offer something of a solution, to competition between groups or teams. This can be a particularly important consideration, especially in AMT environments, where coordination and cooperation between groups and individuals in different functions and departments is often critical. Like team awards, gainsharing plans can make use of a wide variety of performance measures, including productivity ratios such as labor cost/sales, actual hours/standard hours, or even return on investment at the plant level if the accounting system permits.

Gainsharing plans are often confused with profit-sharing plans, but there are important differences. In contrast to profit-sharing, (a) payment is based on a measure of productivity (often plant level), not profits (usually organization level);

(b) payments are distributed more frequently (e.g., monthly or quarterly); and (c) closely related, the payments are not deferred. (They are under most profit-sharing plans.)

More generally, in practice, gainsharing plans often include non-pay components such as periodic meetings, problem-solving teams, newsletters, steering committees, and suggestion systems (Conference Board, 1990). As several authors (Hammer, 1988; Milkovich & Wigdor, 1991; Mitchell, Lewin, & Lawler, 1991) have noted, these non-pay aspects may well explain some of the success associated with gainsharing plans. In one study, for example, goal-setting and feedback interventions appeared to be much more important than monetary group incentives in generating performance improvements (Pritchard, Jones, Roth, Stuebing, & Ekenberg, 1988). However, Pritchard et al. suggested that the monetary incentives may have been important in sustaining such performance improvements over the longer run. In addition, evidence from other studies indicates that compensation can have a significant independent effect on performance (Schuster, 1990), as illustrated, for example, by the positive experiences with Improshare (Fein, 1981) and other pay-oriented plans (Wagner, Rubin, & Callahan, 1988; Kaufman, 1992).

Ross and Ross (1991) argue that the following contextual factors are conducive to the success of gainsharing programs: (a) management commitment,

(b) either a need to change or a strong commitment to continuous improvement, (c) management acceptance and encouragement of employee input, (d) high levels of cooperation and interaction, (e) employment security, (f) information sharing on productivity and costs, (g) goal setting, (h) commitment of all involved parties to the process of change and improvement, and (i) agreement on a performance standard and calculation that is understandable, seen as fair, and closely related to managerial objectives.

Finally, one administrative challenge that can arise with any of these three plans concerns the question of "Who's on the team (or in the group)?"[8] A project development team, for example, might include people from marketing, research, engineering, and so forth. How long is each individual involved in the project and how much time does each allocate while involved? Each persons may be on multiple "teams" at any point in time, which may be difficult to define because they are fluid. The result can be a significant administrative challenge.

Benefits

Several features of AMT have important consequences for the design of benefits. First, given the large capital investment in automation, production down-time is expensive and needs to be minimized. Variation in production can also cause difficulties under many circumstances, such as under a just-in-time system. Underutilization of equipment can stem from several sources, including

breakdowns, tool availability, set-up time, rejected products, and lack of operator availability (Lenz, 1989). Benefits programs can have a significant influence on the latter through their influence on both employee attendance and retention (Gerhart & Milkovich, forthcoming). Thus, basic decisions about sick leave policies (amount paid, disciplinary actions for excessive sick leave) take on added importance because of the increased concern with avoiding staffing problems.

Second, as discussed earlier, AMT often entails higher skill requirements (Walton & Susman, 1987). Much as with its investment in physical capital, the organization needs to maximize the return on its investment in employees' human capital (Hayes & Jaikumar, 1988). Therefore, employee retention takes on added importance. In addition to pay level decisions, benefits programs such as pensions and medical insurance need to be designed with this in mind to reduce voluntary quits. More broadly, benefits such as family leave and wellness programs can also be viewed as playing an important role in making sure that human capital is retained (and maintained in good condition).

Third, the organization must create a climate of trust and mutual obligation if it expects employees to accept new technology, learn new skills, and be more proactive. A common theme is that employment security may be necessary to achieve this objective (Walton & Susman, 1987; Womack et al., 1990; Majchrzak, 1988; Hayes & Jaikumar, 1988). As Schuler and Harris (1991) note,

although such a practice "strikes many as out-dated and impractical...companies interested in quality are rethinking this...[because] they recognize that repeated downsizing to reduce costs destroys credibility in HR practices that claim to view employees as important" (p. 196). They also point out that the Malcom Baldridge Award places significant weight on employment security.

Top Management Pay

Top managers have great potential to influence organizational success. Consequently, their pay may warrant some additional discussion. One might argue that a long-term perspective in decision-making takes on added importance in an AMT environment. Automation typically entails a large investment with returns often not realized until several years down the road. Unfortunately, U.S. managers are often described as having a short-run orientation (Hayes & Abernathy, 1980), with a significant amount of the blame being attributed to the design of their compensation (e.g., linking bonuses to short-term, for example, quarterly financial performance; e.g., Rappaport, 1978). Deming's (1986) criticism of the use of numerical goals is in the same general vein. As with individual incentive systems, precise, difficult goals can often be achieved quite successfully. One problem, however, is that trade-offs may be made with other important (but not as clearly specified) goals, such as quality and cooperation.

To encourage long-term (and sometimes risky) investments, greater

emphasis on vehicles such as restricted stock, stock options, and so forth can be considered. Some evidence, for example, suggests that their usage is linked to increased capital investment (Larcker, 1983). In addition, research suggests that an emphasis on long-term goals in executive compensation packages can decrease year-to-year fluctuations in employment levels (Gerhart, 1991), which may be desired to preserve investments in human capital and to show employees that there is a sense of mutual obligation.

Finally, we should note the continued attention in the popular press to the level of top management pay in the U.S. and how it compares with pay in other countries (e.g., Business Week, 1992). In 1989, Towers, Perrin, Forster, and Crosby (TPF&C) reported that the average total remuneration (base, bonus, long term incentives, benefits, perquisites) of U.S. chief executive and chief financial officers in companies with at least $250 million in annual sales was $543,000. By comparison, the average was $352,000 in Japan, $287,000 in the former West Germany, and $130,000 in South Korea (CompFlash, 1990).[9] In addition, the ratio of chief executive pay to that of hourly production workers was 35 to 1 in the U.S., compared with 15 to 1 in Japan and 20 to 1 in Europe (Industry Week, 1990).

There is no consensus on what these numbers tell us (Gerhart & Milkovich, forthcoming). On one side, it can be argued that such pay levels are

needed to attract and retain top executive talent. The pool of such people is small and competition for them is great. On the other hand, the ratio of executive pay to production worker pay has been spoken of as contributing to a "trust gap," described as a situation where employees distrust and resent top management (Fortune, 1989). In any case, if a goal in AMT settings is to reduce status differentials, encourage trust, and develop a team orientation among employees, the design of top management pay is likely receive a good deal of scrutiny from employees who want to see if management is doing its part.

Conclusion

A recurring theme is that no single pay program is capable of achieving the entire set of complex objectives faced in AMT (and other) environments. Thus, in establishing individual differences in pay, some combination of plans (e.g., merit pay, team awards, and profit-sharing) may be chosen to balance multiple and sometimes conflicting objectives. Moreover, the success of decisions in any one major area may be significantly influenced by decisions in others. Welbourne and Gomez-Mejia (1991), for example, discuss the potential futility of using team awards to encourage cooperation among individuals, while at the same time having a hierarchical pay structure that encourages individuals to compete for promotion opportunities.

In general, the attributes of AMT settings will often call for a significantly

different approach to the management and utilization of human resources. Compensation is typically a very important influence on the attitudes and behaviors of employees, whether they be in the executive suite or on the production floor (Gerhart & Milkovich, forthcoming). Consequently, it is important to continually evaluate what attitudes and behaviors are being encouraged (or implicitly discouraged) by the compensation system. Teamwork, innovation, proactive involvement, and other human resource objectives that are especially important in an AMT environment, will otherwise be elusive.

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Footnotes

1.On a brighter note, U.S. productivity growth was more competitive during the late 1980s (Monthly Labor Review tables, 1991).

2.Deming's work also questions the widespread belief that there is a trade-off between quantity and quality, suggesting that they are positively related (as in the automotive data example in the text).

3.Fluctuations in currency exchange rates make such comparisons difficult. However, over the years, hourly compensation costs (including benefits) have been lower in Japan.

4.In some cases, rate ranges are not used. Instead all employees in a particular job are paid a single rate. In other cases, a range may exist, but pay increases are based on seniority. These provisions are most common in the union sector (Freeman & Medoff, 1984).

5.A typical rule of thumb is three or more standard deviations from the average.

6.Unions, for example, have typically opposed using supervisory ratings as a basis for pay. "Because the value of a worker's contribution to a firm is extremely difficult to measure and different supervisors may read the same facts in different ways, the union will seek to protect the membership from the uncertainty of arbitrary supervisory decisions by pressing for a one rate-per-job pay policy" (p. 80). Note the similarity between this view and Deming's (1986) criticisms of merit pay.

7.The much publicized profit-sharing plan for the Dupont Fibers division (Santora, 1991) was eliminated when division profits were down and employees were about to actually experience "downside risk." Saturn has also recently scaled back its reliance on profit-sharing because of lower than expected profits.

8.Thanks to Robert Mulkey for sharing his experiences with this issue.

9.TPF&C reports that spending power differences further widen the U.S. lead in pay.

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