

MANAGING HUMAN RESOURCES FOR INNOVATION AND CREATIVITY

Innovation doesn't just happen—3M, Motorola and other innovative leaders stay that way by consciously pursuing human resource management strategies.

Ashok K. Gupta and Arvind Singhal

OVERVIEW: *People, not products, are an innovative company's major assets. Most innovative companies implement a suitable mix of what the authors describe to be a four-pronged human resource management strategy. Innovative companies carefully analyze personnel needs and hire creative people to fulfill organizational goals. They put into place adequate performance appraisal systems. They implement reward systems to recognize and boost employee creativity. Finally, they find an adequate match between an employee's long-term career objectives and the company's future goals.*

Successful companies create competitive advantage in the marketplace through innovation and creativity. Such companies are innovative and creative not by accident; they effectively manage human resources to create and market new products and services. People are an innovative organization's most vital resource. Successful innovation-based companies have learned how to manage, motivate and reward people (1-3).

This article investigates how companies manage human resources to foster innovation and creativity. While human resource management (HRM) strategies may not be a "cure-all" for ineffective corporate performance, they have the potential to fuel innovation and creativity in organizations.

HRM strategies that foster innovation and creativity can be conceptualized along the four dimensions shown in the diagram on the next page and defined below (4).

1. Human Resource Planning. —This strategy analyzes and determines personnel needs in order to create effective innovation teams.

2. Performance Appraisal. —This strategy appraises individual and team performance so that there is a link

between individual innovativeness and company profitability. This strategy takes into account what tasks should be rewarded and who should assess employee performance.

3. Reward Systems. —This strategy uses rewards to motivate personnel to achieve an organization's goals of productivity, innovation and profitability.

4. Career Management. —This strategy matches an employee's long-term career goals with the organization's goals through continuing education and training.

Human Resource Planning

Human resource planning involves analyzing personnel needs, and selecting and hiring qualified people in order to achieve short and long-term corporate goals. To foster organizational innovation and creativity, human resource planning creates effective venture teams that can rapidly develop and introduce new products.

Venture teams, in which several individuals work together on a project, potentially represent a whole that is greater than the sum of its parts. Motivated teams, composed of individuals with diverse expertise and experiences, usually accomplish much more than individual employees. What set of employee skills do innovative companies look for to create effective teams? How do they recruit individuals to work in teams?

A new product development project, which typically calls for a high degree of innovation and creativity, moves through six stages: (1) pre-project research, (2) identification and screening of project possibilities, (3) project initiation and coalition building, (4) project execution, (5) project outcome evaluation, and (6) project transfer. These six stages often overlap and frequently recycle (5). An analysis of activities involved at each stage suggests that five different work roles are central to the innovation process: (1) idea generation, (2) entrepreneurship or championing, (3) project leadership, (4) gatekeeping, and (5) sponsorship or coaching. When staffing venture teams, planners should keep in mind the following factors (4):

- People with different personal characteristics, knowledge, expertise, and skills will be needed.
- Some individuals may fulfill more than one critical role.

Ashok Gupta is professor of marketing in the College of Business Administration at Ohio University, Athens, Ohio. He received his Ph.D. from Syracuse University. His research and consulting interests include management of innovation in high-technology companies. He has published several articles on managing the R&D/marketing interface and accelerating new product development, in national and international journals. He is the co-editor of *Managing the R&D/Marketing Interface for Product Success: The Telecommunications Focus* (JAI Press, 1990).

Arvind Singhal is assistant professor, School of Interpersonal Communication, Ohio University, Athens, Ohio. He received his Ph.D. from Annenberg School for Communication, University of Southern California. He co-authored (with Everett Rogers) *India's Information Revolution* (Sage, 1989), a book analyzing the diffusion and social impacts of new communication technologies in India.

- Over time, an individual's role in an organization may change.

To foster innovation, human resource planners should consciously recruit people with a variety of professional skills (6). Consider the skill-mix strategy of some innovative companies:

- To identify new product ventures, Motorola has formed several in-house venture teams. A team is typically composed of five to six employees, one each from R&D, marketing, sales, manufacturing, engineering, and finance. Larry Goldstein, a manager of venture teams at Motorola, said that each venture team member must display an "openness to new ideas, a tolerance for ambiguity, and an eagerness for new experiences" (7).

In addition to venture teams, Motorola employs interdepartmental functional teams to develop new products. From the beginning, various functional groups are involved in the new product development process. A newly-created product is thus cost-effective to manufacture, meets customer satisfaction criteria, and can potentially bring the company large profits.

- Like Motorola, the 3M Company, often called the "master of innovation," uses venture teams to develop new products. The employee who "champions" the idea of a new product forms a team comprising people with various skills and disciplines. At one time, team members

At Motorola, each venture team member must display an openness to new ideas, a tolerance for ambiguity and an eagerness for new experiences.

commit themselves 100 percent to only one product venture, temporarily putting other projects on the back burner (8).

- To achieve discipline in the new product development process without stifling creativity, Apple Computer forms teams in which team members' skills and personalities are balanced. In a team, you need people who are technically excellent but broad enough to understand what others have to say, share goals, and exercise good people skills (9).

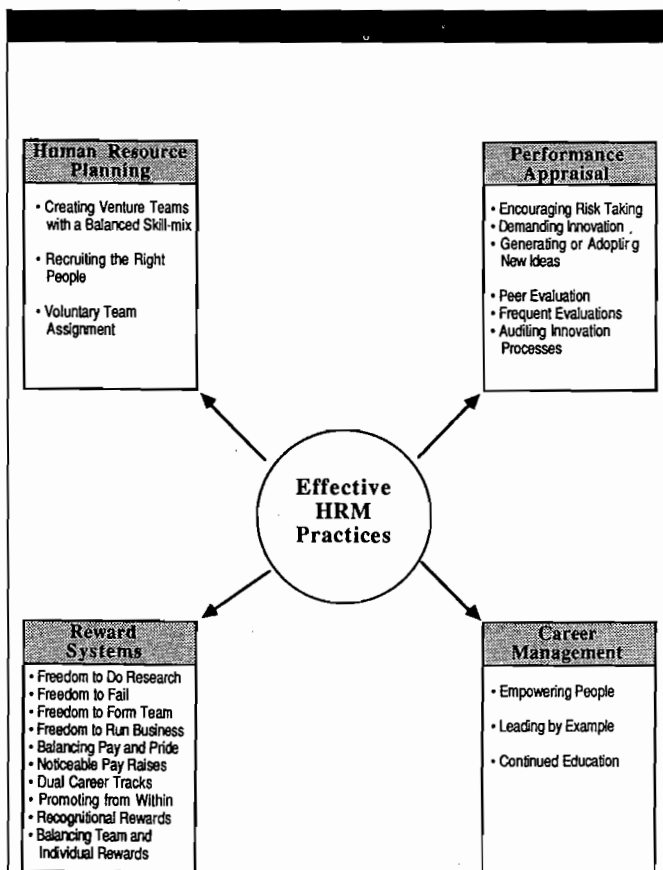
- Du Pont's chief advisor on advanced technology, Abraham B. Cohen, found that in managing research and venture teams, "the best candidates to minimize risk in new ventures were not necessarily outstanding scientists but practical problem-solvers and team players. In general, personnel with multidisciplinary skills do better than specialists" (10). Describing the skills of an effective venture manager, Cohen said: "The venture manager must be as much an artist as a scientist or businessman . . .". Adding that they should understand the interactions of various functional groups and be able to communicate with them, Cohen asserted that, "Above all, they should be decisive; the worst decision in a fast moving venture is no decision."

In addition to creating venture teams with a balanced skill-mix, innovative companies excel in such areas of human resource planning as recruiting, assigning individuals to teams, and interviewing. Consider the following examples.

- Hiring the right people is a top priority at Raychem Corporation, a supplier of technology-intensive products to aerospace and telecommunications companies. Paul M. Cook, founder and former CEO of Raychem, considers finding the right people his *most* important job: "I probably spend 20 percent of my time recruiting, interviewing, and training. It's not unusual for a technologist candidate to go through 10 in-depth interviews." (11).

Raychem executives look for people who genuinely want to serve the customer, who want to create new superior products, and who are willing to stick their necks out to do new things. Such detailed HRM planning has served the company spectacularly in past years. Raychem's sales have consistently grown at about 25 percent per year over the past 25 years.

- At the Saturn division of General Motors, all blue- and



Human resource management strategies that foster innovation and productivity can be conceptualized along four dimensions.

white-collar applicants are recruited through consensus by a committee of union members and management. Saturn's HRM policies represented a big shift from GM's past policies: For example, United Auto Workers members are included in the selection of Saturn's suppliers; all Saturn employees, including the president, eat in the same cafeteria; and a new hire's interpersonal skills are considered as important as his/her technical skills (12).

- At Data General, a highly innovative high-tech company, individuals were generally not drafted into a venture team. For instance, Tom West's team working on 32-bit computer at Data General as described in Tracy Kidder's best-selling book, *Soul of a New Machine*, was created through a voluntary sign-up process. The team members were thus committed to a mission, and gave their hearts and souls to accomplish organizational objectives (13).

Performance Appraisal

Effectively appraising and rewarding personnel performance is central to effective human resource management. Often an organization's performance appraisal and reward systems encourage employee behavior "A," although behavior "B" is desired (14). For example, an organization that rewards its scientists and technologists based on the number of their scholarly publications, might find the same people are not developing new products for the company.

Appraising the performance of professionals is a major organizational challenge, given the nature and diversity of professional tasks. This problem is especially felt in technology-based companies, where a significant time lag exists between research initiation and profitable results. Number of patents, publications, reports, presentations, project completions, and research grants obtained have often been used as surrogate measures of a professional's innovativeness and creativity. However, the validity of such measures is in serious question.

The innovation process is often lengthy, uncertain and multidisciplinary; it involves individual as well as team efforts. What traits does an organization expect its employees to possess that will enhance its innovativeness and creativity? How are employees evaluated in innovative companies? In the following section we seek answers to such questions.

Risk Taking.—Developing new innovative products is a high-risk venture. Innovative companies realize that to succeed, time, talent, and money need to be invested in failure: One can't win if one doesn't play. Innovative companies accept failure as a price of playing the game. Senior management encourages individual initiative and risk-taking.

- Rubbermaid's then-chairman, Stanley Gault, said, "In today's world, you just can't afford to be overly conservative." Gault believes that if a company has a 100 percent new-product success rate, it is too conservative. A company should make mistakes and learn from them (15, p. 111).

Innovative companies accept failure as a price of playing the game.

- Paul Cook attributes Raychem's success to its performance evaluation systems: "We don't just reward success; we reward intelligent effort" (11).

- Robert Johnson, son of the founder of Johnson & Johnson, congratulated a manager who had lost a great amount of company money on a failed new product by saying: "If you are making mistakes, that means you are making decisions and taking risks" (15, p. 112).

- Dick Liebhaer, executive vice president of the \$6 billion MCI telecommunications giant, says: "We do not shoot people who make mistakes. We shoot people who do not take risks" (16).

Profits Through Innovation.—Innovation does not occur by itself. "To be an innovative company, you have to ask for innovation. It's that simple—and that hard" (11). 3M and Rubbermaid demand innovation from their employees—a major reason for their profitability.

- 3M demands that 25 percent of its sale every year should come from products introduced within the previous five years. In 1988, 3M beat its own goal: 32 percent of its \$10.6 billion sales came from products introduced within the previous five years (8).

- Rubbermaid's objective is to generate 30 percent of its annual sales from products that were developed within the past five years. In one five-year period, Rubbermaid introduced 700 new products, exceeding its target (15).

Generate or Adopt New Ideas.—Many successful companies often display arrogance, believing that a new idea is worthless if they did not think of it. They think no one can teach them any thing new, and suffer from the "not-invented-here" syndrome. On the other hand, successful innovative companies encourage adoption of good ideas regardless of their source. 3M considers innovation to be a numbers game. The more product ideas there are, the more product trials there will be, and the more likely it is that some products will be hits. Innovative companies like 3M expect their employees to generate new ideas, or to adopt them from the outside.

- To avoid the "not-invented-here" syndrome, Raychem introduced a "Not Invented Here Award." The idea is to encourage employees to "steal" and adopt ideas from other people within the organization. The person who "steals" another's idea receives a trophy and a certificate which says, "I stole somebody else's idea, and I'm using it." The originator of the idea gets a certificate which says, "I had a great idea, and 'so and so' is using it" (11).

● Rubbermaid looks for new product ideas everywhere. The company has been trying to apply the Ford Taurus-style "soft-look" to garbage cans. Stackable plastic outdoor chairs are a recent success of Rubbermaid's "soft-look" strategy (8).

Performance Evaluation.—The purpose of performance appraisal in innovative companies is not just to reward the "good" employees and punish the "bad" ones; the idea is also to help the marginal performers to do better. At Du Pont, executives have frequent informal talks with managers to set personal growth goals and chart pathways to achieve them (17).

How frequently should employee performance be evaluated? Usually, performance appraisals occur annually. At Toshiba, however, performance appraisals occur every six months. Mid-year evaluations permit mid-year corrections if employee performance is not on target. Mid-year evaluations also mean two deadlines for employees each year, leaving less room for procrastination (18).

Who should conduct employee performance evaluations? 3M relies on the "self-policing" strategy for its new product innovators. While new product development teams must meet financial standards before proceeding to the next stage, peer reviews and feedback serve an important control function (8). Individual team members are self-motivated to perform adequately (nobody wants to be a dead weight on a team).

Besides evaluating individual employee performance, innovative companies like 3M conduct a unit-by-unit technical audit of their innovation process. Such audits, which are optional, help 3M's operating units to allocate resources and implement programs. They are not used to terminate specific company programs (19). Evaluators rate each R&D program on technical factors, business factors, and overall viability.

Technical factors include technology strength (patentability and competitiveness); personnel strength (numbers and skills); competitive strength (knowledge of the competition and 3M product performance); R&D funding available; manufacturing implementation (feasibility and cost); and the probability of technical success. Business factors include financial potential (sales and profits); 3M's competitive position (marketing channels and product value); and the probability of marketing success. The overall viability factors assess the R&D unit's organization and planning (strategy, focus, and clarity of goals); staffing (number and skills); program balance (product maintenance compared to related/unrelated new product efforts); and coordination (with marketing, manufacturing and other R&D units) (19).

While 3M's technical audits present several advantages, their benefits come at a price (audits consume time, money and company resources). However, 3M maintains that the advantages of technical audits outweigh the costs. Technical audits predict the success or failure of an R&D program, helping 3M to select, prioritize and execute the programs. Technical

Companies like 3M conduct a unit-by-unit technical audit of their innovation process.

audits have greatly enhanced innovation in 3M's R&D units.

Reward Systems

Several companies have created in-house reward systems that motivate employees to achieve goals of innovation, productivity and profitability. In companies where innovation is the driving force, an effective reward system motivates employees to take risks, develop successful new products, and generate more new product ideas. Employee reward systems include such practices as providing freedom for creativity, financial rewards, promotions, and other recognition.

Freedom for Creativity.—Granting individuals the freedom to create and innovate is an important HRM practice in successful organizations. Innovative organizations grant this freedom in various ways: through freedom to conduct research, freedom to fail, freedom to run one's own show, and divisional freedom. Freedom to conduct research can involve:

● *Bootlegging.* —Innovative companies allow their employees a certain amount of free time to engage in their own research projects. 3M, for example, encourages its employees to spend about 15 percent of their work time on individual research projects (18). 3M's purpose behind "bootlegging" employee projects is to develop new product ideas that the company can market later. Hewlett-Packard urges its scientists to spend 10 percent of their time on their own pet research projects, providing 24-hour access to H-P labs and equipment.

● *Fellowships.* —Another way companies reward their scientists and engineers is by providing them with a chunk of free time, generous research budgets, and a broad latitude to pursue projects without interference. TRW's space and defense division in 1990 named 19 such "technical fellows." IBM and Apple have similar Fellow programs. Merck provides its researchers time and resources to pursue high-risk, high-payoff products (17).

● *In-House Grants.* —Free time does not guarantee money to build prototypes or take the idea closer to reality. Innovative companies provide small in-house grants to ensure that good ideas do not languish due to lack of resources. "Thou shalt not kill a new product idea," is an 11th commandment at 3M (20). 3M rewards 90 Genesis grants of \$50,000 each year, without an elaborate review process, to help researchers move their

projects from the idea to the implementation stage. Texas Instruments provides similar Idea Grants of up to \$25,000. These in-house grants allow researchers to test the feasibility of their ideas so that they can later demonstrate a need for greater funding (8).

● *Autonomy.* —Du Pont has found that giving researchers greater autonomy increases their productivity dramatically. Researchers are freed from bureaucratic busywork. In 1985, Kurt Landgraf, a Du Pont scientist, found many impediments to starting a new pharmaceutical project: His proposal could not survive four levels of review. As a result, Du Pont reportedly lost the opportunity to license some promising drugs in Europe. By 1988, Landgraf could take chances. That year, his request for \$5 million to start a new generic-drug venture needed approval from only one manager above him (17).

Senior managers in innovative companies view failure as a price of being innovative. They realize that if people are to stick their necks out for uncertain ventures, their heads cannot then be cut off. Management protects creative individuals from the fear of failure.

3M holds a remarkably constructive attitude toward failure. If a project fails, the employees are not punished but encouraged to continue with the next project. Henry Owen, in charge of public affairs at 3M, said: "If you are threatened with dismissal after working on a project that fails, you will never try again" (21). If one fails at 3M, the company gives you a new position at the same level at which you were prior to joining the failed venture team (20).

3M's benevolent reward system has encouraged many of its employees to persevere despite failures to eventually create successful new products. Similarly, Raychem's Paul Cook says, "We've paid sizable bonuses to people who have worked day and night, with remarkable proficiency, on a year-long project—only to find the market had disappeared" (11). In innovative companies, people are rewarded for their efforts, not just for results.

Innovative companies realize that a product champion's prime motivation is the freedom to choose his/her own venture team. A befitting reward for a successful new product development effort is providing the opportunity to do it again. 3M gives its primary researchers (and its product champions) an opportunity to manage the new venture as if it were their own company. People are not assigned to new product development teams; they are voluntarily recruited. Thus, team members from diverse functional groups pursue the same idea, rather than looking for ways to prove that the idea will not work (20).

Financial Rewards.—Important as it is to provide employees the freedom and support to innovate, appropriate financial rewards are essential to motivating creative individuals.

Salary raises and financial benefits play an important role, especially in situations where an innovator might become dissatisfied if he/she is not adequately compensated. However, simply raising an employee's salary rarely makes him/her more innovative.

Hewlett-Packard urges its scientists to spend 10% of their time on their own pet research projects.

Creative individuals often give up large salaries in order to work for innovative companies. Such was the case, for example, with several employees of Chiat/Day, a Venice, California-based advertising agency, who knew they could perhaps make more money working for other advertising agencies. Working at Chiat/Day is considered prestigious and challenging (22). The turnover rate in such innovative companies is very low. For instance, at 3M, turnover of technical employees is a low 2–3 percent, in part because 3M, much like Chiat/Day, offers a challenging and creative work environment.

The main purpose of pay raises in innovative companies is to reward creative performers just enough that they continue to excel, but not so excessively that the raise ceases to motivate. Pay raises for employees who are not as creative should be enough to keep them satisfied, but not large enough that creative performers become dissatisfied with the closeness of their respective pay scales. Pay raises should lead to creative satisfaction.

Merck has different pay raise policies for performers and non-performers. In addition to basic pay, creative performers receive other monetary and non-monetary rewards that the non-performers do not. Financial rewards are based on performance, not on seniority. Such a financial reward system encourages even greater creativity from Merck's employees (23).

Promotion.—Companies often face a dilemma about promoting scientists and engineers who may not be interested in becoming managers with direct line responsibility. Should a scientist or researcher be dislocated from R&D and promoted into line management, or should he/she be left in R&D with no possibility of further promotion? By dislocating the scientist from R&D, the company gains an average manager and loses a highly valuable researcher. Leaving the scientist in R&D with no possibility of further promotion is equally problematic for the scientist's morale. Salary increases alone are often not enough to solve this dilemma. One way out is to install a dual track career ladder (24–26).

In a dual track career system, management and administrative employees move up a managerial track, while technical and professional employees move up the scientific track. Employees can switch tracks. Positions on both tracks are matched in proportion, pay, status, and influence. In the dual track system, technologists do not have to manage people to move up the career ladder. 3M and H-P are two companies that have successfully implemented the dual track career system (17,21).

Establishing a dual track career system presents several advantages to the company and the employee. The thought of promotion motivates an employee to be innovative. Lester Krogh, vice president of R&D at 3M said: "We do not punish engineers who don't want to be managers. The dual ladder allows employees to go back and forth from management to research. As scientists they can have the same benefits and monetary privileges as managers" (21).

A dual track career system helps a company to gain more well-rounded employees, who learn the challenges of both tracks. By moving employees back and forth between tracks, the employee never outgrows the company but grows with it. It is no surprise that 3M's employee turnover is so low.

However, the dual track career system is not free of problems (27). 3M's success with the dual track represents an exception, not a rule.

How can the dual track system be improved? Allen and Katz suggest creating a third ladder on which engineers and scientists will be rewarded with an opportunity to engage in challenging and exciting research activities and projects regardless of promotion (28). Their study found overwhelming preference for this "third-ladder" over the traditional promotion-based tracks.

Another strategy that encourages organizational innovation is promoting employees from within to fill available non-entry-level positions. Incumbent employees can thus look forward to excellent career advancement opportunities within the organization and not be tempted to look outside. This in-house promotion strategy can positively affect employees' loyalty, creativity and innovation. However, if the company *always* promotes from within, promising senior-level executives from outside could be overlooked.

Awards—Recognizing individual and team accomplishment with awards also encourages innovation. Whatever form an award might take (peer recognition, banquet, plaque, letter of appreciation, etc.), its very existence can galvanize employee contributions.

3M has a Golden Step Award for those employees who develop new products or product lines, or new markets for an existing product or product lines, or new businesses (21). To be eligible for the Golden Step Award, the new business must become profitable within the first three years of its inception. Each team member receives an individual plaque and a team award at an annual company event.

To honor its outstanding scientists and technologists, Procter & Gamble in 1990 created the Victor Mills Society, named after P&G's most innovative technologist (best known for creating Pampers disposable diapers) (29). Being inducted into the Victor Mills Society is the highest recognition that P&G innovators can receive. In 1990, 12 of P&G's top career technologists were inducted as charter members.

Balancing Team Rewards With Individual Rewards.—Developing new products requires teamwork. How do innovative companies strike a balance between

Only a few organizations have successfully implemented the dual track career system.

rewarding a team as a whole and rewarding individual members for their contributions to the team? In a new product development project, the team members are highly interdependent; therefore the reward system should be designed to encourage cooperation rather than competition. The common belief is that when a team as a whole is rewarded, the best performers are demotivated. When only the best performers are rewarded, the others on the team are demotivated. Astute managers strike a fine balance between team and individual rewards.

Mower and Wilemon have identified situations in which team *or* individual rewards are warranted (30). They suggest rewarding the entire team:

- At the start of a new project.
- When a milestone has been reached.
- When a destructive conflict is settled.
- When team spirit, cooperation and morale are low.
- When a tough problem has been solved.
- After a crisis.
- At the beginning and end of every meeting.
- To celebrate project completion.

They would reward individual team members:

- When someone has clearly gone "the extra mile."
- To encourage the less assertive.
- To encourage the newcomer.
- To thank someone who is leaving.
- When someone's contribution has been ignored by the team.
- To stir things up when "groupthinking" is beginning to set in.
- When team members differ greatly in the kind of rewards they want.

Research indicates that teams which are rewarded as a whole—where team members share rewards equally—almost always out-perform teams in which some members are rewarded more than others (31).

provide their employees with various kinds of freedom to boost creativity, and they honor achievers by bestowing financial rewards, promotions, and other forms of recognition. Employees get freedom to conduct R&D; they enjoy the freedom to fail, and they have freedom to run their own new product venture as a profitable business. Further, individual company divisions are encouraged to run themselves, as if they were separate corporations. Achievers are rewarded with pay raises and promotions, where the chief purpose is to cause "creative dissatisfaction" not "inactive complacency." Dual track career systems with a possibility of a third ladder minimize friction between scientists and managers, providing individuals in each group the room to boost their professional careers. Promoting employees from within reduces employee turnover. Awards and other recognitions are designed to motivate employees to achieve higher levels of productivity. The challenge lies in balancing team rewards with individual rewards.

4. In terms of managing employee careers, innovative companies empower their employees, provide them the opportunity to tackle new problems, gain varied experiences, and prepare for greater challenges. Top leadership sets personal examples in seeking, propagating and implementing new knowledge. Employees are continually educated and trained in different skills to provide them a well-rounded professional experience. Innovative companies like Motorola, 3M, Du Pont, Merck, Raychem, Johnson & Johnson, Hewlett-Packard, and Rubbermaid exemplify how human resources can be managed effectively to gain competitive advantage in the marketplace. By adopting HRM strategies that foster organizational and individual innovation, such companies have established a spectacular reputation for creating and marketing new products and services. People, not products, are an innovative company's major assets. ④

Acknowledgment

This article benefited from the research grant provided by the College of Business Administration, Ohio University. We thank Eric Chastain for his research assistance.

References

1. Badawy, Michael K. (1978), "One More Time: How to Motivate Your Engineers," *IEEE Transactions on Engineering Management*, May, pp. 37-42.
2. Gupta, Ashok K., David Wilemon, and Arvind Singhal (1991), "Bringing New Products to Market Speedily," *Journal of Product and Process Innovation*, Vol. 1, No. 4, July-August, pp. 5-10.
3. Roberts, E. (1988), "Managing the Process of Invention and Innovation," *Research*Technology Management*, January-February, pp. 11-29.
4. Badawy, Michael K. (1988), "Managing Human Resources," *Research*Technology Management*, Volume 31, No. 5, September/October, pp. 19-35.
5. Roberts E. and A. Fufeld (1982), "Critical Functions: Needed Roles in the Innovation Process," in *Career Issues in Human Resource Management*, R. Katz eds., NJ: Prentice-Hall.
6. Wolff, M. F. (1984), "Hiring People Who Do Good Research," *Research Management*, January-February, pp. 8-9.
7. Kapp, Sue (1987), "Lawyer Turned Marketing Crusader," *Business Marketing*, July, pp. 12-16.

8. *Business Week* (1989), "Masters of Innovation," April 10, pp. 58-63.
9. *Wall Street Journal* (1987), "Apple Computer Tries To Achieve Stability But Remain Creative," July 16, p. 1.
10. Cohen, Abraham B. (1988), "Innovation at Du Pont—A Real-Time Perspective," *Research*Technology Management*, November-December, pp. 47-52.
11. Taylor, William (1990), "The Business of Innovation: An Interview with Paul Cook," *Harvard Business Review*, March-April, pp. 97-106.
12. *Business Week* (1990), "Saturn Plant of GM," April 16.
13. Kidder, Tracy (1981), *Soul of a New Machine*, Boston: Little, Brown & Co. Inc.
14. Kerr, Steven (1975), "On the Folly of Rewarding A, While Hoping for B," *Academy of Management Journal*, Volume 18, No. 4, pp. 769-783.
15. Shanklin, William L. (1989), *Six Timeless Marketing Blunders*, Massachusetts: Lexington Books.
16. Peters, Tom (1990), "Prometheus Barely Unbound," *Academy of Management Executive*, November, Volume 4, No. 4, pp. 70-84.
17. *Business Week* (1990), "Farewell Fast Track," December 10, pp. 192-200.
18. Rehfeld, John E. (1990), "What Working for a Japanese Company Taught Me," *Harvard Business Review*, November-December, pp. 167-176.
19. Krogh, Lester C., Julianne H. Prager, David P. Sorensen, and John D. Tomlinson (1988), "How 3M Evaluates its R&D Programs," *Research*Technology Management*, November-December, pp. 10-14.
20. Roberts, E. (1980), "New Ventures for Corporate Growth," *Harvard Business Review*, July-August.
21. Johnson, Alicia (1986), "3M: Organized to Innovate," *Management Review*, July, pp. 38-39.
22. *Fortune* (1984), "Long Hours + Bad Pay = Great Ads," July 23, pp. 77-79.
23. *Business Week* (1987), "The Miracle Company," October 19, pp. 84-90.
24. Sacco, G., Jr. and W. Knopka (1983), "Restructuring the Dual Ladder at Goodyear," *Research Management*, July-August, pp. 36-41.
25. Wolff, M. F. (1987), "Revisiting the Dual Ladder at General Mills," *Research Management*, May-June, pp. 8-12.
26. Wolff, M. F. (1985), "Misusing the Dual Ladder" or "The Case of Joe Mertz," *Research Management*, March-April, pp. 7-9.
27. Wolff, M. F. (1989), "Fixing Wobbly Dual Ladders," *IEEE Spectrum*, September, p. 24.
28. Allen, Thomas and Ralph Katz (1990), "The Treble Ladder Revisited: Why Do Engineers Lose Interest in the Dual Ladder as They Grow Older?" *Working Paper 7-90*, International Center for Research on the Management of Technology, Massachusetts Institute of Technology, Cambridge, Massachusetts.
29. Goedl, Jane (1990), "Leading the Way in Technology," *Moonbeam*, December, pp. 10-12.
30. Mower, Judith C. and David Wilemon (1989), "Rewarding Technical Teamwork," *Research*Technology Management*, September-October, pp. 24-29.
31. Johnson, D. W., G. Maruyama, R. Johnson, D. Nelson, and L. Skon (1981), "Effects of Cooperative, Competitive, and Individualistic Goal Structures on Achievement: A Meta Analysis," *Psychological Bulletin*, Vol 89, pp. 47-62.
32. Galagan, Patricia (1986), "Focus on Results at Motorola," *Training and Development Journal*, May, pp. 43-46.
33. *Business Week* (1985), "A Research Whiz Steps Up From the Lab," June 24, pp. 87-88.
34. Wiggenhorn, William (1990), "Motorola U: When Training Becomes an Education," *Harvard Business Review*, July-August, pp. 71-83.
35. *Business Week* (1989), "The Rival Japan Respects," November 13, pp. 108-118.
36. *Business Week* (1988), "Motorola Sends Its Workforce Back to School," June 6, pp. 80-81.
37. Wagel, William H. (1986), "Building Excellence Through Training," *Personnel*, September, pp. 5-10.