



## How Effective Are Voluntary Measures to Curb Pollution?

**t**raditionally, U.S. environmental policy has emphasized mandatory regulations that prescribe limits on emissions of pollutants or the use of specific abatement technology such as scrubbers. While these regulations have protected the environment, they have encouraged firms to concentrate on pollution controls that operate at the end of the factory smokestack or at the point of effluent discharge rather than at preventing pollution. They have also imposed high costs on both firms and regulators. A growing belief in the need to provide flexibility to firms and to lower the costs of environmental protection has led to increased reliance on programs that encourage voluntary action to control pollution. Such programs emphasize pollution prevention at the source as the preferred method of pollution control, offering technical assistance, recognition, and financial and regulatory benefits to firms that implement an environmental management program. Green Lights is one such voluntary program. It encourages the use of energy-efficient lighting in buildings. In 1991 the Environmental Protection Agency launched the 33/50 Program, which encourages firms to reduce voluntarily emissions of 17 high-priority toxic chemicals at the source. The goals of the program were to reduce the aggregate releases of these chemicals by 33 percent by 1992 and by 50 percent by 1995. The Climate Challenge Program, initiated in 1994, invited electrical

utilities to reduce emissions of greenhouse gases to a level of their own choosing by 2000. The public policy trend towards promoting voluntary action and pollution prevention has been accompanied by a growing number of “business-led” initiatives to change corporate culture and management practices by incorporating environmental concerns into production decisions. These initiatives include the development of firm-structured environmental management systems, trade association programs emphasizing codes of environmental management, and international certification programs that set standards for environmental management, such as those of the International Standards Organization. These environmental management systems represent an institutional change in the management of corporations and an internally motivated effort at environmental self-regulation. The organizational changes that integrate environmental concerns into production decisions allow firms to identify opportunities for pollution (waste) reduction, link employee compensation to improvements in environmental performance, and implement plans to make continuous improvements in production methods and environmental performance, report progress to stakeholders, and set aside funds for environmental accidents. How comprehensive these systems are varies widely from firm to firm.

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## How Effective Are Voluntary Measures to Curb Pollution?

*The effect of consumer pressure is stronger on firms that would have otherwise adopted the fewest environmental management systems.*

Such efforts at environmental management by firms, and their potential for identifying cost-effective and self-enforcing strategies for pollution control, have caught the attention of regulatory agencies and led to a spate of programs in the United States to encourage greater adoption of such systems. These policy incentives are based on the presumption that the systems improve environmental performance, a presumption that remains to be proved. While there is some evidence that the unregulated toxic releases emitted by firms decreased by 43 percent from 1988-1997, the role of the systems in achieving this reduction has not been systematically examined. Since most such systems focus only on the means (proactive efforts) to pollution control rather than the ends (actual improvement), they do not necessarily guarantee better pollution results

George Deltas, Illinois assistant professor of economics, along with colleagues Wilma Anton of the University of Central Florida and Madhu Khanha of the Illinois Department of Agricultural and Consumer Economics, examined data from a sample of S&P 500 firms to determine the factors that influence the quality (defined as the number of environmental management practices adopted by firms—for example whether a firm had a procedure through which employees could offer suggestions on improving operations) of the management systems adopted by firms and to establish the extent to which the quality of a firm's environmental management affects the amount of toxic material it releases. They found that the most relevant determinants of whether or not a firm will adopt environmental management systems include consumer and (possibly) investor pressure, the potential for future liability, and the scale of its

past emissions. Their analysis, based on parametric modeling, shows the intriguing result that the effect of consumer pressure is stronger on the firms that would have otherwise adopted the fewest environmental management systems. Studying data from the Toxic Release Inventory, they found that the adoption of environmental management practices has led to a significant reduction in the intensity, defined as pollutants released per unit of output produced, of toxic emissions. This result holds only for firms that in the past had higher than average emission intensity. They found no evidence that the consumer or investor pressure or the risk of future litigation that influence the quality of emission management systems have a *direct* effect on the emissions intensity. Thus, their study establishes that these factors reduce emissions indirectly through encouraging institutional change in the operation of the firm.

The adoption of higher quality environmental management systems significantly reduces the pollution intensity of firms, and this impact is greater for firms that have the worst environmental histories. Further, results show that environmental management systems reduce the intensity of on-site releases and off-site transfers of toxic materials, though not the amount of hazardous air pollution per unit of sales. On the whole, none of the market-based or regulatory pressures considered—the pressure of public opinion and/or that from their own stockholders, the fear of costly litigation and possibly even costlier judgments or settlements, or the desire to stave off future stringent environmental regulation—appear to have had a significant *direct* impact on the intensity of pollution by firms. The effects have been *indirect*, and they operate through

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the adoption of better environmental management systems. Taken together, the results of the research by Anton, Deltas, and Khanna suggest that public policy can play a role in improving the prevention of toxic pollution by creating regulatory and market-based pressures (including the threat of strong government controls and making public information about the environmental record of firms) that give firms a strong motivation to adopt better environmental management systems.

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George Deltas is an assistant professor of economics at UIUC. The original paper upon which this article is based is "Incentives for Environmental Self-Regulation and Implications for Environmental Performance," is available in its entirety from the College Web site. Go to <http://www.cba.uiuc.edu/research/>. You can contact Professor Deltas at [deltas@uiuc.edu](mailto:deltas@uiuc.edu).

## High Tech Employees Take Vital Knowledge into New Ventures

**I**n a recent article, "Inheritance by the Unintended Child: The Impact of Knowledge Transfer on Spinout Generation, Development, and Survival," Rajshree Agarwal and three colleagues studied companies started by former employees of established high technology firms. They examined the role of knowledge as a driver of the formation of organizations and as a subsequent source of competitive advantage. The authors use the term "spinout," coined by the business press, to describe an entrepreneurial venture started by an ex-employee of such a firm.

Agarwal and her colleagues tested their hypotheses regarding the creation, development, and performance of spinout firms using data from the disk drive industry. The industry, which began in 1973, has been characterized by a great deal of innovation with numerous architectural, modular, and incremental changes. In response to the profit opportunities inherent in such rapid technological dynamism and market growth, many companies entered the market. Among the entering firms, approximately 25 percent were spinouts, and they offer an important source of information about the diffusion of knowledge and the transfer of technology in the industry.

The researchers investigated how the knowledge inherent in a firm affects the likelihood

that its employees will leave to form their own spinouts. Innovation is often the motivation for the founding of the spinout, and typical spinout entrepreneurs are knowledge-rich research engineers with the support of venture capitalists.

In technology-rich markets, the extent of scientific know-how embodied in a product is typically high. Research creates R & D capital that has the potential to earn profits for the firm, while it also increases the human capital of the research workers. Of course, patents are intended to protect the value of the knowledge created for the firm. However, much of the knowledge generated is implicit, and a substantial part of a firm's R & D capital may be embodied in its employees. Such intellectual human capital is transferable from one firm to another through labor mobility or executive migration.

The access of an employee to valuable information and scientific know-how through working on research projects is likely to be higher if the employer is operating close to the technological frontier. Such higher levels of know-how are likely to make it easier for employees to start new, high-tech firms of their own. They have the confidence to create entrepreneurial enterprises. They know that they possess valuable and difficult-to-acquire know-how if they decide to give up a secure

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job to start a chancy new business. There are also financial reasons that such employees are more likely to jump into entrepreneurship: Since venture capitalists who look at the R & D capital of the parent firm may be more willing to back ventures where the transferable knowledge is more advanced. Therefore, firms on the cutting edge of technology are more likely to produce spinout entrepreneurial ventures.

Along with technological expertise, another, important capability of successful hi-tech firms is strength in the complementary area of commercializing technology ahead of competitors. This is another form of know-how that an employee can use to increase the possibility of the success of a spun-out firm. Market-pioneering know-how exists throughout an organization in the shared beliefs, values, norms, and the behavior of members of the firm. So, even without direct access to marketing operations, employees in market-driven firms are more likely to absorb a market-focused worldview. Employees may also pick up principles of marketing behavior, routines, and procedural knowledge about new product development. The “war stories” and “hall talk” of past successes in pioneering markets can inspire an employee to want to strike out on his or her own.

Since many spinout firms are founded to exploit technological sub-fields of the products of the parent company, one way to deter the flight of knowledge into new, spinout firms might lie in the firms exploiting these sub-fields themselves. Thus, a firm can deter the formation of spinouts by excelling at both creating value through technological innovation and appropriating value by marketing the technological developments. When employees perceive that their innovations are either not making it to the market or taking a very long time to do so, they may become increasingly frustrated with working at the parent firm. There is definitely greater job satisfaction among employees when they perceive that the organization is committed to taking emerging technological developments to market.

Agarwal and her colleagues also find that “smart parents” tend to produce “smart offspring,” that is, employees of firms that are very good at developing and marketing innovations tend to spinout new firms that are also good in both areas. This “smartness”

tends to last, so that the new spinout firms tend to enjoy a competitive advantage over others in their markets. “Simply put, the knowledge inherited by the spinouts enables them to sustain knowledge-leadership over non-spinout entrants.”

The inherited edge in knowledge, coupled with the organizational flexibility of being an entrepreneurial venture, results in spinouts that have performance superior to other entrants. The researchers found that spinouts tended to have higher survival rates relative to other entrants. Since the founders gained a great deal of knowledge in the parent company, the spinout firms have the advantage of experience and know-how so they are less likely to face the costs of the pure trial-and-error efforts of other entrants. Spinouts also inherit social capital, such as reputation and connections in the parent’s network. This gives them more credibility with external stakeholders. These advantages help mitigate the usual liabilities of start-ups. An additional advantage may be their entrepreneurial origin. Organizational flexibility is an important attribute, particularly in technologically dynamic markets where resources need to be utilized and combined in creative ways to address new opportunities and anticipate change. All of these advantages make it more likely that a spinout will survive longer than a non-spinout.

Thus, the unintended knowledge transfer from a firm through employee entrepreneurship can result in increased competition for the firm. Agarwal and her colleagues provide managerial implications for their observations. For parent firms, knowledge can be a double-edged sword, but if they act to bring to market the products of technological subfields of their products, they reduce future competition by retaining their employees. For the spinout firms, the research of Agarwal and colleagues unequivocally shows how inherited knowledge, coupled with entrepreneurial flexibility, results in a sustained advantage in terms of both knowledge capabilities and performance.

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# Strategic Management Researchers Study How Property Rights Can Affect Profitability

**J**ongwook Kim and Joseph Mahoney of the Illinois Department of Business Administration have delved into the role that property rights (the social institutions that define or limit the range of privileges granted to individuals or entities to specific resources) play in the success of a firm. The objective of the study is to expand property-based theory in a business context in which there are difficulties in establishing property rights that will enhance the economic value of resources. In some instances there is a considerable, persistent gap between potential value and realized value. The researchers maintain that approaching the question of resources from the perspective of property rights would shed light on more than just potential value, illuminating the much more challenging economic and strategic management issues of creating realized value. Their study, “Resource-based and Property Rights Perspectives on Value Creation: The Case of Oil Field Unitization,” was published in *Managerial and Decision Economics*.

To illustrate their merging of resource and property-rights theory, they examined the case of oil field unitization in the United States. Oil field unitization is the practice of having a single firm designated as the unit operator to develop the oil reservoir as a whole. The practice is economically desirable because it creates joint incentives to develop the reservoirs in a way that maximizes the creation of value over time. The parties to the process are a single unit operator and the other leaseholders who have rights to residual profits from the reservoir. In their examination of the case, Kim and Mahoney applied both resource-based theory, which focuses on the potential value of the oil field, and property-rights theory, which explains why the realized value created can be disappointingly below the potential value.

One of their first tasks was to establish the importance of property-rights theory to strategic management, which focuses on why certain firms outperform others. In the United States a large number of owners often own the land over a subsurface oil reservoir. Even more important, oil migrates, meaning that it

moves within the reservoir so that it is possible for one leaseholder to drill on his land and to extract oil that had been under a neighbor’s land. According to common law, leaseholders can drill a well on their land and drain oil and gas from their neighbors without penalty because property rights to oil are assigned only after extraction. It is the combination of multiple ownership of the surface land and the migration of oil that can lead to an economically inefficient exploitation of an oil field.

Oil field unitization, according to Kim and Mahoney, is the most straightforward economic solution to a serious problem in oil and gas production where there is the potential for large losses in economic efficiency. A unit is formed by joining oil leases within the reservoir. Individual leaseholders become parties to a contract that designates a single firm to develop the oil field, with economic shares of all the landowners specified in advance. Therefore, the strategy shifts from maximizing the respective values of each individual leaseholder to maximizing the value of the unit as a whole. Normally, the firm chosen to operate the unit is the one with both the most to gain and the most to lose. This mechanism unifies the interests of the operator and the other leaseholders to maximize the production of the reservoir as a whole.

There is, of course, a wide range of circumstances and behavior by the unitizing firm and the other leaseholders that can interfere with the most efficient exploitation of the unitized reservoir. And there have been few unitized reservoirs. As late as 1975 only 38 percent of Oklahoma production, and only 20 percent of Texas production, came from firms unitized reservoir-wide—due to the failure of attempts to create contracts to unitize production.

Despite the theoretical potential of unitization to increase value, there is a surprisingly low rate of oil field unitization, particularly in Texas. For instance, among the secondary recovery projects in the state (about 3,300) only 821 operate as unitized fields. They produced about 577,000 barrels per project in

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1979, while the 2,477 non-unitized projects produced an average of only 45,117 barrels per project. This empirical fact highlights the economic importance of getting the institutional details of the property rights correct in order to create realized value. Property rights theory explains the impediments to achieving this economic value due to differences in the quality and quantity of information available to the various potential parties to a unit and to conflicts over the distribution of potential profits, all of which can lead to an economic result that is far below the potential aggregate economic gains.

One example of such economic waste is the Slaughter oil field in Texas. This field is divided into 25 unitization areas and 28 recovery projects that have not achieved unitization. On this oil field there are 427 offset injection wells, which are wells that are set up for the purpose of preventing oil migration to an adjacent tract of land but that do not contribute to actual oil or gas production. Costs for setting up these wells amounted to about \$156 million. Furthermore, these costs presumably do not include the opportunity costs of oil lost by not having unitized, making the inefficiencies of competitive drilling that much greater than a cooperative unitization solution. Indeed, failure to achieve unitization has far-reaching implications for overall loss.

In summary, Kim and Mahoney maintain that the more valuable the resources, the more

incentives there are to make the property rights to those resources more precise; and the more precisely delineated the property rights to resources, the more valuable the resources become. In essence, the process of making property rights more precise can be another way of looking at the value-creation process. The authors hasten to add, however, that their work emphasizes that even when there are large and undisputed potential aggregate economic benefits to be derived from changes in property rights, there are business cases in which property rights do not necessarily transfer in ways that facilitate higher yields. In the case of oil field unitization, a variety of firms operating in an environment of uncertainty and with unequal information can result in a sustained inefficient economic outcome.

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This article is based on , "Resource-based and Property Rights Perspectives on Value Creation: The Case of Oil Field Unitization," published in *Managerial and Decision Economics*. Joseph Mahoney is an associate professor of strategic management in the Department of Business Administration. Jongwook Kim is a Ph.D. candidate in the department. For further information about this research, contact Professor Mahoney at [josephm@uiuc.edu](mailto:josephm@uiuc.edu).

# Research News

*This feature highlights the recent research achievements of the faculty of the UIUC College of Commerce and Business Administration. To find out more about any of the projects mentioned, contact the editor, Janet Fitch, who can put you in touch with the appropriate faculty member.*

## Honors

**James Gentry**, Finance, emeritus, was recently notified that he has been selected by the Italian Fulbright Commission to serve as the Tuscia (Viterbo) Distinguished Chair in Business Administration during the fall 2003 semester.

**Jeffrey Schmidt**, Business Administration, was recently awarded the *Journal of the Academy of Marketing Science* Sheth Foundation Best Paper Award for 2002 for an article co-authored with Roger J. Calantone, "Escalation of Commitment during New Product Development," *Journal of the Academy of Marketing Science*, Vol. 30, 2002, pp. 103-118.

**Ira Solomon**, Accountancy, received an award from the American Accounting Association in January 2003 as the Outstanding Auditing Dissertation Committee Chair.

## Grants

**Juha Seppala**, Economics, received \$18,324 from the Campus Research Board in 2001.

**Glenn Hoetker**, Business Administration, received a Professional Development Grant from the UIUC Center for East Asian and Pacific Studies to fund his participation in two conferences: the Wharton Technology Mini-Conference and the Consortium on Competition and Cooperation.

## Recent Publications

**Rashree Agarwal**, Business Administration, with Raj Echambadi and M.B. Sarkar, "The Conditioning Effects of Time on Firm Survival: A Life Cycle Approach," *Academy of Management Journal*, Vol. 45, No. 8, 2002, pp. 971-994.

\_\_\_\_\_ with Barry Bayus "The Market Evolution and Take-off of New Product Innovations," *Management Science*, Vol. 48, No. 8, 2002, pp. 1024-1041.

\_\_\_\_\_ with April Frano, Raj Eschambadi, and M.B. Sarkar, "The Role of Knowledge in Organizational Formation and Performance: Spin-out Generation and Survival," *Academy of Management Best Paper Proceedings*, 2002.

\_\_\_\_\_ with Michael Gort, "Products and Firm Life Cycles and Firm Survival," *American Economic Review*, Vol. 92, No. 2, 2002, pp. 184-190.

**T. J. Attwood**, Accountancy, "Implicit Taxes: Evidence from Taxable, AMT, and Tax-Exempt State and Local Government Bond Yields," *Journal of the American Taxation Association*, Spring 2003, pp 1-20.

**Werner Baer**, Economics, with P. Elosegui and A. Gallo, "The Achievements and Failures of Argentina's Neo-Liberal Economic Policies," *Oxford Development Studies*, Vol. 30, No. 1, 2002.

\_\_\_\_\_ with T. Cavalcanti and P. Silva, "Economic Integration without Policy Coordination: The Case of Mercosur," *Emerging Markets Review*, November 2002.

\_\_\_\_\_ with J. Bang, "Privatization and Equity in Brazil and Russia," *Kyklos*, Vol.55, fasc. 4, 2002.

\_\_\_\_\_ with E. Amann, "Neoliberalism and Its Consequences in Brazil," *Journal of Latin American Studies*, November 2002.

\_\_\_\_\_ with D. Coes, "National Sovereignty and Consumer Sovereignty," *The Quarterly Review of Economics and Finance*, Winter 2002.

**Daniel Bernhardt**, Economics, with E. Hughson, "Intraday Trade in Dealership Markets," *European Economic Review*, 2002, pp. 1697-1732.

**Murillo Campello**, Finance, "Internal Capital Markets in Financial Conglomerates: Evidence from Small Bank Responses to Monetary Policy," *Journal of Finance*, December 2002, pp. 2773-2805.

**Dennis Chambers**, Accountancy, with Ross Jennings and Robert B. Thompson II, "Excess Returns to R & D-Intensive Firms," *Review of Accounting Studies*, June/September 2002, 133-158.

**C. Bryan Cloyd**, Accountancy, with Ben Ayers and John Robinson, "Capitalization of Shareholder Taxes in Stock Prices: Evidence from the Revenue Reconciliation Act of 1993," *The Accounting Review*, October 2002, pp. 933-947.

\_\_\_\_\_ with Lillian Mills and Connie D Weaver, "Market Nonreaction to Inversions," *Tax Notes*, January 13, 349-262.

**Stephen D'Arcy**, Finance, "Insurance Price Deregulation: The Illinois Experience" in J. David Cummins, *Deregulating Property-Liability Insurance* (American Enterprise Institute-Brookings Institution Joint Center for Regulatory Studies, 2002).

\_\_\_\_\_ and Jui Xia, "Insurance and China's Entry into the WTO," *Risk Management and Insurance Review*, Spring 2003.

## Research News

**Marianne A. Ferber**, Economics, emerita, "Women's Uneven Progress in Academia: Problems and Solutions," in Lilli Hornig, ed. *Women at Research Universities*, Plenum/Kluwer, 2003, pp. 281-309.

\_\_\_\_\_ "Feminist Critique of Becker's Theory of the Family," in Karine Moe, ed. *Women, Family, and Work*, 2003, pp. 9-23.

\_\_\_\_\_ with Jane W. Loeb, "Issues in Conducting an Institutional Salary-Equity Study," in R. Toutkoushian, ed., *Conducting Salary-Equity Studies: Alternative Approaches to Research, New Directions for Institutional Research*, No. 115, Fall 2002, pp.41-70.

\_\_\_\_\_ with Carole Green, "Career and/or Family: What Choices Do College Women Have?" *Journal of Labor Research*, Vol. 24, No. 1, Winter 2003, pp. 143-151.

**James D. Hess and Dilip Chhajed**, Business Administration, with W. Kevin Chiang, "Direct Marketing, Indirect Profits: A Strategic Analysis of Dual-Channel Supply Chain Design," *Management Science*, Vol. 49, No. 1, January 2003, 1-20.

**Darren Lubotsky**, Economics, with Anne Case and Christina Paxson, "Economic Status and Health in Childhood: The Origins of the Gradient," *American Economic Review*, Vol. 92, No. 5, 2002, pp. 1308-1334.

\_\_\_\_\_ with Angus Deaton, "Mortality, Inequality, and Race in American Cities and States," *Social Science and Medicine*, Vol 56, No. 6, 2003, pp. 1139-1153.

**Juha Seppala**, Economics, with Rao Aiyagari, Albert Marcet, and Thomas Sargent, "Optimal Taxation without State-Contingent Taxes," *Journal of Political Economy*, Vol. 110, 2002, pp. 1220-1254.

**Ira Solomon**, Accountancy, with K.T. Trotman, "Experimental Judgment and Decision Research in Auditing: The First 25 Years of AOS." *Accounting, Organizations & Society*, May 2003, pp. 395-412.

\_\_\_\_\_ with Timothy Bell, eds. *Cases in Strategic-Systems Auditing*, KPMG: Montvale, NJ, 2003, 369 pages.

### Other Activities

**Werner Baer**, Economics, coordinated the CIBER/ European Union Center sponsored conference on Europe's Peripheral Economies, February 22, 2003.

**Peter Colwell** has recently agreed to continue his position as Honorary Professor in the Department of Land Economy at the University of Aberdeen, Scotland. The appointment entails an annual trip in June to present lectures and seminars, consult with faculty, and attend the European Real Estate Society Meeting.