ACCELERATED DIFFUSION OF POLLUTION PREVENTION TECHNOLOGIES (ADOP²T)™

WMRC unveils an innovative model for promoting P2 adoption

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Most individuals involved in the diffusion of innovative pollution prevention (P2) strategies would agree that while many successful cases of P2 adoption have been documented, pollution prevention continues to diffuse relatively slowly across most industrial sectors. This phenomenon is particularly troublesome given the obvious advantages P2 offers over other environmental management strategies with respect to areas such as cost reduction, improved efficiency, improved compliance, and waste reduction.

This article describes a new model for P2 diffusion devised by the Waste Management and Research Center (WMRC) in Illinois. The model—which we call Accelerated Diffusion of Pollution Prevention Technologies, or ADOP²T™—offers an innovative and practical approach to speeding up the adoption of pollution prevention technologies.

Background: Why P2 Is Being Adopted Slowly

A summary of the reasons for P2's relatively slow adoption rate is provided below.

- *Prevention as a "Hard Sell"*—Prevention tends to be a difficult concept to sell because the benefits occur in an unknown distant future (Rogers, 1995). For example, seatbelts were not widely adopted until laws were instituted that required their use, despite the fact that the advantages of seatbelts, in terms of injury prevention, were well documented and publicized.

- *Change Agent Identity*—Government change agents (P2 technical assistance providers) that actively promote pollution prevention are

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generally regarded as being "very different from" or even "hostile to" the private sector entities they are trying to influence regarding P2 adoption. Businesses do not normally turn to government agencies for sources of innovation (Bierma and Waterstraat 1995).

- *Emphasis on Awareness*—Most entities that are actively trying to promote P2 have focused on creating "awareness knowledge" of pollution prevention practices. Emphasis has been placed on creating fact sheets, case studies, databases, and Internet resources. These materials generally are effective at describing the advantages of various P2 practices. The change agents that distribute the awareness materials often become frustrated with their clients for not adopting the practices because they feel that the awareness information should be adequate to justify adoption. However, many change agents fail to recognize that assistance with developing sound technical principles and "how-to" support regarding implementation of P2 practices are also often required to ensure that the practices are adopted (Lindsey, 1998).

Research recently conducted by WMRC suggests that providing "awareness" information alone regarding P2 innovations is inadequate with respect to encouraging adoption.

- *Optional Nature of P2*—Very few regulatory requirements have been instituted that require the implementation of P2. While most potential pollution prevention adopters recognize its value and importance, the choice to adopt P2 remains predominantly optional, with little urgency associated with it. Consequently, P2 tends to be pushed aside in favor of more immediate compliance-oriented strategies that are not optional (Lindsey, 1998).

- *P2's Innovation Characteristics*—According to Rogers (1995), the adoption rate of innovations tends to be affected by five basic characteristics:

- *Relative advantage* over the idea that the innovation supersedes
  - *Compatibility* with the existing values, past experiences and needs of potential adopters
  - *Complexity*—perceptions regarding how difficult the innovation is to understand and use
  - *Observability*—the degree to which the results of the innovation are visible to others
  - *Trialability*—the degree to which an innovation can be experimented with on a limited basis

P2 innovations tend to exhibit strong relative advantage attributes. The other characteristics, however, can vary widely depending on the innovation in question (Lindsey, 1998).

"Awareness" Is Not Enough

Research recently conducted by WMRC (Lindsey, 1999) suggests that providing "awareness" information alone regarding P2 innovations is inadequate with respect to encouraging adoption. This research examined a data set of 76 companies that were identified by WMRC P2 change agents as strong candidates for adopting membrane filtration technology for in-process recycling of aqueous cleaners and/or metalworking fluids. These companies were viewed as having both the economic incentives and the technical ability to adopt the new technology.

Forty-seven of the companies examined in this research received only awareness information about the technology in the form of case studies, presentations, fact sheets, and vendor information. *None of these companies ultimately adopted the technology.*

An additional eight companies received brief demonstrations (lasting several hours) of the technology along with the awareness information. None of these companies adopted the technology, but four of them decided to pursue a more

extended pilot trial based on the encouraging results of the demonstration.

In contrast, at least 13 of the 21 companies (62%) that conducted extended pilot trials of the technology ultimately adopted it permanently. The pilots lasted one to two months. Several other companies in this group of 21 will likely adopt the technology in the near future when they receive budget approval for capital expenditures.

Clearly, fact sheets, case studies, and vendor databases provide potential adopters with awareness of an innovation's advantages. However, as the results of the WMRC research indicate, these resources do not adequately address some of the key factors that determine whether an innovation will be adopted—especially issues regarding the innovation's compatibility with existing operations and the perceived technical complexity that often accompanies unfamiliar technology.

The WMRC research suggests that demonstrations of P2 technologies can significantly increase a potential adopter's interest. However, for innovations that require substantial changes in a company's operating procedures, pilot trials of the technology need to be conducted. These pilot trials allow the adopter to reduce uncertainty regarding the technology's compatibility with existing operations and lessen the perceived technical complexity associated with the technology.

Pilot trials also provide the information and the uncertainty reduction required for key decision makers within a facility—"innovation champions"—to increase their comfort level with the technology. Once these innovation champions are convinced that the innovation is a good fit for their organization, they will use their influence to make sure that the obstacles that commonly arise regarding the adoption process are overcome.

ADOP²T™: A New Model for Accelerating P2 Diffusion

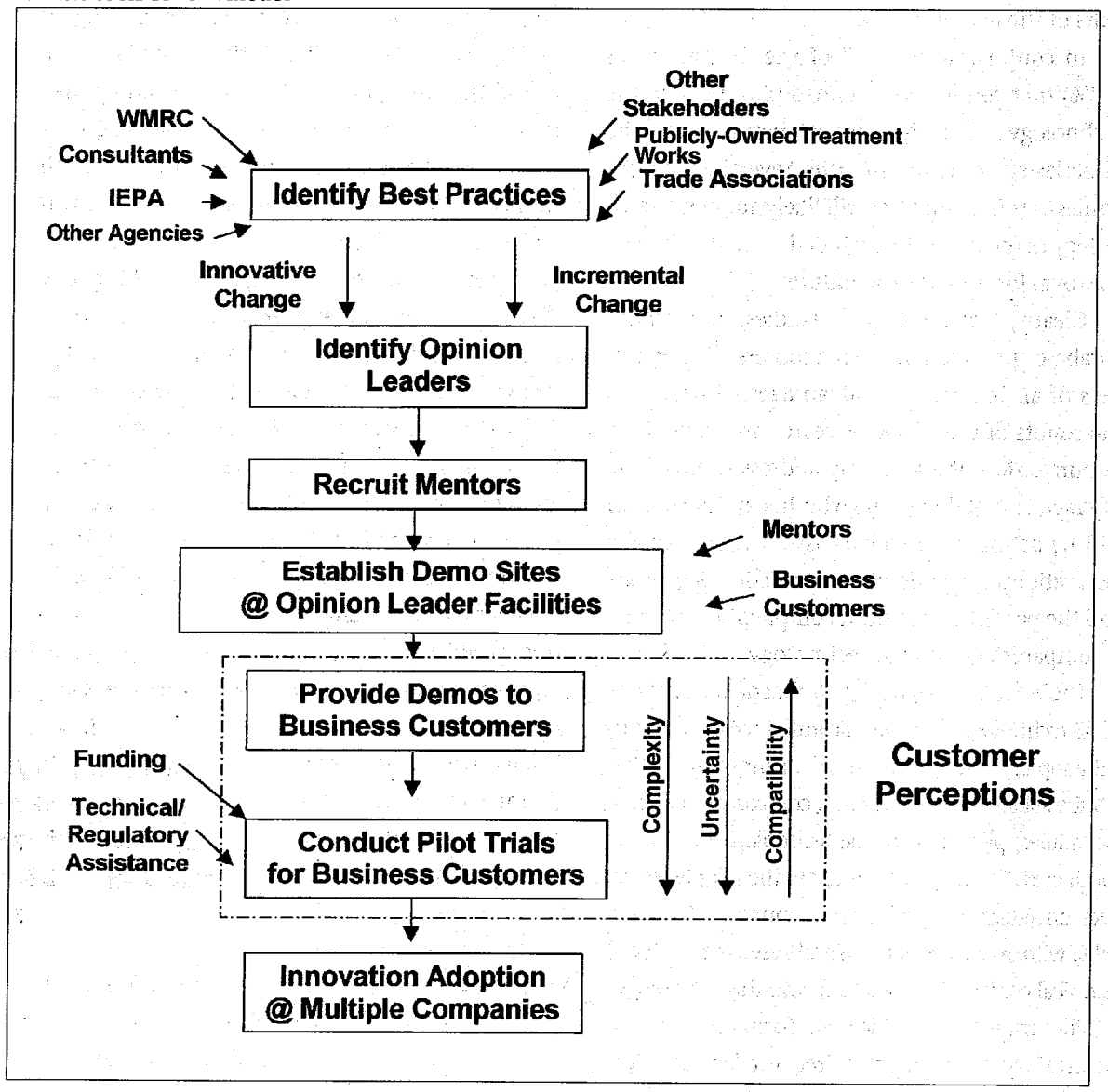
Based on the observations described above, WMRC has developed a new model for accelerating P2 adoption. This model—called Accelerated Diffusion of Pollution Prevention Technologies, or ADOP²T™—is founded on time-tested innovation diffusion principles that have been applied to innovations in industries as diverse as agriculture and communications. WMRC research (Lindsey, 1999) has confirmed that these principles apply to P2 as well.

A general process flow diagram describing how this model could be applied to a given sector is presented in **Exhibit 1**. As shown, the model begins by working with various stakeholders—including other agencies, trade associations, and consultants—to identify the best P2 practices for an individual sector. (The "other agency" category will generally include the relevant state environmental protection agency; in the case of WMRC, which is located in Illinois, this would be the Illinois Environmental Protection Agency [IEPA]). The stakeholders would use "Design for the Environment" principles to simultaneously evaluate the performance, cost, environmental impacts, regulatory requirements, and worker health and safety of the various P2 practices under consideration. The best practices identified would be divided into "innovative" and "incremental" process changes.

Once these innovation champions are convinced that the innovation is a good fit for their organization, they will use their influence to make sure that the obstacles that commonly arise regarding the adoption process are overcome.

Rogers (1995) points out that most decisions to adopt or reject an innovation are based on a subjective evaluation of the innovation grounded in input from peers who are perceived to be credible. For this reason, the stakeholders involved in the P2 diffusion effort would identify industry sector "opinion leaders" that the majority of individual businesses look to for innovation advice. Some of these opinion leaders would be recruited to serve as "mentors" to companies that have not yet adopted innovative P2 practices.

Exhibit 1. ADOP²T™ Model



Demonstration sites would be established at mentor facilities. WMRC technical assistance personnel and other stakeholders could then bring individuals from companies that have not yet adopted the best practices to the mentor facilities to view demonstrations of the innovative practices.

In some instances, technologies may show potential as "best practices" although they have not yet been adopted by opinion leaders. In such cases, WMRC or other stakeholders would conduct technical and economic evaluations of the technologies. Developmental and applied research would be conducted as necessary to fully develop the technical principles of the technology required to facilitate implementation. This information could, in turn, be used to facilitate the development of a demonstration site at a mentor facility.

It is conceivable that some companies would choose to implement certain incremental practices based solely on observations of these practices at the mentor facilities. However, pilot trials would generally be needed in the case of practices that

require more extensive process changes and/or more sophisticated technology implementation.

Pilot trials of innovative P2 practices would be conducted at the facilities of potential adopters with technical and monetary support from WMRC and other stakeholders. It is anticipated that the demonstrations and pilot trials would enable potential adopters to reduce the uncertainty associated with the previously unfamiliar practices. These activities would also help resolve compatibility issues associated with the practices' incorporation into adopters' existing operations and address the perceived technical complexity of the innovation.

The results of the pilot trials, demonstrations, and research efforts would be incorporated into a variety of fact sheets, case studies, and database materials that could be used to create additional awareness of innovative best practices among other change agents and companies who have not yet adopted them.

Addressing Information Gaps

Depending on the maturity and complexity of the various process technologies under consideration, a range of information gaps may exist that prevent them from being widely adopted. These information gaps would be addressed by conducting various technology evaluation projects tailored to the type of technology in question:

Level 1. Proven technologies that have not diffused broadly. Evaluate, troubleshoot, and customize technologies to prove their performance on a site-specific basis.

Level 2. Promising but unproven technologies. Confirm and document technical capabilities and performance, promote awareness of the technology, and proceed to Level 1.

Level 3. P2 problems with no known solutions. Conduct basic research to develop technical principles and technology required to solve the problems and proceed to Level 2.

Addressing the information gaps with these three levels of research would ensure that appropriate testing is performed to facilitate technology transfer and innovation adoption.

Conclusion

The ADOP²T™ model should substantially improve the diffusion of innovative P2 practices because it provides mechanisms to address the deficiencies that are common in other pollution prevention technical assistance models. The key to this model's success will center on providing the "how-to" knowledge required for successful implementation. It is anticipated that the model would have broad application with respect to many P2 technologies in a variety of industrial sectors.

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The ADOP²T™ model also offers the further advantage of providing results that are readily measurable. Measuring the adoption/rejection of the specific P2 practices promoted through this model can be easily accomplished by simple survey methods.

References

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