Innovation Adoption Processes for Third Party Property Management Companies

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ABSTRACT

Innovation adoption studies have never been applied to third party property management companies. These companies manage buildings for a fee as their primary business. Property management companies are influential in the adoption process for new technologies because they act as gatekeepers for technical information. This study analyzes radical and routine adoption process that are found in large, professionally operated property management companies. The process is explicated. The technical managers, and their role as technology gate keepers, are described. The distinction to the technical managers between routine and radical technology is that routine technologies do something in a new way and radical technologies do something new. Observations concerning evaluation and adoption of information technologies are described. The findings suggest methods of successfully tailoring and introducing technologies to this market.

Introduction

This paper describes research undertaken as part of a multi-year study on the building technology adoption process for radical and routine technologies used by fee-based property managers. The technology adoption research was part of a larger, multi-institutional project on diagnostics for commercial buildings (Sebald and Piette 1997, Piette et al. 1999). The research has included identifying the participants in the decision making process, defining the process, and selecting a promising performance monitoring technology. This paper summarizes all of those activities, plus the comments and responses from four third party technical managers who visited the pilot site. The purpose of this research is to track radical and routine technical innovations from the point of initial knowledge of the technology through the adoption of the technology. The research is funded by the California Institute for Energy Efficiency and the California Energy Commission to increase the understanding of adoption procedures used by large commercial property managers. This increased understanding is intended to be useful to shaping research and market transformation concepts to promote energy efficiency in buildings.

The paper begins with an overview of a monitoring and diagnostic technology demonstrated in a large office building. This is followed by an overview of innovation theory and technology adoption processes. Next, we describe the project and methods used in the study, including a description of the property management companies, the technology managers, and perspectives on routine versus radical innovations. The discussion of findings includes recommendations for both commercialization of new technologies and research methods to involve property managers.

Overview of the "Radical" Technology: The IMDS

A building prototype Information Monitoring and Diagnostic System (IMDS) was developed and tested for monitoring heating, ventilation, and air-conditioning (HVAC) system performance in office buildings. The IMDS originated from similar technology that has been most widely used in "high tech" manufacturing facilities. Its selection to be studied was an outgrowth of an interview process and direction offered by the technical managers interviewed. The site was selected based on the willingness of the participant to allow open access, pay for the installation of the equipment, and be available for further interviews. The site also had to conform to the size and budget of the research program. The original industrial monitoring and data visualization tools were modified to tailor it more directly to the needs of the fee management business. The purpose of the technology is to aid the operators and technical managers to better operate their building. The technology adoption analysis was conducted during the same period as the technology development and asssessment (Sebald and Piette 1997, Piette et al. 1999).

The IMDS consists of a set of high-quality sensors, plus data acquisition and visualization software, including a web-based remote access system. It is a prototype system deployed in a unique combination of sensors, hardware, and software to examine its value in a controlled test. Further details have been reported in a series of reports (Sebald and Piette 1991, Piette et al. 1999). The project web site has an extensive description of the system, along with a "virtual tour" (http://eetd.lbl.gov/EA/IIT/diag/). The system can be built up from individual components and installed in any commercial building. It is, however, a high-end system, intentionally designed for reliability, accuracy, and speed in data acquisition, archiving and retrieval. This demonstration will allow the controls industry to examine the value of such systems that greatly exceed today's current Energy Management and Control System technology. Such a system is the starting point for more advanced, automated, diagnostics, such as model-based or rule-based systems. Installation of the IMDS by the building engineers commenced in December 1998 and was finalized in May 1999. The IMDS is still fully operational.

Theory Background

Innovation adoption theory has been applied to a wide variety of products and services. The first step to understand the adoption of new products and services is to understand the process used by the potential adopter to select or reject a technology. The adoption process is found to contain five essential steps in **all** cases: Knowledge, Persuasion, Decision, Implementation, and Confirmation or Denial (Rogers 1983). These broad categories are found in **all** types of adoption decisions and are not unique to this study.

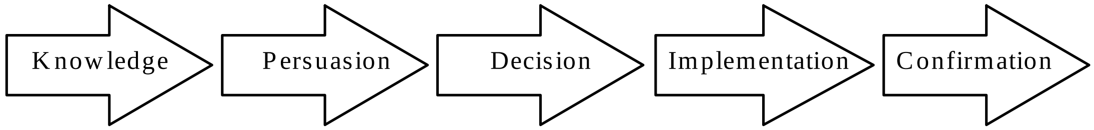

Figure 1. Stages in the Adoption Process.

Within any population, innovations are not accepted simultaneously by all of the participants. Certain individuals are predisposed to try out innovations first. Some people are inclined to take greater risks, be more venturesome and tolerate early disappointments. These differences are based on personality, temperament, experience and perceived need. Innovation researchers label these individuals as innovators and research finds that they are typically about 1.5-3% of a population (Figure 2, Rogers 1991).

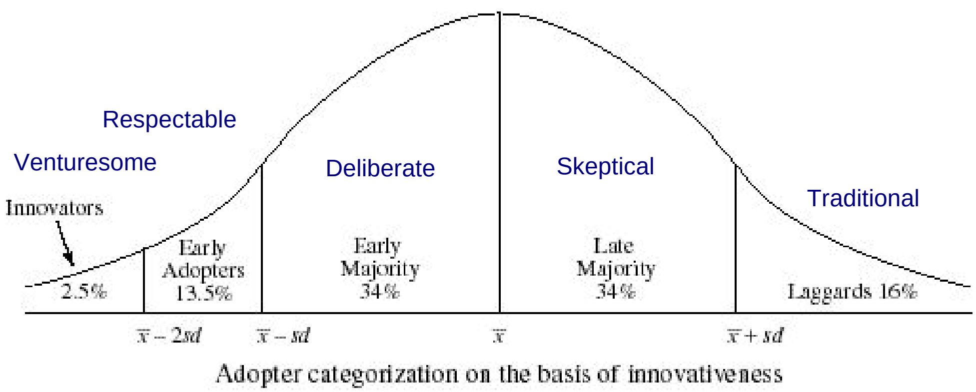

Figure 2. Innovators are a Small Portion of the Population

Success with the innovator does not guarantee success with later adopters, but it is a required step in the adoption of any innovation. Innovators and early adopters are frequently categorized together. Combined, innovators and early adopter constitute 16% of the population. Recent studies confirm that the adoption by early adopters does not guarantee success with the broader population of mature, late and laggard adopters and that a "gap" may occur after the introduction of a technology to the early adopters and innovators (Moore 1991). This research focuses on the small subset of early adopters and innovators and does not address "crossing the gap".

Gatekeepers are persons in a population who have the ability to control information. Rejection by gatekeepers may mean that promising technology is never introduced system for further appraisal. Adoption by gatekeepers does not imply complete adoption, merely, that the gatekeeper found the technology promising and is willing to have it further considered. Gatekeepers can bring in promising technologies, guide them through adoption process and are often responsible for determining if the technology is a success (Allen 1981, 1989).

Many types and characteristics of innovation have been studied by previous researchers (Nord and Tucker 1987). This research focuses on radical and routine innovation adoption processes defined as follows:

- **Radical.** A radical technology is new to the organization and provides a product or service that does something that formerly they could not do with existing technologies. It is likely to involve more substantial expenditures and be more complex to understand. If it were implemented throughout a company, it could require changes to the company's structure or the skills of the workforce.

- **Routine.** A routine technology innovation is one that while new to the organization will not require a substantial expenditure or include significant structural or skill changes to the workforce.

Project Description and Methodology

This project began with an analysis of the commercial sector market and plans to identify innovative building operators for collaboration in the development of information technology for improving building operations. We decided to use an industry association to identify innovators. Innovators were originally selected by technical committees at the California Building Owner and Managers' Association's (BOMA) local offices. The committees were given a description of innovators and asked to select companies from their member organization who fit the profile of innovators. The BOMA committees were not told whether the innovation was in technology, management systems or marketing.

Several names occurred more than once from the different geographical areas as senior technical manager's areas in many cases cover several cities. The original group was interviewed by telephone and asked about their willingness to participate. Six companies were chosen that represented union/non-union companies, Northern and Southern California and urban/suburban buildings. The managers selected were also recommended from the group of innovators selected by the technical committee. That is, during the telephone interviews with the all individuals selected by the BOMA technical committees, the subjects were asked who among their peers they believed were the most innovative leaders. The technical managers interviewed in the last portion of the research are those who were named by their BOMA committees and further selected by their innovative peers. The six companies interviewed were all represented by a technical manager acting as a gatekeeper for new technologies. The gatekeepers were asked to schedule a significant amount of time for an interview about their business practices. These interviews took place at the subject's place of business and took from 6 to 14 hours to administer over several visits.

The technical managers described existing business practice, incentives and barriers to the adoption process. A workshop was held to show the innovators a variety of building operations performance analysis and information technologies. From these original interviews and results of the workshop, the IMDS-type technology was selected for the project and a specific design was developed. Similar technology had been previously utilized by the Supersymmetry Group. Such technology had been most widely used in "high tech" manufacturing facilities where high energy bills and larger operations budgets allowed for investment in the high quality sensors, data acquisition systems, and visualization tools. It was interesting to the technical managers, but considered economically unfeasible because of high first costs and unknown benefits.

This research uses Participant Action Research (PAR). This method varies from the conventional research methodology with an impartial interviewer and a subject that may not be told the purpose of the research so that results are not biased (Schwenk 1985). In PAR, the participant is aware of the goals and methodology of the research. Participants are asked to do a significant amount of self reporting and notify researchers of changes. Participant Action Research is valuable in situations where the subject is complicated, occurs in a complex environment and the adoption process occurs over a long period of time. It is also useful in situations where the participants are busy and possibly unwilling to be interviewed unless they know the purpose of the interview.

A survey instrument asking about operations and maintenance practices was administered twice. The first survey asked participants to describe a recent routine technology they had evaluated. In this interview, the questions on the survey were designed to cover the process for knowledge of the innovation to confirmation or denial. During the second interview, the technology managers were shown the IMDS and asked to describe what would be necessary for the adoption of the technology. One site was selected to test the IMDS and determine its acceptance to the commercial building market. The costs and benefits of the IMDS and other test results are reported in Piette et al. (1999). This analysis include bi-weekly interviews with the operators to evaluate how they utilized the IMDS. The research team tracked building operations problems identified and remedied by the on-site staff with the use of the IMDS.

Description of Pilot Study

The pilot site is located in downtown San Francisco at 160 Sansome Street. The IMDS is currently operational, collecting data for the building engineer and technical manager's use. The building is a moderately sized, 100,000-square-foot, 20-story commercial office building that is operated by one engineer. One of the floors is the home for the third party property management company, but the property is not owned by them.

After a slow start (over several months) in adopting the technology, the technical manager and engineer now use the IMDS system as it was intended. They recently decided to enhance the technology further and use the IMDS as a base system for a complete control and monitoring system. This means that the radical innovation has gone all the way through the innovation process from knowledge, persuasion, decision, implementation to confirmation and acceptance. This pilot study presents a unique opportunity to view the adoption process for a radical innovation from start to finish.

Confidentiality and Respect for the Participant Researchers Privacy

The participant action subjects have been open to showing the IMDS to researchers and competitors in the building industry. Our test-site agreement requested their willingness to show the techology to others and they have fully complied. The researchers agreed not to publish detailed information about costs or business practices. We have agreed not to reveal information about operating or related confidential costs. We have complied with this request and have an ongoing collegial relationship with the pilot study participants.

Description of the Participant Companies

The survey and the pilot study participant are all large fee-based management companies who do a substantial business in California. The vast majority of the business generated by these companies comes from professional property management services including leasing, operating and financial management services. Four of the companies interviewed are multi-national, though their technical innovations are reviewed regionally or nationally. The remaining two companies are California founded and based, although the owners of the properties they manage are located around the globe.

The companies' technical management team's responsibilities are overshadowed by the size and resources dedicated to financial and marketing management. The dominance in these organizations is not held in the technology and maintenance departments; however, in context of their business environment, the technical managers have significant control of the technical decision making and are the leaders of the innovation adoption process.

These companies have all been involved in reorganizations in the last ten years, with consolidations and mergers in the last three years. The companies generally do not yet have national or international policies for technical adoption, although three of the companies have an emerging national technical management system. Their primary purpose is to keep the properties at a quality level acceptable to the marketing departments. Many companies who are now customers of the fee managers formerly operated their own facilities. There is a trend in this industry towards out-sourced, fee-based property management.

One interesting observation is that government office building practices are of little interest to fee-based managers. They rarely track advances in government buildings. This prejudice against government operated structures is widespread and there is very little intersection between the operators of government buildings and the private sector.

Technical managers are responsible for finding, hiring and organizing building operations and engineering staff. Some regional areas are vast, encompassing "all properties west of the Mississippi," for example. In the urban areas, engineers are members of the Stationary Engineers Union. In the suburban buildings, many engineers are not union members. The technical managers are salaried employees. Office buildings that exceed 100,000 square feet tend to have on-site engineers. Small buildings share engineers, or are serviced by vendors under the fee-based managers. Technical managers report considerable competitive pressure to manage with fewer and fewer on-site labor hours. Technology innovations that offer the promise of lowering labor hours are of interest.

Building engineers' tasks involve checking of equipment within daily operations. A small, but significant portion of the labor for upgrades and maintenance is done by the engineers. Other work is bid out to contractors. An exception is automation and controls. The technical managers express considerable dissatisfaction with the status quo in building controls. The primary reason appears to be a lack of accesibility to the technology which they describe as "black box". Black-box technologies may perform the functions required, but the method is not clear. The managers prefer open technology. Building control systems have historically used proprietary software and hardware. The managers report dissatisfaction with the ongoing relationship they are forced to maintain with control vendors. The inability to competitively bid service work for controls work also leads to dissatisfaction.

Description of the Technology Managers

All six of the technology managers interviewed were males between the ages of 45 and 60. Without exception they had been with the property manager for a significant amount of time (ten or more years). They tend to follow management personnel that they had previously worked with. The managers' skills are generally not school-trained skills. Only one of the managers has a university degree engineer. The managers describe their early work in the industry as a progression from building engineer at a larger property. Early in their working years, they become chief engineers responsible for their own properties. Their companies later placed them in larger facilities where they shared their expertise with several buildings in the same geographic area. Soon, their expertise was used widely within the company and they were moved into corporate management.

A significant part of the technical manager's job is the acquisition of new work. The technical managers describe their position as less important than the marketing and financial parts of the team from the perspective of the future clients. Generally, decision makers at the asset management companies and owner organizations have financial backgrounds. They have little technical knowledge to evaluate the technical mangers. Customers of the fee managers assume that the technical management services offerings of each company are equivalent. Since the decision makers do not understand technology, they tend to hire a property manager on their financial and leasing abilities.

The ability to rise to the top as a technical manager is related to the manager's ability to work with people. The technical managers gather about themselves an information network to identify, evaluate and test new technologies. An early finding of the study was that salespeople, unless well known, are not considered valuable sources of information for new technologies. Knowledge based on experience is the most valued selection attribute for any new technology. These technology gatekeepers maintain long term relationships with former colleagues. While they never reveal specific information about a client, they are willing to offer advice to peers on technical issues. Their ability to share information in industry groups and with peers is a source of pride. The technical managers in the innovative companies generally know each other, at least by reputation. They tend to speak flatteringly of one another; although, over time, some jealousy in their relationships is apparent.

Building engineers do not appear to move frequently and many spend nearly all of their careers in the same buildings; however, the building's fee manager change several times in the life of a building due to sales and mergers of the structure. This means that many of the technical managers know building engineers that are working for another fee manager. The technical managers continue their relationships with the building engineers and commonly call upon building engineers now working for their competitors for advice and council.

New buildings provide a rich source of new technology for evaluation. Managers tend to be careful to refer only proven technologies for installation or upgrades, so innovative new technologies that are introduced with a newer building are highly valued. Advances in electronic technologies found in newer buildings are carefully scrutinized. The managers generally do not have funds such as those available in new construction, though creative technical managers often find out ways to get new technology into a building if it is useful.

Technology Process for Radical and Routine Technologies

Radical and routine innovations are viewed differently. The managers do not like surprises, so projected upgrades are often planned for up to ten years in advance. The longer an upgrade is known, the greater the comfort for the managers. Building owners may see their entire annual return on investment negated by a single chiller replacement. Advance knowledge of major costs is highly desired.

Routine technologies identified by the managers tend to be upgrades to features of existing technologies. Often old technology may be in need of replacement because of its limited capabilities. Items needing upgrades are easy to sell to financial managers. There is a conscious intent to encourage the decision making by repeatedly reminding the financial managers at the owner organization of the necessity of future upgrades. The technical managers do not intentionally dissemble about the need for new technology, but some dissembling takes place. This dissembling appears to be analogous to a doctor who tells a patient what they need to hear to encourage them to submit to tests and procedures that are good for their health. Technical managers describe the short attention span of financial managers whose "eyes glaze over" on technical matters. The technical manager's attempt to convince the financial managers of the "right" technical decision by a judicious application of the truth. In other words, the financial managers may be allowed to continue in ignorance of the reasons for a new routine technology as long as they support the "right" decision. This is not considered unethical, and is a widespread practice reported by each company interviewed.

Both property managers and corporate finance people have little knowledge of technology. These managers are not interested in investing time to learn about technologies. However, the technical manger is expected to have some financial knowledge and to help prepare budget forecasts. He is also expected to prepare reports and presentations for new properties evaluating the state of a property and expenditures to bring the property to regulatory and industry standards.

Routine technologies tend to be less costly than radical technologies, but even costly chiller retrofits were categorized as routine. Irrespective of the definition offered by a researcher, technical managers interpret routine and radical innovations using their own language. The distinction to the technical managers is that routine technologies do something in a new way and radical technologies do something new.

Radical technologies are harder to review for adoption. The managers are so eager to get an opportunity to look at some new technologies that they are willing to bend their own rules to enact them. For example, the technical managers have installed or assisted in the installation of some of the IMDS devices. Working together with their building engineers, they were willing to install the equipment on off hours. Their primary motivation appears to be the opportunity to take a look at new technology. The idea of a new technology, especially in the difficult to penetrate information technology field, has been a compelling reason behind their willingness to adopt the radical technology.

Many of the contacts developed over time by the technology managers do not include people who understand controls and electronic technology. The technical managers have knowledge of the companies that service their industry. They have strong feelings about the service technicians, products and capabilities. They believe they know who can give them good advice, but they do not know the new technologies thoroughly. Actual direct knowledge about information technologies is hard to come by and highly valued.

At this point in their careers, many of these senior managers are reluctant to reveal their ignorance of new electronic technologies. They rely upon a small pool of knowledgeable building engineers with newer electronic systems to tell them what is desirable and required. This lack of direct personal understanding and knowledge about the newest electronic technologies is a source of some anxiety to these senior managers. However, they have made their name in their companies for their fearlessness towards new technical changes and their knowledge of new technologies. This tension between the desire to hold personal position and not reveal ignorance regarding the new technology is the greatest source of anxiety for the technical managers. They are generally isolated in the companies corporate headquarters and at this level much of their time is filled with preparing the companies cost reports, new client presentations and operational personnel issues. They have less direct opportunity to observe and tinker with new electronic technologies.

Findings

Technical managers are the key to the adoption of new innovations within these companies. Although the managers can recall many instances of technology they recommended for adoption being rejected, none can recall a technology they rejected that was subsequently adopted. An affirmation of approval by the technical manager does not mean automatic acceptance since the innovation must still pass financial and property management approval.

The technical managers are willing to recommend a promising technology whether it is routine or radical if they believe that it is in the client's interest. The manager's believe that most of the owners and asset managers of the properties have very little technical experience and are generally not interested in learning about new technologies as it is a minor part of their jobs. The technical manager acts as an interpreter and guide helping the property managers and owners make the decisions that are good for them even if they lack the knowledge or experience of the technologies.

The technical managers would prefer if every technology were a routine adoption decision. They would like to understand the potential costs and present them to the ownership with no surprises. The quickly evolving information technologies have been particularly difficult for these managers to understand and adopt because of elusive costs and benefits.

Limitation of technical adoption of new information technologies falls into three categories. First, the managers have moved into a position where direct experience is not as easy to obtain. The managers do not have the technical background or education with information systems that allow them to understand changes as they occur. Second, the method of obtaining information about new systems is not organized and relies upon outside factors beyond the control of the technical managers. The acquisition of new technologies in buildings and in new buildings is random and cannot be planned for. Existing networks of friends and peers with knowledge of new information systems is limited as others in the industry do not understand the new information systems well either. Finally, the complexity of many of the systems exceeds the manager's ability to understand them in quick, telephone conversations with peers, employees, and salesmen.

Recommendations for Commercial Providers of Technology

The technical managers at large third party property management companies are the gatekeepers for new technologies. A detailed understanding of their business practices shows that they lack good sources of information about new technologies and are skeptical of traditional sales methods. Knowledge based through experience is the most highly valued information. The establishment of peer referrals at present is random and idiosyncratic to each manager. Helping to foster communications between successful users of a new technology and these technical managers may be the best sales method to use. Generally, these managers do not consider governmental sources of information as valued sources and describe the best information as that information that comes to them based on knowledge from experience. These managers have extensive experience with many of the control companies in the industry today, who tend to be the providers of new information technology. Past negative experience can be a strong disincentive to future work and negative experiences even those that occurred many years ago are remembered.

Findings for the Research Community

Obtaining collaboration with the commercial property market is difficult given the number of independent levels involved in decision making; however, the payoffs can be great. Presenting the opportunity to see a new technology in one of their own buildings is a compelling method of getting the attention of these technical managers. They are a rich source of information about the business practices and are willing to share this information if they receive knowledge about new innovations. Presently, the managers are interested in information systems, Internet applications for commercial buildings, and the ability to optimize the use and purchase of energy.

The process for routine and radical adoptions is different, though the managers attempt to make all decisions routine by identifying them early and presenting them without fanfare. Radical innovations require more active intervention on the part of the technical managers since the cost and disruption to the staff may be significantly greater. Relationships of trust and respect with these gatekeepers are difficult to obtain, but not impossible to develop.

The existing level of knowledge about information systems is low given the managers' opportunity to directly observe new technologies. Researchers must be prepared to provide deep and ongoing assistance to the users of new technology to help them understand its use and purpose.

Participant Action Research projects are easier to sell to these subjects than traditional blind studies. Blind studies that do not provide open information or are indirect may be perceived as devious, with key information withheld even if the manager does allow the interview. The technical managers are extremely busy and not interested in spending time on activities that do not provide useful information. The opportunity to fully participate in the project at all levels keeps the managers interested and allows the researcher to see the complexity of the decision making process.

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References

Allen, Thomas J. 1981. *Managing the Flow of Technology,* Cambridge, MA, MIT Press.

Allen, Thomas J. and Kumar S. Nochur, 1992. "Do Nominated Boundary Spanners Become Effective Technological Gatekeepers?", *IEEE Transactions on Engineering Management*, August , Vol. 39. No. 3.

Benson, Brian, Sage, Andrew P and Cook, Gerald, 1993. "Emerging Technology - Evaluation Methodology with Application to Micro-electromechanical Systems." *IEEE Transactions in Engineering Management*, p. 114-123, May, Vol. 40. No. 2.

Moore, Goeffery A., 1991. *Crossing the Chasm: Marketing and Selling High-Tech Products to Mainstream Customers.,* New York, NY: Harper Collins Publishers.

Nord, W. R. and S. Tucker, 1987. *Implementing Routine and Radical Innovations.* Lexington, D. C. Heath and Company, Lexington Books.

Nyberg, David, 1994. *The Varnished Truth, Truth Telling and Deceiving in Ordinary Life.* Chicago, IL: University of Chicago Press.

Piette, M. A., S. Khalsa, P. Haves, P. Rumsey, K. L. Kinney, E. L. Lee, A. Sebald, and C. Shockman, 1999. "Performance Assessment and Adoption Processes of an Information Monitoring and Diagnostic System Prototype," report to the California Energy Commission, LBNL Report No. 44453.

Sebald, A. S., and M. A. Piette, 1997. "Diagnostics for Building Commissioning and Operations," prepared for DOE and the California Institute for Energy Efficiency, LBNL Report No. 40512, December.

Rogers, Everett M., 1983. *Diffusion of Innovations*, Third Edition. New York, NY: The Free Press.

Schwenk, Charles, 1985. "The Use of Participant Recollection in the Modeling of Organizational Decisions." *Academy of Management Journal*. 10 (3): 496-503.

Utterbach, James M., 1994. *Master the Dynamics of Innovation, How Companies can Seize Opportunities in the Face of Technological Change*. Cambridge, MA: Harvard University Press.