

OVERCOMING CUSTOMER RESISTANCE TO INNOVATION: A CASE STUDY IN TECHNOLOGY TRANSFER FROM THE DEVELOPER TO THE PEST CONTROL OPERATOR

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INTRODUCTION

Companies are constantly seeking methods to increase customer acceptance of new technology when it is first marketed. Many factors internal and external to companies have been identified as causes for market failure of new technology (Booz, Allen and Hamilton, Inc., 1982). One important external factor is customer resistance to adopt new technology (Ram and Sheth, 1989). Customers resist innovation when it disrupts their established routines and conflicts with their prior belief structure.

One industry with established routines and beliefs is the subterranean termite control industry. For fifty years in the US, this industry has relied on soil barrier treatments using liquid termiticides (Mampe, 1993; Rotramel, 1992). The objective of these treatments is to create a barrier through which foraging worker termites can not pass and survive (Su, 1995). The routine requires a labor- and equipment-intensive application of the termiticide, followed by annual inspections and retreatments, if necessary. The belief was that long-residual termiticide activity was a fundamental attribute for a subterranean termite control product (Kard, 1996; Mampe, 1996; Stanley, 1994).

In 1995, DowElanco began selling the Sentricon* *Colony Elimination System*, which utilizes Recruit* termite bait, the first termite bait registered in the US. Recruit contains the chitin synthesis inhibitor hexaflumuron. Recruit is the only termite bait documented in mark-recapture studies to eliminate subterranean termite colonies (DeMark *et al.*, 1995; Forschler and Ryder, 1996; Su, 1994; Su *et al.*, 1995a, 1995b). Pest control operators (PCO's) who use the Sentricon System must dramatically change their operating procedures and product performance expectations for subterranean termite control. Installation of the Sentricon System involves drilling holes in soil adjacent to structures to insert stations containing non-toxic monitoring devices. Installing the Sentricon System is less labor- and equipment-intensive compared to barrier treatments, but requires monthly to quarterly inspections depending on termite activity. When termites are found in Sentricon stations, Recruit termite bait is placed only in stations with termite activity. Recruit is removed and replaced with monitoring devices after termites are eliminated (DowElanco, 1995). Therefore, long residual activity is an unnecessary, irrelevant performance attribute for a termite bait. Instead, slow-acting toxicity and no feeding deterrence are important performance attributes for termite baits (Su and Scheffrahn, 1993; Su *et al.*, 1995a). This paper documents the marketing strategies used by DowElanco to overcome any potential resistance by PCO's adopting the Sentricon System during its launch in 1995 in the US.

IDENTIFYING THE BARRIERS

The Sentricon System represents a new product to the world, but a product for which there was an existing market; the professional subterranean termite control companies. DowElanco, through developing and marketing Dursban* TC, is recognized in the US for leadership in the subterranean termite control market (Mix, 1991). For this market, the Sentricon System is a pioneering innov-

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ation as compared to an incremental innovation, as represented by a new formulation or new active ingredient for a soil barrier termiticide.

Companies are more successful at marketing new products which are consistent with the company's main business (Davis, 1988). Specifically, chemical companies have a 65% success rate for introducing new technology into an existing market in which they are already selling products (Cooper and Kleinschmidt, 1993a). Nonetheless, an incumbent company with a large share in an existing product market has little incentive to develop pioneering products (Ali, 1994). Pioneering innovations can cannibalize the demand for an incumbent company's existing technology. The market transition from existing to pioneering technology is extremely difficult for an incumbent company to predict and manage and can disrupt the company's existing customer base (Easingwood and Beard, 1989).

DowElanco recognized the above challenges with introducing a pioneering technology into subterranean termite control market. To ensure a successful market launch of the Sentricon System, DowElanco used a modified version of the Lead User Method for market research (Herstatt and von Hippel, 1992). Lead users understand the needs of the general marketplace and expect to benefit significantly by obtaining a solution to those needs. Lead users meet with manufacturer personnel in problem-solving sessions to jointly develop product or service concepts. The concepts co-developed with the lead users are then tested using surveys, focus groups, or other methods with typical users in the target market (Herstatt and von Hippel, 1992).

DowElanco selected a group of approximately 100 professional termite control companies to review the development of the Sentricon System. All companies had extensive experience in the subterranean termite control market. The companies represented geographies throughout the US where DowElanco was currently marketing its termiticides and intended to market the Sentricon System. The companies represented various categories of adopters of new technology; such as innovators, early adopters, early majority, and late majority, according to the classification system of Robertson (1971).

Marketing and technical personnel from these companies periodically met in DowElanco-sponsored regional and national meetings during 1993 and 1994. The goals of these meetings were to review the research results to date of the Sentricon System, identify potential barriers to its adoption, and review proposed marketing options for overcoming these barriers. At these meetings, PCO's identified specific issues associated with product usage patterns, functional risks, and economic risks as the primary barriers for DowElanco to overcome for PCO's to adopt the Sentricon System. DowElanco developed various marketing strategies described below to overcome the specific barriers identified by PCO's.

ISSUES AND SOLUTIONS FOR THE BARRIERS TO ADOPTION

Product Usage Patterns

PCO's observed that the use patterns for the Sentricon System were not consistent with the scheduling, technician and equipment deployment, and cost models established for the termiticide barrier treatments. The use patterns for the Sentricon System were comparable to those in other PCO treatment markets, such as general pest control and/or turf and ornamentals, in that all these services require monthly to quarterly site visits. Therefore, PCO's felt the industry was capable, with appropriate guidance, of rescheduling, redeploying personnel and equipment, and altering cost models as necessary to be compatible with ongoing monitoring required with the Sentricon System.

Issue: PCO's were concerned about their ability to maintain potentially complex records tracking the location of Sentricon stations installed per customer site and documenting stations with termite activity and bait application following each inspection. PCO's also desired a method to verify that Sentricon stations were located and opened for visual inspection by their technicians during each site visit.

Solution: DowElanco developed the Windows-based, proprietary computer software system, ProInx* Information Management System, for tracking location and status of Sentricon stations and Baitube* devices containing Recruit termite bait. DowElanco places unique barcodes on the

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underside of each Sentricon station cap and on each Baitube. A microwand scanner is used at the customer site by the technician to record information. Station barcodes are scanned during installation to record station location and during subsequent inspections to record station status; with or without termites, monitor or bait. The station cap must be removed to inspect the monitoring device or Baitube and to scan the barcode. After installation, any station whose barcode is not scanned during a site visit is documented in Prolinx as not inspected. When the station is baited, the barcode of the Baitube is scanned to track bait application in a station. The data from the barcode scanner are downloaded into a computer at the PCO office and a standardized report of station location and status per customer site is generated.

Functional Risk

When initially presented to PCO's in early 1993, they were impressed with the concept of a termite bait and the efficacy of hexaflumuron demonstrated in laboratory trials (Su and Scheffrahn, 1993) and in field trials at six locations in Florida (Su, 1994). In the Florida field trials, the concept and fundamental methodology of the Sentricon System were first tested. Test sites were monitored for termite activity using wood monitoring devices placed in soil where conditions were conducive to subterranean termite foraging. Wood monitoring devices were regularly inspected for subterranean termites. Each monitoring device containing termites was replaced with a Baitube containing a cellulose matrix impregnated with hexaflumuron. Subterranean termites were harvested from the monitoring device and placed in a Recruiter's chamber in the top of the Baitube. Conducting this Self-Recruitment* procedure enhanced the rate of bait consumption by subterranean termites. Auxiliary wood monitoring devices were installed around each Baitube. On subsequent inspections, monitoring devices with termites were replaced with Baitube devices as described above.

A triple-mark-recapture procedure was used to measure termite foraging population size and territory before and after application of the bait in the Florida field trials. This procedure verified that subterranean termite colonies were eliminated by consuming the bait containing hexaflumuron. Prior to the Florida field trials, baiting to eliminate colonies as a method for controlling ground-foraging subterranean termite colonies was hypothetical and unproven.

Issue: PCO's found the results of the Florida field trials encouraging and the methodology intriguing. Nonetheless, they were concerned that baiting termites with hexaflumuron would not work in geographies outside of Florida.

Solution: DowElanco sponsored thorough testing of the Sentricon System at over 50 research sites throughout the US by 20 scientists from DowElanco, Universities, and the USDA-FS (Fehrenbach, 1994). In these trials, standardized mark-recapture procedures were used to measure subterranean termite foraging population size and territory prior to application of the bait. The Sentricon System is the only termite control technology available which has been documented, by University and government researchers using scientifically-validated mark-recapture procedures, to eliminate subterranean termite colonies (DeMark *et al.*, 1995; Forschler and Ryder, 1996; Su, 1994; Su *et al.*, 1995a, 1995b).

Issue: In spite of the extensive research on Sentricon, PCO's still questioned if the technology would function properly and reliably in "the real world" when they used it.

Solution: DowElanco developed a unique approach to commercially test the Sentricon System with PCO's. Within each of seven geographically distinct termiticide marketing regions in the US (West Coast, Southeast, Northeast, Southwest, Midwest, East Coast, Hawaii), a DowElanco sales specialist with extensive experience in the subterranean termite control market was selected as a Sentricon specialist. During 1994, the Sentricon specialists established more than 300 commercial trial sites with about 100 pest control companies (Bader Rutter, 1995), generally including the PCO's involved in the 1993-1994 DowElanco-sponsored Sentricon review meetings.

Marketing research has documented that mass-media advertising is useful for creating awareness of a new product, but information based on experience is much more effective in facilitating adoption (Harrer *et al.*, 1988). Change agents, such as teachers, professional consultants, government extension agents, and trade association representatives, can encourage new technology adoption by customers. The agricultural extension service in the US is widely regarded as being

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extremely successful in utilizing extension agents as change agents to encourage farmers to adopt new agricultural technologies (Harrer *et al.*, 1988). The Sentricon specialists are the industry equivalent of extension agents.

Research on new product success in the chemical industry (Cooper and Kleinschmidt, 1993b) has documented that 97% of successful new product introductions had field trials. When field trials were omitted, successful rates for new products ranged from 14–64%. The computer industry has developed the concept of beta testing, in which a small number potential adopters are selected to evaluate new software in their business operations. Monitoring product performance in real-world situations on a regular basis is considered a critical component of a beta test program (Dolan and Matthews, 1993).

Modifying new products and technology according to customer experience in field trials is an essential component of the product development process. An excellent example is the development of Courtyard by Marriott. Marriott Corporation's first field trial with Courtyard was conducted in 1982, when a prototype Courtyard was built with movable walls. Several hundred people visited the test site and provided critique. For example, most visitors indicated that they did not like a room narrower than normal, but did not mind a shorter room. The first fully operational Courtyard began service in 1983. It had rooms of varying configurations so Marriott could continue to investigate customer reaction. Customers did provide additional insight. Most reported that they would not mind rooms even smaller than those developed from the prototype phase, but they did object to closets without doors. By 1986, Marriott began full-scale marketing and production of Courtyard incorporating the feedback received from guests (Davis, 1988).

Feedback from PCO's to Sentricon specialists during the 1994 field trials resulted in modifications to the station housing components, system use directions, and most significantly, Prolinx software and hardware. During the 1994 field trials, the Sentricon specialists field-tested the Prolinx software using pen-based, lap-top computers. PCO's involved in the trials perceived the lap-top computers would be too fragile, large, and complicated for their technicians to use efficiently in the field. PCO's requested a durable, hand-held, simple-to-use field data recording instrument in lieu of lap-top computers for their technicians to use at customer sites. In response, DowElanco incorporated the microwand scanner as the field data recording instrument for Prolinx prior to the commercial introduction of the Sentricon System.

Issue: PCO's involved in the 1994 field trials realized that the Sentricon System required a different set of use standards compared to those of termiticide soil barrier treatments. For example, Sentricon stations are placed in areas conducive to termite foraging, such as decorative landscape timbers and tree stumps, which are usually located at least several or more feet from structures. Applying bait to termite-infested stations adjacent to these landscape features protects the nearby structure from termites by eliminating termite colonies foraging around the structure. Conversely, applying a termiticide soil barrier to landscape timbers and tree stumps will not protect a nearby structure from invasion by subterranean termites.

The use standards for the termiticide soil barrier treatments were developed over fifty years of industry experience (Rotramel, 1992) and are well recognized and understood by companies providing termite control. Conversely, the use standards for the Sentricon System have been developed over five years of intensive research and commercial field trials and were unfamiliar to many companies providing termite control, except those companies involved in commercial trials. Therefore, PCO's questioned how the integrity and performance success of termite bait technology could be maintained after commercial introduction of the Sentricon System.

Solution: To ensure continued performance success of the new termite bait technology, DowElanco used a "Managed Introduction" to market the Sentricon System. Pest control companies must be authorized by DowElanco to use the Sentricon System. Part of the authorization process requires the pest control company to evaluate the Sentricon System at one or two trial sites. Pest control sales personnel, technicians and managers must complete an extensive training course and successfully pass exams on the Sentricon System. The pest control company must have the appropriate computer hardware and training to use the Prolinx program. DowElanco provides all the training resources that PCO's would otherwise have to provide to train their employees to use the new technology. All coordination of field trials and training programs in 1995 and 1996 continues to be conducted by the DowElanco Sentricon specialists.

In addition to providing training and trials for authorizing PCO's, DowElanco has taken other steps to ensure continued performance success of the Sentricon System. Pest control companies sign a marketing agreement with DowElanco which authorizes the company to use the Sentricon System. The marketing agreement contains detailed product stewardship requirements with which the authorized pest control operator agrees to comply. Quality Assurance Reviews (QAR's) are conducted with each authorized operator at regularly scheduled intervals. The QAR process was co-developed by DowElanco and authorized operators. During the QAR, a DowElanco representative, such as the Sentricon Specialist, visits the authorized operator to review inventory and Prolinx reports, and visit sites where the Sentricon System has been installed. The QAR is an opportunity for both DowElanco and the authorized operator to review the performance of the Sentricon System, Prolinx, DowElanco, and the authorized pest control operator in an unbiased, objective manner. The QAR's enable DowElanco and the authorized operator to continuously improve the components and use directions for the Sentricon System and Prolinx while working together to establish and maintain the integrity of this new technology.

Economic risk

Market research has documented that early adopters are generally not price sensitive. They are looking for superior performance (Easingwood and Beard, 1989). Offering a free introductory trial enables the potential adopter to assess the product's performance with minimal economic investment. At all commercial trial sites with Sentricon, DowElanco provides the Sentricon System components and assistance from Sentricon specialists at no charge to the PCO's. In return, PCO's service the Sentricon System during the trial period at no charge to the property owners where the system was installed.

Issues: PCO's were very concerned about their ability to estimate cost for the Sentricon System when making a bid proposal to a potential customer. For termiticide soil barrier treatments, PCO's can determine prior to application the cost of materials and labor to make a bid proposal to a potential customer. The amount of termiticide applied to create a soil barrier treatment is calculated based on the size and construction of the structure to be treated (DowElanco, 1994). In contrast, the amount of termite bait applied and the number of site visits required are dependent on foraging activity of termites, including the number and size of colonies, around the structure to be treated. Termite foraging activity can not be accurately determined prior to installation of the Sentricon System. PCO's were also concerned about the financial investment required to purchase computer hardware required for the Prolinx System.

Solutions: In the US, DowElanco took a novel cost sharing approach to reducing the financial risk for PCO's adopting Sentricon System. DowElanco sells Sentricon as a system for protecting an entire structure. The price to the authorized operator is based on the size of the structure, calculated by linear footage of the structure around which the System will be installed. The standard price per linear foot includes all Sentricon System components; stations, monitoring devices, and Baitube devices, regardless of the number of stations and Baitube devices ultimately required to eliminate the termites from around the structure.

After the first year the Sentricon System is installed, DowElanco charges an annual support fee for the authorized operator to continue to obtain all Sentricon System components necessary to service the site. Again, the support fee is standardized, regardless of the number of stations or Baitube devices which may be required to eliminate future invading subterranean termite colonies. Using this pricing method, PCO's can calculate the material costs up front for installing and servicing the Sentricon System.

The Prolinx Information Management System developed to track Sentricon station location and status was modified to include reporting linear footage of each site where Sentricon is installed. The authorized operator sends to DowElanco via modem information from Prolinx necessary to generate invoices for Sentricon Systems installed. DowElanco also tracks Baitube devices applied to automatically replenish authorized operator inventory before their Recruit termite bait stock is depleted.

As an additional cost sharing service, DowElanco provides computer hardware, such as the microwand scanner, and Prolinx software to authorized operators at a cost significantly below the

actual value of these materials. For example, the microwand scanner is purchased by DowElanco and made available to authorized operators for a modest monthly user fee. The fee includes technical support and upgrading of components. Through economy of scale, it is financially advantageous to the authorized operator for DowElanco to purchase the microwand scanners.

Cost sharing through lending, leasing, user fees, or other methods are strategies which are infrequently pursued by producers when introducing new technology (Easingwood and Beard, 1989). The main reason for this is the producer often can not afford price sharing options because of the costs already incurred in developing the new technology. DowElanco pursued the cost sharing strategy to minimize any financial burden for PCO's adopting the Sentricon System.

UNIQUE BENEFITS WHICH REDUCE BARRIERS TO ADOPTION

One potential barrier to adoption of a new technology would be physical risk; potential harm to people or property in using the new method (Ram and Sheth, 1989). The Sentricon System has reduced physical risks compared to conventional technology. The active ingredient, hexaflumuron, affects synthesis of chitin, a compound found in insects and not mammals. Hexaflumuron was the first compound approved for registration under the US Environmental Protection Agency's reduced-risk pesticide initiative (EPA, 1994). A very low concentration of hexaflumuron is impregnated in an inert matrix in a Baitube, which is placed in a Sentricon station in the ground. The station contains a child-resistant cap to discourage tampering. Recruit is only applied in stations when and where termites are active. When the termite colony is eliminated, the Baitube is removed and replaced with a monitoring device. Used Baitube devices are returned to DowElanco for proper disposal. All these features limit potential exposure of the applicator, property occupants, pets, wildlife, and environment to hexaflumuron. In addition, installation of the Sentricon System is less disruptive to the structure because it does not involve drilling into foundations and flooring.

PCO's reviewing the Sentricon System identified that its unique benefits, including colony elimination and reduced physical risk, were of value to them. Market research has demonstrated that new technologies with unique attributes have a higher market success rate than those that do not (Cooper and Kleinschmidt, 1993a).

CONCLUSIONS

DowElanco was in the challenging position of introducing a unique termite bait technology, the Sentricon System, to potentially supersede conventional technology for subterranean termite control in which it was already a market leader. DowElanco selected a group of experienced termite control companies to review the Sentricon System, its potential barriers to adoption, and proposed marketing methods to overcome these barriers. In response to ongoing reviews by PCO's, DowElanco developed diverse and creative marketing strategies to overcome potential PCO reluctance to use the Sentricon System and ensure the continued performance success of this new technology.

The development and commercial introduction of the Sentricon System has been a resource intensive process for DowElanco. Although hexaflumuron was registered by the US EPA in March 1994, DowElanco continued extensive field testing of the Sentricon System through 1994 and did not begin commercially market Sentricon until 1995. The Managed Introduction has limited the number of Sentricon Systems that could have been installed due to the process pest control companies must complete to become authorized to use Sentricon. DowElanco views the development and commercialization costs for the Sentricon System as a long-term investment necessary to establish the essential foundation on which this new technology can gain PCO and consumer confidence. In termite intensive areas, growing consumer demand coupled with increasing PCO requests to become authorized to use the Sentricon System would tend to confirm the success of the market introduction strategies developed by DowElanco.

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