

FIELD SALES PEOPLE AND WIRELESS COMPUTING TECHNOLOGY: TESTING INNOVATION-DIFFUSION THEORY

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This study of industrial sales people examined wireless computing technologies from the adoption-diffusion theory perspective. A comparison of adopters and non-adopters found two variables (i.e. age and education) are significantly different. As hypothesized, younger salespeople and salespeople with more formal education tend to be adopters. This may suggest a successful pattern of adoption and diffusion of these technologies may flow from the younger to older salespeople –and from those with more academic credentials to those with less. Thus sales teams or workshops that increase the interaction between senior salespeople and those with recent college level computer exposure may speed the adoption-diffusion process.

Introduction

Wireless technology and mobile computing offer the field salesperson obvious advantages. A geographically dispersed sales force can gain faster and easier access to data. Field salespeople can perform more tasks (such as generating quotes, getting product specifications and entering orders) in a buyer's office –and in a much shorter period of time. Benefits like these are compelling and support the notions proposed by theorists. The characteristics of wireless innovations are especially well suited to the needs of this specific adopter, the field salesperson (Edwards 2006; Gilbert 2004; Horowitz 2005; Thompson 2006; McWilliams 2004). Given these capabilities and the resultant benefits, it is surprising to find the majority of salespeople have been slow to adopt the more mobile forms. While salespeople have embraced sales force automation, they tend to do so in more conventional wired and office-bound forms (Widmier, Jackson, and McCabe, 2002).

If this technology offers benefits to all field sales organizations, why are some adopting and others are not? Using the conceptual framework offered by innovation diffusion theory, this study compares field salespeople who have adopted wireless forms of computer technology to those who have not. Innovation diffusion

theory suggests both individual adopter characteristics as well as contextual characteristics may explain the adoption rate of new technologies (Rogers, 1995). The subsequent sections describe the relevant individual salesperson and contextual characteristics that differentiate field salespeople who adopt and do not adopt this form of information technology.

Differences in Salesperson Individual Characteristics

Since the field salesperson does not have the benefit of frequent face-to-face interaction with co-workers, one could argue the characteristics of this individual adopter are especially important. Innovators are more likely to be highly involved, to engage in cognitively more complex problems and to be less risk adverse (Rogers, 1995). Innovators within the information technology area tend to portray these three qualities in both attitudinal and demographic indicators. Specifically, computer technology innovators or early adopters tend to set themselves apart in terms of their motivation, education and age.

More risk taking and faster adoption tend to occur when the adopter is highly independent, confident and possesses psychological strength (Wejnert, 2002). Part of this strength and independence in the field salesperson takes the

form of intrinsic motivation. Intrinsic motivation of the industrial salesperson is tied to their feelings of autonomy and self-efficacy (Ingram, Lee, and Skinner, 1989; Tyagi, 1985). Mobile computing allows the salesperson to operate independently, facilitates access to numerous sources of information – and as a result enhances the buyers' opinion of the salesperson (MacDonald and Smith, 2004; Vanstone and Yates-Mercer, 2002). Cognitive evaluation theory suggests that the drivers of intrinsic motivation include the level of autonomy, control and self-efficacy (Deci, Connell, and Ryan, 1989). The relationship between intrinsic motivation and computer use bears out these expectations. IT researchers have repeatedly found associations between intrinsic motivation and user's perceptions of computer ease of use (Davis and Wiedenbeck, 2001; Venkatesh, 1999). Since these perceptions are precursors to actual use, one might expect intrinsic motivation will be higher for mobile users than nonusers. Thus the following hypothesis is suggested:

H₁: Adopters of wireless technology will be more intrinsically motivated than non-adopters of mobile technology.

Familiarity with the innovation speeds its adoption (Rogers, 1995). Because younger salespeople have had more exposure to computers (in both educational and entertainment venues), studies frequently find significant differences in the age of workers who adopt a technology and those who do not. These differences seem to affect work-related behaviors such as performance on computer-based tasks (Czaja and Sharit, 1998; Czaja et al., 2001) and computer skill acquisition and retention (Gattiker 1992). These results in the non-sales setting parallel those found in various sales settings. These settings include agricultural products industry (Harris and Pike, 1996), real estate and telecommunication sales (Speier and Venkatesh, 2002). If age is an indicator of wireless or mobile computing familiarity and if

these three sales settings are widely applicable, then one might expect an inverse relationship between ages of industrial salesperson adoption of wireless technology. Therefore the following hypothesis is suggested:

H₂: Adopters of wireless technology will be younger than non-adopters of mobile technology.

Innovation diffusion theory claims tolerance for risk is higher when the adopter employs more complex cognitive processes and uses a wider array of sources of information. To the degree that formal education encourages these cognitive processes or increases these information sources, then one might expect adopters will have more formal education. Education was certainly an important factor for consumer's adoption of PC's in their homes (Schwartz, 1988). Home use of personal computers may not, however, be seen as threatening or intimidating as work-related use of personal computers (Keillor, Bashaw, and Pettijohn, 1997). In fact, a study comparing PDA use in both an education and work-related context ran counter to what one might expect. Jones, Johnson and Bentley (2004) did not find a positive association between education and PDA use. Thus, the relationship between education and adoption is not a foregone conclusion – and worthy of further study. Consistent with the expectations of innovation diffusion theory, this study will test the expectation that adopters will possess more formal education. These findings lead to the following hypothesis:

H₃: Adopters of wireless technology will have higher levels of education than non-adopters of mobile technology.

Differences in Selling Context

Adopter's willingness and ability to adopt new technology is constrained or facilitated by the environmental context. These contextual (or external) issues have a permissive effect and the presence or absence of these externalities largely

determines the decision to adopt (James, 1993). Since the salesperson operates at the boundaries of the organization, these externalities can have a dramatic affect on his or her work environment.

Certainly the degree of competition the salesperson faces everyday may make the sales task either predictable or turbulent. Industry turbulence influences the degree to which organizations adopt new technologies – and could affect the individual salesperson as well (Galskiewicz and Burt, 1991; Mizruchi, 1993). Innovation diffusion studies are a little less clear on just what effect a turbulent industry would have. When the industry is highly changeable, turbulent and competitive, this may lead to faster rates of initial adoption – but to slower rates of subsequent diffusion (Wejnert, 2002). In their qualitative study of 19 firms' use of e-commerce, Kettinger and Hackbarth (2004) found their reasons for adoption were less a result of externally imposed industry pressures. Not all studies agree. In their empirical analysis of over 160 survey responses, Schillewaert et al. (2000) found sales managers' acceptance of information technology is likely to be in response to industry pressures. If the nature of the selling context is highly changeable- and if a salesperson's competition is responding to the fast pace of change with innovative use of IT, then one might expect industry turbulence will encourage risk taking and subsequent adoption. Therefore the following hypothesis is presented:

H₄: The adoption of wireless technology by sales people would be greater in industries that are characterized by higher levels of turbulence.

Adoption behavior cannot occur if the resources are not available to the salesperson. In their comparison of various technology acceptance models, Taylor and Todd (1995) found resources to be an over-riding factor. Given larger firms tend to have more resources (e.g. expertise, support, and finances) the size of the firm may affect salesperson adoption of more innovative forms of technology such as wireless technology. Meta-analyses do tend to support innovation

diffusion theory proposals on resources – and found size was an important factor in manufacturing firms (Damanpour, 1992). Unfortunately the meta-analyses were less conclusive on the degree to which the size of the firm affects initial adoption.

A review of IT and sales literature is similarly less conclusive. Smaller firms are more homogeneous, have less bureaucratic ways of making adoption decisions—can move faster to adopt. Smaller firms feel they have had more productivity improvements as a result of investments in sales force automation (Keillor, Bashaw, and Pettijohn, 1997). While smaller firms feel they stand to gain they do not take actions based on these feelings. In their survey of manufacturers, Rivers and Dart (1999) found smaller firms are somewhat less likely to invest in sales force automation.

On the other hand, larger firms have more resources, are able to absorb risk, tend to have specialized IT support staff that assist users. Anecdotal evidence implies larger firms tend to make more use of innovative forms of sales force automation. The most widely publicized examples of wireless technology tend to describe deployments made by large firms such as Pfizer and United Pipe and Supply (Gilbert, 2004; Shim, 2004). This form of wireless technology is innovative and some would argue still developing (Chan et al., 2002). Given this stage of product development, wireless use is more complex than other forms of IT (that is it may require more technical/service support). This type of support and ability to address the complexities may be more closely associated with larger firms (Bajwa and Lewis, 2003). This research led to the generation of the following hypothesis:

H₅: Sales people employed by firms with larger annual revenues would be more likely to adopt wireless technology than those in smaller firms.

METHOD

Subjects and design

Surveys were sent to firms engaged in manufacturing (NAICS codes 31, 32 and 33) located in the southeastern part of the United States. Each of the participating firms employed its own sales force. Because mobility and wireless technology was the focus of this study, the sample included only geographically dispersed sales people (i.e. field salespeople, not centrally located). Responses were returned in self-addressed stamped envelopes directly to university researchers to assure confidentiality. Surveys were delivered to 1141 salespeople and usable responses for this study were received from 267 industrial salespeople ($267/1141=23.4\%$). These salespeople were engaged in the sale of a wide array of products: from consumer durables to industrial equipment and supplies (See Table #1 for Distribution of Manufacturing Firms).

The questionnaire was designed to measure first user status, then attitudinal items, and ended with a request for demographic information. The two mobile devices used to distinguish

adopter from nonadopter were selected to reflect the more innovative salesperson (Gizon, 2002; Tynan, 2004). Adopters were defined as salespeople who indicated the length of use for either Palmtop devices or wireless access for their personal computers. The user status item was framed to ask respondents to estimate how long they used a specific form of hardware in their current sales position. Response categories included “never” and those selecting this category for both wireless devices were categorized as non-adopters. This sample was comprised of approximately 65% nonadopters ($n_{\text{non}}=174$) and 35% adopters ($n_{\text{adopt}}=93$). Intrinsic motivation was measured using the six-item scale from Oliver and Anderson (1994) and the coefficient alpha was .74 for this sample (Average 29.39 and standard deviation 6.07).

To gauge the degree of turbulence in each of the industries represented in this sample, researchers used outside evaluators. Evaluators with experience in more than one industry can make informed comparisons. Beyond this obvious logic, studies imply industry insiders may be far too immersed in the current industry events to provide sufficiently reliable and valid measures

Table 1: Distribution of Manufacturers

	<u>Total</u>	<u>Proportion</u>
Manufacture Consumer Non-Durable Products and components	43	16%
Manufacture Consumer Durable Products and components	48	18%
Manufacture Industrial machinery or equipment	78	29%
Manufacture Industrial supplies or components	98	37%

(Buchko 1994). Snyder and Glueck (1982) compared industry insiders to outside experts and found more accurate estimates were generated by the outside experts. Certainly the selection of experts could inject yet another bias and the design employed here sought to diminish this possibility. A pool of MBA students were screened for level of and type of industry experience. Using the same criterion for selecting experts as that developed by Johnson, Sohi, and Grewel (2004) each industry (in this case type of manufacturer) was assigned one of six different values. Each industry expert evaluated the degree of turbulence using previously developed scales (Johnson, Sohi and Grewel 2004). Low numerical values described low levels of turbulence (stable, moderate changes) and higher numerical values described industries characterized by intense competition, radical change and dynamic markets. The industries in this sample represent a cross-section of turbulence levels since these values

spanned the range of 1 to 6.

The number of the industries falling into one of these six levels was not disproportionately high in any one of the six levels. More specifically the proportions of ratings from low to high were 25%, 25%, 12%, 9%, 14% and 15%. This distribution seems to be comparatively heterogeneous and represents a cross-section of stable to turbulent industries [i.e. (Johnson, Sohi and Grewel's 2004 study resulted in a distribution of 4%, 24%, 15%, 13%, 15%, 29%).]

Results

MANOVA was used to analyze the data in order provide for stricter analysis and to avoid potential errors caused by comparing five sets of averages. This provided a stringent comparison of adopters to nonadopters on all five hypotheses simultaneously. Overall, MANOVA results (significant) supports the notion adopters

Table 2 : Results of Overall MANOVA

F Value 3.00 (.0121)			
Wilks Lambda .9395			
Roy's Greatest Root .0644			
Variable	User	Nonuser	Univariate F (prob)
	n=93	n=174	
INDIVIDUAL ATTRIBUTES			
Intrinsic Motivation	29.14	29.06	.00 (.9617)
<u>Age</u>	<u>3.28</u>	<u>3.62</u>	8.10 (.0048)
<u>Education</u>	<u>2.74</u>	<u>2.42</u>	4.32 (.0387)
ORGANIZATIONAL ATTRIBUTES			
Industry Turbulence	3.12	3.01	.35 (.5560)
Firm Annual Revenues	3.47	3.42	.64 (.4241)
<u>Bold and Underlined means are significantly different</u> at a probability value of .05 or less (Scheffe pairwise comparison).			

differ from non-adopters (See Table #2). Because some of our data was categorical we supplemented the overall MANOVA test of average differences with a Chi-square test for

differences in proportions (See Table #3). Results from both tests converge and reflect the same pattern. Generally the direction of all of the averages was as hypothesized, with two of

Table 3: Proportion of Users and Nonusers: Age, Education and Size of Firm

	Proportion of User (n=93)	Proportion of Non Users (n=174)
Age		
Under 25	3.23%	2.30%
25 to 34	21.51%	13.22%
35 to 44	31.18%	31.03%
45 to 54	31.18%	28.74%
55 to 64	10.75%	22.99%
65 or more	2.15%	1.72%
	Proportion of User (n=93)	Proportion of Non Users (n=174)
Education		
High School	6.45%	21.84%
Some College	31.18%	30.46%
College Degree	48.39%	37.93%
Some Graduate School	9.68%	3.45%
Graduate Degree	4.30%	6.32%
	Proportion of User (n=93)	Proportion of Non Users (n=174)
Revenue		
\$2.5 to 5 million	11%	13%
\$5 to 10 million	6%	11%
\$10 to 20 million	27%	26%
\$20 to 50 million	44%	28%
\$50 to 100 million	6%	14%
\$100 to 500 million	5%	7%

the five hypotheses being statistically significant. Individual means were compared using both univariate *F*'s as well as Scheffe pairwise comparisons (both test statistics evaluated at .05 probability level or less).

The two significant differences were both attributes of individual salespeople. Adopters tend to be younger than non-adopters. Among the users of mobile computing devices, approximately 56% of the salespeople were younger than 45 and approximately 53% of the non-adopters were 45 or older (See Table 3). *H*₂ hypothesized that adopters would be younger than non-adopters. This hypothesis was supported and significant at the .05 level. *H*₃ hypothesized that adopters would have higher levels of education than non-adopters. This hypothesis was supported and significant at the .05 level. Among the non-adopters of mobile computing devices, approximately 52% of the salespeople achieved a formal level of education at less than a complete four year college degree (i.e. the highest level of education completed was some part of college or high school) while 62% of users had completed undergraduate college degree or higher.

None of the hypotheses regarding the organizational attributes were supported. *H*₄ hypothesized that the adoption of technology by sales people would be greater in industries that are characterized by higher levels of turbulence. *H*₅ hypothesized that sales people employed by firms with larger annual revenues would be more likely to adopt technology than those in smaller firms. While the pattern of the differences in the fourth and fifth hypothesized comparisons were in the direction expected they were not significantly so. Thus, these two hypotheses were not supported.

Conclusions

Two comparisons of adopters and non-adopters were substantial –and both of these differences existed at the individual salesperson level. This pattern is consistent with analyses of

comprehensive models which conclude individual differences explain over half of the variation in perceived usefulness of a new form of information technology (Agarwal and Prasad, 1999). In this sample of industrial salespeople, the two significant individual level variables were age and education. The degree of difference in just these two individual level variables carried sufficient significance to drive fairly stringent overall statistics (testing all, not just two comparisons). While age and education differed, no differences in the salesperson's motivation level, the size neither of firm nor in the turbulence of the industry were uncovered.

Younger salespeople in this sample tended to be adopters. Salespeople with more formal education also tended to be adopters of mobile computing technology. While these findings are consistent with adoption-diffusion stream of research, this finding bears additional attention. Age does apparently identify those salespeople who are going to be more receptive, but we still do not know yet precisely why. As with any fruitful research effort, this study suggests a focal point for yet more attention. What are the cognitive, affective – or even experiential mechanisms by which younger salespeople are faster to adopt? Studies which compare attitudinal as well as demographic characteristics (more specifically the combination of age and computer-related venue use) may explain why younger salespeople are faster to embrace this form of technology. If more formal levels of education foster more complex cognitions and a wider array of source of information (as some research suggests), additional efforts examining types of complexity or sources relevant to IT technology could be fruitful. This type of information may help managers convert the more recalcitrant and resistant salespeople.

Contrary to expectations, intrinsic motivation levels did not indicate any significantly higher level for wireless users than non-users. This may be in part attributable to the type of compensation or control system. An intrinsically

motivated salesperson (who is commission-based and part of an outcome-based control system) may be less receptive to investing the time in learning how to use a new form of computing technology. This salesperson may be focused on making as many sales calls as possible since their compensation based on generating revenue. They may see new wireless forms of hardware as an attempt by the home office to hand off administrative chores. Alternatively this lack of significant differences may have more to do with the software than the hardware. In a study of PDA use by salespeople Shim (2004) found satisfaction levels were not significant for hardware- but did find differences in terms of software features. While this sample provided insights to a cross section of users and technology, more research could focus on a narrow range of mobile computing software applications.

The selling contexts (i.e., size of firm and turbulence of industry) were not substantially different for salespeople using wireless compared to salespeople who are not. If wireless is still at the infancy stages of technological development, then these findings may not be surprising. The selling contextual factors may play more of a part during the diffusion stage than in the initial adoption stage of mobile computing technology. At this point in the adoption of wireless computing capability this may imply that organizations or general industry issues are not as immediate or influential as expected. Wireless is touted as the next great wave of computing. The profile of non-adopters in this sample may suggest this wave has substantial distance to cover before it crests.

Managerial Implications

Like any good theory, however, innovation-diffusion lends itself to practical solutions. Theoretically adoption is facilitated when the new technology can be observed first hand. Tests of this theory show the single most influential source of observation is co-workers

(Brancheau and Wetherbe, 1990). Given the age and education differences, sales managers may consider matching younger with older sales representatives on various team projects or in training exercises. In these assignments the younger or more formally educated salespeople can demonstrate the wireless computing capabilities to non-adopters. A standard recommendation to any IT initiative is to support it with thorough training. Findings of our study suggest this may be especially important for older or less educated members of the field sales force. If these groups of salespeople are resisting adoption because of lack of familiarity, then additional training, encouragement and technical support are crucial.

Because wireless computing represents a substantial investment (in support services, effort as well as finances) sales managers concerned with getting immediate use should first target the more receptive salespeople. Results of this study indicate those salespeople will be the younger members or those with higher levels of formal education. These two identifiers are clear, unambiguous and unlike attitudinal precursors, are easy to use. Like most easy options, however, using age or education to allocate resources to employees may raise concerns about fairness or equity. From a managerial viewpoint, however, these concerns would represent preferable problems. In effect the salesperson who feels they have not been equitably allocated wireless mobile technology is making a form of commitment to use it. In light of the findings here this may mean that the older or less formally educated salesperson (who perceives inequitable allocation) who does complain will then feel more compelled to be an adopter.

Efforts aimed at identifying early adopters and increasing diffusion of wireless technology use throughout the sales force are aimed at improving performance. While success stories abound in the popular press, empirical studies show the relationship between IT technology use

and sales performance may not be purely linear (Ahearne, Narasimhan and Weinstein 2004). If a curvilinear relationship exists, then sales managers may be wise to monitor and track productivity indicators over time. Results of this study imply the pattern of productivity may differ based on the age and education of the salesperson. Expecting this type of pattern may help sales managers make meaningful comparisons between younger and older sales representatives' use of wireless technology.

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